

Original Research Article

Performance Study of Koshihikari Rice Variety and Its Economic Prospect in Comparison with Other Three High Yielding Rice Varieties of Bangladesh

ABSTRACT

The research was conducted to observe the growth and yield performance of Japanese Koshihikari rice variety in agro climatic condition of Bangladesh in comparison with other high yielding rice varieties of Bangladesh and its economic prospect. The experiment was laid out in a Randomized Complete Block Design (RCBD) with five replications. Experimental site is located in the Agroecological Zone (AEZ) 13 with the geographical location of 22°47' N and 89°34' E at the Dr. Purnendu Gain Field Laboratory of Agrotechnology Discipline, Khulna University, Bangladesh and the field was typical rice growing medium high land with clay-loam soil texture. Four rice varieties namely BRRI dhan28, BRRI dhan47 and BRRI dhan50 and Koshihikari rice variety of Japan were trailed to compare the yield potential. At harvest, the tallest plant height was produced by BRRI dhan47 (93.19 cm) while the most dwarf plant by Koshihikari (78.30 cm) and the maximum number of tiller hill⁻¹ was produced by Koshihikari. BRRI dhan50 was produced the tallest panicle (22.87 cm) and maximum number of grains panicle⁻¹ (119.32) while the shortest panicle (14.93 cm) and minimum grains panicle⁻¹ (59.56) was produced by Koshihikari variety. The highest 1000 grain weight (22.21 g) and grain yield (7.62 t ha⁻¹) were observed in BRRI dhan47 whereas the lowest 1000 grain weight (21.83 g) and grain yield (5.6 t ha⁻¹) were found in Koshihikari variety. However, Koshihikari has some performance limitations, but it has bright economic prospect than the other three rice varieties in Bangladesh as cultivating Koshihikari only in 0.1% mean rice cultivated land area in Boro in Bangladesh and exporting at the price of only 10% of retailer price in world market may bring about BDT 1091 million export revenue that will be more than total revenue earned by Bangladesh by exporting rice at present.

Keywords: Koshihikari, Yield, Performance, Economic, Prospect, Rice, Export

1. INTRODUCTION

Rice is the most vital food crop of the developing part of the Globe and that is the staple food of more than half of the world's population, for which about 90% of rice is grown by more than 200 million small rice farmers, who individually possess less than 1 hectare of land. This cereal is harvested from 159 million hectares annually, which has twice the value of production in the developing world as any other food crop and the value is more than US\$150 billion per year. More than 1 billion people, one-fifth of world population depend on rice cultivation for their livelihood [1].

Bangladesh ranks third in area and fourth in production of world rice and over 90% of its population depend on rice for their daily diets [2]. Rice is cultivated in 10.29 million hectares of land and that is 80% of cropped area of Bangladesh that produce 25.18 million tons of rice [3]. The staple food rice, accounts for about 92% of the total food grains produced in Bangladesh and rice production employs almost 55-60% of our labor forces providing national food security [4].

The agro based economy of Bangladesh is predominated by intensive rice cultivation and the national average yield is 2.77 t ha⁻¹ while the yields of other rice growing countries of Asia such as China, Taiwan, Indonesia, and Japan are 5.72, 4.60, 4.38, and 5.97 t ha⁻¹ respectively [5]. India and Vietnam are also successful in developing semi-dwarf modern hybrid varieties of rice as a viable alternative. Good hybrid

rice has the potential of yielding 14-28% more than the best-inbred or pure line variety grown under similar environmental conditions [6].

Koshihikari is a popular rice variety cultivated in Japan as well as in Australia and the United States. It is considered super-premium short grain rice with unique characteristics such as firmness, consistency, aroma, and a natural sweetness. Slightly off white, firm yet creamy, this low glycemic rice has attributes that make it perfect for sushi or general consumption, if one is so inclined. In time, this rice still managed to find its way to different parts of the world. California and Tennessee are two states that have found success in cultivating Koshi rice, and even though it may not be grown in Japan, the American variety of rice manages to retain many of its qualities that make koshi rice such a unique product. Being grown locally, it is less expensive and more readily available than the Japanese variety [7].

Rice is playing a vital role in Bangladesh economy and Bangladesh has natural advantages like favorable climate, soil and cheap labor force as key factor for relatively higher production. Bangladesh can earn some extra foreign currency by producing and exporting rice that demanded in the world market besides feeding its population. Among the demanded rice, Koshihikari is important one that may help Bangladesh to reduce its huge trade deficit. Therefore the goal of this research is to observe the growth and yield performance of Koshihikari rice variety in Bangladeshi agro climatic condition, in comparison to other high yielding rice varieties of Bangladesh and its economic prospect in Bangladesh.

