

PERFORMANCE OF HYBRID AND INBRED RICE GENOTYPES AT TWO DIFFERENT LOCATIONS OF BANGLADESH DURING DRY SEASON

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Abstract

Bangladesh is an extremely land scarce country. Any improvement of rice yield has significant impact on the overall food security of the country. Hybrid rice is one of the viable and proven technologies that have been considered as a new frontier to increase rice production. Performance of two new exotic hybrid rice genotypes from India BIO-404 and BIO-452 including two popular BRAC hybrid (Alloran and Sathi) and one inbred (BRRI dhan28) were evaluated at BRAC Agricultural Research and Development Centre of Gazipur and also in the farmer's field of Rajshahi district during dry season (boro) of 2011. Both the exotic BIO genotypes showed a better cold tolerance at the seedling stage. The initial growth of BIO-404 and BIO-452 were better compared to other tested genotypes. But at the later stage they showed a higher plant height and lower panicle number resulting in lower grain yield than the check hybrids. The spikelet fertility of the two exotic hybrid rice genotypes was also low. Hybrid Alloran produced the highest grain yield in both the locations which was attributed to higher spikelet fertility and higher individual grain weight.

Key words: Hybrid rice, Grain yield, and Spikelet fertility

Introduction

Agriculture is the mainstay of Bangladesh economy and about 43.6% of the labor force is employed in agriculture with about 57% being employed in the crop sector (BER, 2011). The principal crop and the dominant food staple is rice, which occupies nearly 76% of its total cropped area in the country (BER, 2005). Due to the inception of HYVs under irrigated condition in Bangladesh, the rice yield has increased to manifolds. But the ever increasing population demands further improvement in yield level as the cultivation area is either decreasing or remaining constant.

One important innovation could be the development of hybrid rice varieties, which is expected to shift the yield potential of the rice plant by 15-20% or more with the application of almost same amount of agricultural inputs (Hossain *et al.*, 2000). Nevertheless, hybrid rice is one of the viable and proven technologies that have been considered as a new frontier to increase rice production and it has greatly contributed to the growth of rice production in China (Lin, 1991; Lin, 1994; Virmani *et al.*, 1998). The technology has attracted the attention of research leaders and policy-makers in many Asian countries who found it as an opportunity to overcome the yield ceiling reached by many enterprising farmers in the irrigated ecosystem (Hossain *et al.*, 2003). Hybrid rice is rice that has been created by crossing two different parental strains. Such crosses generally result in an F1 generation that is more robust than either of the parental strains. Good rice hybrids have the potential of yielding 15-20 percent more than the best inbred variety grown under similar conditions

Farmers achieve 25-30% yield gains from hybrids as compared to best inbreds. So hybrid rice can play a vital role in future food security of Bangladesh. In 2010-11, country's hybrid rice production was only 28 lakh tones from 6.53 lakh hectares of land, but now the hybrid rice production has increased significantly (www.bangladesh-economy.org). A recent report in the Philippine Star, a major Manila daily, said that Bangladesh was banking on the Philippine-produced hybrid rice seeds in its program to achieve rice self-sufficiency. Therefore, an in-depth study on prospect of hybrid rice cultivation at the farmers' level is essential to evaluate yield performance and profitability, and farmers' acceptance of hybrid rice varieties and their production technology. The main focus of the present study is to generate primary data from two different regions to study the performance of two new exotic hybrid rice genotypes BIO-404 and BIO-452. The study also focuses on the farmers' perception about the hybrid rice.

Materials and Methods

An experiment was conducted at BRAC Agricultural Research and Development Centre (BARDC) Gazipur and a field of Paba Upazila of Rajshahi district during the boro season 2011 to study the performance of two new exotic hybrid rice genotypes BIO-404 and BIO-452 including two hybrid (Alloran and Sathi) and one inbred (BRRI dhan28) checks. The

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experiment was laid out in Randomized Complete Block Design with three replications. The treatments were randomly distributed to the plot in each block. There were (5×3) or 15 unit plots whereas the unit plots size were (4m x 2m) or 8 m². The plot to plot distances was 0.4 m and block to block distance was 0.8 m. During the grain period of the crops all necessary cares (application of fertilizers, pesticides, irrigation, weeding etc.) were done to ensuring and maintaining the normal growth and development of the crop.

Ten hills were selected at random from each plot and total number of tillers at each of 20, 40 and 60 DAT and also at 50% flowering and harvesting were measured and averaged. 1 m² area was selected from each plot and total number of tiller m⁻² at each of 20 40 and 60 DAT; and also at 50% flowering and harvesting were measured and averaged. Plant height was measured from the ground level to the top of the panicle from plants of 10 hills in each plot and averaged. 1 m² area was selected from each plot and number of panicle was measured and averaged. Panicle lengths were measured from 10 selected panicles, recorded in cm and averaged. Twenty panicles were selected and the filled and unfilled grains panicle⁻¹ were counted and averaged. 1000 grain weights were calculated from 3 unit samples of each plot and averaged. 8 m² of each plot was harvested and yield was converted to ton ha⁻¹ at 14% moisture content.

Results and Discussions

At both locations the highest plant height was observed in BIO-452 and Alloran had the lowest plant height among the tested genotypes. At Gazipur adequate number of tiller was observed at BIO-404 and it was highest at 40 days after transplanting (DAT) but at later stage we observed severe blight infestation that might be cause of reduce number of tiller production (Table 1). Highest number of tiller m⁻² was observed in BRRI dhan28 at flowering stage where BIO-452 produced lower tiller number. At Rajshahi tiller number of three checks (Alloran, Sathi, and BRRI dhan28) was higher than two BIO hybrids at flowering stage (Table 2).

Table 1. Plant height and tiller dynamics of hybrid rice during boro 2011-12 season at Gazipur

Genotypes	Plant height (cm)	Tiller dynamics (m ⁻²)			
		20 DAT	40 DAT	60 DAT	50% flowering
BIO-404	111	117	442	282	237
BIO-452	124	133	333	200	197
Alloran	109	125	400	225	203
Sathi	111	100	375	250	222
BRRI dhan28(Ck)	117	100	400	258	258
CV (%)	2.60	32.60	8.90	11.20	10.20
LSD	5.59**	NS	64.