2. MATERIAL AND METHODS

The experiment was conducted at the Dr. Purnendu Gain Field Laboratory of Agrotechnology Discipline, Khulna University, Khulna, Bangladesh. The experimental site is located in the Agroecological Zone (AEZ) 13 with the geographical location of 22°47' N and 89°34' E having subtropical climate characterized by moderate temperature and heavy rain fall during the Kharif season (April to October) and low rainfall and low temperature during the Robi season (November to March). The experimental field was typical rice growing medium high land with clay-loam texture having p^H of 8. Soil samples were collected from 0-15 cm depth of the experimental field to examine the fertility status of the field according to the prescribed method. The experiment was conducted in Robi season and four rice varieties were trailed, among them three high yielding rice varieties of Bangladesh namely BRRI dhan28, BRRI dhan47 and BRRI dhan50 and the another was Koshihikari rice variety of Japan. The experiment was laid out in a Randomized Complete Block Design (RCBD) with five replications. The selected field was firstly divided into five equal blocks and each block was further divided into four unit plots of 20 m² (5 m x 4 m) size. The distance between block to block was 1.0 m and plot to plot distance was 50 cm. A piece of medium high land was selected for seedbed preparation with 2 m length and 1.25 m width and space between the beds were 0.5 m. Seedbed was made ready by ploughing four times with power tiller followed by laddering. The bed was kept wet by irrigation as and when required. Before sowing in the seedbed, seeds were soaked for 24 hours for sprouting and care was taken to ensure no pests and diseases infestation. The experimental field was prepared 15 days before transplanting sufficiently enough to make the field ready for transplanting with application of basal doses of fertilizers. Urea (255 kg ha⁻¹), TSP (130 kg ha⁻¹), MoP (120 kg ha⁻¹), Gypsum (70 kg ha⁻¹) and Zinc Sulphate (10 kg ha⁻¹) were applied according to fertility status and SRDI recommendation. The total TSP, MoP, Gypsum, Zinc Sulphate and 1/4th of Urea were applied as basal dose. The rest of the urea was applied at three equal split doses at 50 DAS, 70 DAS and 90 DAS. Transplanting was done with three seedlings hill⁻¹ maintaining 15 cm plant to plant and 20 cm row to row distance. Two hands weeder were used to control weed infestation in the experimental field at 50 DAS and 80 DAS. The experimental field was irrigated regularly depending upon the moisture content of the field and flood irrigation was applied during panicle initiation state. The crops were harvested at their full maturity when more than 80 % of the seeds turned into golden color. The harvested crop of each plot was bundled separately, tagged properly and brought to the clean threshing floor. The bundles were dried in open sunshine and were threshed after proper drying. The grain and straw weight for each plot were recorded after proper drying and were adjusted to 14% moisture level. Data on growth, and yield contributing characteristics were recorded from five randomly selected hills of each plot and data for growth parameters were recorded at 60 DAS, 75 DAS, 90 DAS, 105 DAS and at harvesting and data for

yields were collected after harvesting. Recorded data were analyzed statistically with the help of computer package program MSTAT-C and the mean differences were adjudged with Duncan's Multiple Ranges Test [8]. The harvest index has been calculated by the following formula:

$$\text{Harvest index (\%)} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

For determining economic prospect, a survey was conducted to collect price of Koshihikari rice in the online retailer shops. Data of rice production in Boro season were also collected [9] and both the collected data were later analyzed with the help of SPSS 20 computer package program. The expected export revenue was calculated by the following arithmetic formula:

$$\text{Revenue (BDT)} = \% \text{ of Average Online Retailer Price of Koshihikari Rice (BDT Kg}^{-1}) \times \% \text{ of Mean Rice Cultivated Land Area in Boro Season in Bangladesh (ha)} \times \text{Yield of Koshihikari Rice (Kg ha}^{-1}).$$

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109 3. RESULTS AND DISCUSSION

Table 1. Effect of variety on plant height of Koshihikari, BRRI dhan47, BRRI dahn28 and BRRI dhan50 rice varieties

Variety	Plant height (cm)				
	60 DAS	75 DAS	90 DAS	105 DAS	Harvest
Koshihikari	51.65	67.59a	82.19a	80.26b	78.30b
BRRI dhan47	40.54	60.10b	80.41a	91.50a	93.19a
BRRI dhan28	34.33	51.59c	74.86b	89.48a	91.11a
BRRI dhan50	39.34	55.45bc	72.87b	79.53b	80.33b
Level of significance	**	**	**	**	**
CV (%)	9.15	4.43	3.84	3.50	3.18

DAS= Days After Sowing

CV = Co-efficient of variation

** = Significant at 1% level

110 3.1 Plant Height

The plant height was varied significantly ($P=0.01$) among the varieties at regular interval after sowing. Koshihikari produced the tallest plant (51.65 cm) followed by BRRI dhan47 (40.54 cm) and BRRI dhan50 (39.34 cm) while BRRI dhan28 Produced the shortest plant (34.33 cm) at 60 days after sowing (DAS). The plant heights of BRRI dhan47, BRRI dhan50 and BRRI dhan28 were found statistically similar at 60 DAS. Still koshihikari was observed the tallest plant height (67.59 cm) at 75 DAS followed by BRRI dhan47 (60.10 cm) and BRRI dhan50 (55.45 cm) whereas BRRI dhan28 was observed the shortest plant (51.59 cm). Again, at 90 DAS, Koshihikari was produced the tallest (82.19 cm) plants and was statistically similar with BRRI dhan47 where BRRI dhan50 produced the shortest plant (72.87 cm). The tallest (91.50 cm) plant at 105 DAS was observed with BRRI dhan47 and the shortest (79.53 cm) plant was observed with koshikikari (80.26 cm) rice variety which was statistically similar with BRRI dhan50. At the time of harvesting BRRI dhan47 was the tallest (93.19 cm) followed by BRRI dhan28 (91.11 cm) which were statistically identical and Koshihikari was the shortest plant (78.30 cm) preceded by BRRI dhan50 (80.33 cm) (Table 1). BRRI [10] reported the plant height of 90,105, 82 cm for BRRI dhan28, BRRI dhan47 and

124 BRRI dhan50 respectively. However, Salam *et al.* [11] found relatively higher plant height at harvest. He
125 observed 101 and 105 cm plant height for BRRI dhan47 and BRRI dhan28.

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127 3.2 Number of Tiller Hill⁻¹

Table 2. Effect of variety on tiller number per hill at different growth stages of Koshihikari, BRRI dhan47, BRRI dhan28 and BRRI dhan50 rice varieties

Variety	Number of tiller hill ⁻¹				
	60 DAS	75 DAS	90 DAS	105 DAS	Harvest
Koshihikari	9.85b	14.27ab	17.51	17.57a	16.09a
BRRI dhan47	9.06b	12.33b	15.14	11.70b	9.41c
BRRI dhan28	12.51a	16.74a	17.10	13.97ab	12.91b
BRRI dhan50	9.07b	12.74b	15.61	12.51b	11.61bc
Level of significance	*	*	NS	**	**
CV (%)	13.98	11.23	10.90	12.17	11.34

DAS= Days After Sowing

CV = Co-efficient of variation

** = Significant at 1% level

* = Significant at 5% level

NS = Non significant

128

129 The number of tiller hill⁻¹ was influenced significantly among the varieties at four different stages (60 DAS,
130 75 DAS, 105 DAS and at harvest). At 60 DAS, BRRI dhan28 produced the highest tiller number hill⁻¹
131 (12.51) and the lowest number of tiller hill⁻¹ was found with BRRI dhan47 (9.06) which was statistically
132 similar to BRRI dhan50 (9.07) and Koshihikari (9.85). At 75 DAS, BRRI dhan28 had the maximum tiller
133 number hill⁻¹ (16.74) whereas BRRI dhan47 had the lowest tiller number (12.33) which was statistically
134 similar to BRRI dhan50 (12.74) and Koshihikari (14.27). Tiller number hill⁻¹ was varied insignificantly
135 ($P=0.01$) among the varieties at 90 DAS and the largest tiller number was found with the variety of
136 Koshihikari (17.51). At 105 DAS and at harvest; Koshihikari produced the maximum tiller number per hill
137 while the minimum number of tiller hill⁻¹ was produced by BRRI dhan47.

138 3.4 Days Required for Booting

139 Days required for booting was varied significantly ($P=0.01$) among the varieties and the maximum booting
140 days was required by BRRI dhan28 (88.21 DAS) which was statistically similar to BRRI dhan50 (87.6
141 DAS). However, Koshihikari attained booting with the minimum days (73.78 DAS).

142 3.5 Days Required for Flowering

143 The days required for flowering was also varied significantly ($P=0.01$) among the varieties. Result showed
144 that Koshihikari was required the minimum days for flowering (85.7 DAS) while the variety BRRI dhan50
145 required the maximum days for flowering (99.2 DAS) which was statistically similar to BRRI dhan28 (98
146 DAS).

147 3.6 Days Required for Grain Maturity

148 The statistical analysis showed that, required grain maturity days was varied significantly ($P=0.01$) among
149 the varieties. The result revealed that Koshihikari was matured earlier (113.2 DAS) than other tested
150 varieties. BRRI dhan50 required maximum days for grain maturity (132.6 DAS) which was statistically
151 similar to BRRI dhan47 (130 DAS) and BRRI dhan28 (126.2 DAS) (Table 3).

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Table 3. Effect of variety on days required for booting, flowering, grain maturity and harvesting of Koshihikari, BRRI dhan47, BRRI dahn28 and BRRI dhan50 rice varieties

Variety	Booting (DAS)	Flowering (DAS)	Grain Maturity (DAS)	Harvesting (DAS)
Koshihikari	73.78c	85.7c	113.2b	124.2c
BRRI dhan47	81.03b	92.2b	130.0a	144.6a
BRRI dhan28	88.21a	98.0a	126.2a	137.0b
BRRI dhan50	87.6a	99.2a	132.6a	145.2a
Level of significance	**	**	**	**
CV (%)	2.46	2.35	2.85	1.67

DAS= Days After Sowing

CV = Co-efficient of variation

**= Significant at 1% level

153 3.7 Days Required for Harvesting

154 Required days for harvesting were varied significantly ($P=0.01$) among the varieties. Minimum harvesting
 155 days (124 DAS) were required for Koshihikari variety and the maximum days were required for BRRI
 156 dhan50 (145 DAS) which were statistically identical to BRRI dhan47 (144 DAS) (Table 3). However, BRRI
 157 [10] reported that the life span of BRRI dhan28, BRRI dhan47 and BRRI dhan50 were 140, 152 and 155
 158 DAS respectively. From the above discussion it can be stated that Koshihikari is the best variety in terms
 159 of days required for grain maturity as it took the lowest days to be harvested.

160 3.8 Effective Tiller Hill⁻¹

161 A significant ($P=0.01$) variation was observed in effective tiller hill⁻¹. The maximum tiller hill⁻¹ was noticed
 162 in Koshihikari (16.09) whereas the minimum tiller number hill⁻¹ (9.41) was observed in BRRI dhan47
 163 (Table 4). BRRI dhan28 (12.68) and BRRI dhan50 (11.78) were found statistically similar in producing
 164 effective tiller hill⁻¹.

165 3.9 Panicle Length

166 The panicle lengths were differed significantly ($P=0.01$) among the four varieties (Table 4). Data of
 167 analysis showed that BRRI dhan50 (22.87) was produced the tallest panicle which was statistically
 168 identical to BRRI dhan47 (22.64) while the shortest panicle was produced by Koshihikari (14.93) variety.
 169 Toriyama *et al.* [12] observed the panicle length of koshihikari 17.7 cm which is higher than findings of
 170 this study that may be due to the effect of coastal saline soil. Here, Koshihikari is following behind in
 171 production of grain amount in comparison with other three high yielding rice varieties of Bangladesh due
 172 to its smallest panicle length.

173 3.10 Number of Spikelets Panicle⁻¹

174 Table 4. shows significance difference ($P=0.01$) among the varieties in number of spikelets panicle⁻¹. The
 175 maximum number of spikelets panicle⁻¹ was found in BRRI dhan50 (136.10) whereas the minimum
 176 (66.45) number of spikelets panicle⁻¹ was found in Koshihikari. BRRI dhan47 (108.43) and BRRI dhan28
 177 (100.25) were found statistically similar in producing number of spikelets panicle⁻¹.

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Table 4. Yield and yield contributing characters of Koshihikari, BRRI dhan28, BRRI dhan47 and BRRI dhan50 rice varieties

Variety	Number of effective tillers hill ⁻¹	Panicle length (cm)	Number of spikelets panicle ⁻¹	Number of grains panicle ⁻¹	1000 grain weight (g)	Grain yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
Koshihikari	16.00a	14.93c	66.45c	59.56c	21.83a	5.60b	9.34b	59.93a
BRRI dhan47	9.44c	22.64a	108.43b	89.45b	22.21a	7.62a	13.26a	57.48a
BRRI dhan28	12.68b	21.19b	100.25b	89.43b	19.20b	7.05a	13.44a	53.12b
BRRI dhan50	11.78bc	22.87a	136.10a	119.32a	17.30c	7.02a	13.14a	52.56b
Level of significance	**	**	**	**	**	**	**	*
CV (%)	9.13	3.54	10.73	8.37	2.89	7.27	8.52	6.12

CV = Co-efficient of variation

** = Significant at 1% level

* = Significant at 5% level

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180 3.11 Number of Grain Panicle⁻¹

181 A significant ($P=0.01$) distinction was examined among the four rice varieties in case of grain number
 182 panicle⁻¹. The maximum number of grains panicle⁻¹ was recorded by BRRI dhan50 (119.32) but the
 183 minimum number of grains per panicle was given by Koshihikari (59.56) variety (Table 4). BRRI dhan47
 184 (89.45) and BRRI dhan28 (89.43) were found statistically similar in number of grains panicle⁻¹.

185 3.12 1000-grain Weight

186 1000-grain weight varied significantly ($P=0.01$) among the varieties. The highest 1000 grain weight was
 187 observed in BRRI dhan47 (22.21 g) which was statistically similar to Koshihikari (21.83 g) variety whereas
 188 BRRI dhan50 produced the lowest 1000-grain weight (17.30 g) (Table 4). Takai *et al.* [13] found that
 189 1000-grain weight of Koshihikari was 21.7 grams which is almost similar to this study and Siddiq [14]
 190 observed 21.81 grams of 1000-grain weight of for BRRI dhan28 which is slightly higher than this study.

191 3.13 Grain Yield

192 Grain yield was significantly ($P=0.01$) influenced by the varieties. The maximum grain yield was obtained
 193 from the saline tolerant variety BRRI dhan47 (7.62 t ha⁻¹) which was statistically similar to BRRI dhan28
 194 (7.05 t ha⁻¹) and BRRI dhan50 (7.02 t ha⁻¹) while the minimum grain yield was found in Koshihikari variety
 195 (5.60 t ha⁻¹) (Table 4). Takai *et al.* [13] suggested 5.6 tha⁻¹ yield of Koshihikari and it is absolutely same
 196 as the result of this research. In another study conducted by Toriyama *et al.* [12] reported 5.5 tha⁻¹ of
 197 grain yield of Koshihikari which is very closely to the present study. Salam *et al.* [11] found 7.4 and 5.9 t
 198 ha⁻¹ of grain yield for BRRI dhan47 and BRRI dhan28 and the findings is lower in comparison with this
 199 study. Siddiq [14] reported that the yield of BRRI dhan28 is 7.5 t ha⁻¹ which is in agreement with this
 200 study.

201 3.14 Biological Yield

Analysis of variance showed that biological yield was varied significantly ($P=0.01$). The highest biological yield was observed in BRRI dhan50 (13.44 t ha^{-1}) which was statistically similar with BRRI dhan28 (13.25 t ha^{-1}) and BRRI dhan47 (13.14 t ha^{-1}). The lowest biological yield was found in Koshihikari (9.34 t ha^{-1}) which was significantly lower than the other three high yielding varieties of Bangladesh (Table 4).

3.15 Harvest Index

The experimental data analysis showed that the harvest index varied significantly ($P=0.05$) among the varieties. The highest harvest index was obtained in Koshihikari (59.93 %) which was statistically similar to BRRI dhan47 (57.48 %). The lowest value of harvest index was found in BRRI dhan50 (52.56 %) and was found statistically similar to BRRI dhan28 (53.12 %) (Table 4).

3.16 Average Land acquisition and production for local and high yielding rice varieties in Bangladesh

Table 5. Average Rice Production and Rice Cultivated Land Area in Boro Season in Bangladesh From 2000 to 2009

Category	Number of Years	Mean Production (t/h)	Standard Deviation	Mean Cultivated Land Area (ha)	Standard Deviation	Mean total production (Ton)	Standard Deviation
Local Varieties	10	1.92	0.169	162510	37108	312900	75425
High Yielding Varieties	10	3.43	0.476	4021336	575970	13730200	2320002
Average Rice Production in Boro Season	10	3.37	0.465	4183846	547384	14043100	2266364

The analysis of the rice production in Boro season reveals that local variety rice production is minimum in a unite land area (1.92 t ha^{-1}) while the highest production is observed in High Yielding Varieties (3.43 t ha^{-1}) but the average rice production in Boro season is still 3.37 t ha^{-1} . In an average, to produce 14.04 million ton of rice, farmers had to use 4.18 million hectors of land in that particular season between 2000 and 2009. Among the total cultivated land area Local and High Yielding rice varieties were cultivated in 0.16 and 4.02 million hectors of land that provided 0.31 and 13.73 million tons of rice respectively.

3.17 Market Price of Koshihikari Rice

Table 6. Online Retailer Price of Koshihikari Rice

Number of Brand of Kohsihikari	Mean Price (BDT Kg ⁻¹)	Standard Deviation	Range
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11	465.82	205.20	711.60
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The price of Koshihikari rice collected from different online shops all over the world. The analysis of the data shows that the average online retailer price of koshihikari rice is 465.82 BDT Kg⁻¹, where as in Bangladesh the price of available rice ranges from 29 to 110 BDT Kg⁻¹. As Koshihikari is demand rice in world market, Bangladesh can cultivate it for exporting by utilizing its cheap production factors that are recently utilizing for producing the low valuable rice varieties.

3.18 Economic Prospect of Koshihikari in Bangladesh

Table 7. Projected Production and Export Revenue of Koshihikari Rice

	Revenue (Million BDT)				
	10% of RP	20% of RP	30% of RP	40% of RP	50% of RP
0.1% of CLA	1,091	2,183	3,274	4,366	5,457
0.25% of CLA	2,728	5,457	8,185	10,914	13,642
0.5% of CLA	5,457	10,914	16,371	21,828	27,285
0.75% of CLA	8,185	16,371	24,556	32,742	40,927
1% of CLA	10,914	21,828	32,742	43,656	54,570
2.5% of CLA	27,285	54,570	81,855	109,139	136,424
5% of CLA	54,570	109,139	163,709	218,279	272,849
7.5% of CLA	81,855	163,709	245,564	327,418	409,273
10% of CLA	109,139	218,279	327,418	436,558	545,697

CLA = Mean Rice Cultivated Land Area in Boro Season in Bangladesh (4,183,846 ha)

RP = Average Online Retailer Price of Koshihikari Rice (465.82 BDT Kg⁻¹)

Koshihikari rice yield in Bangladesh is 5600 Kg ha⁻¹

Revenue (BDT) = % of Average Online Retailer Price of Koshihikari Rice (BDT Kg⁻¹) × % of Mean Rice Cultivated Land Area in Boro Season in Bangladesh (ha) × Yield of Koshihikari Rice (Kg ha⁻¹)

The yield of Koshihikari (5.60 t/ha) is still higher than the average rice production (3.37 t/ha) in Boro season in Bangladesh. The projected production and exports table illustrates expected export revenues that are derived from different combination of percentages of rice cultivated land area in Bangladesh in Boro season and percentages of online retailer prices of Koshihikari rice in world market. In 2009 Bangladesh exported 7.53 million kg of native rice and gained revenue of 723.80 million BDT at an average unit price of 96.11 BDT/kg [15].

4. Conclusion

Koshihikari was the earliest variety among the rice varieties taken in this research. It took only 124 days for harvesting after sowing. The maximum yield was found in BRRI dhan47 but Koshihikari had the all the good yield contributing characteristics except the long panicle length. Koshihikari variety had the shortest panicle length, so it contains the lower number of grain per panicle that results the lowest yield comparing with the other three high yielding rice varieties of Bangladesh. The effective tiller hill⁻¹ was the maximum in Koshihikari that was the one of the most important character for higher yield. The yield of the Koshihikari rice variety may be higher than the BRRI dhan47, if the panicle length will be about 22 cm.

The shattering rate of grain was very low in Koshihikari variety and it can tolerate cold more than the other three varieties. The average production of Koshihikari rice in 0.1% cultivated land in Boro season may bring about BDT 1,091 million export revenue at an exporting price of only 10% of the online retailer price of Koshihikari in the world market and the revenue will exceed total revenue comes from rice exporting at present. Moreover, Bangladeshi rice varieties are not that much popular in world market but Koshihikari is well accepted in many developed countries all over the world. As an agriculture dependent economy, Bangladesh can improve its economic situation to a great extent by best utilization of production factors and encouraging farmers to produce relatively valuable Koshihikari rice more for exporting to earn foreign remittance.

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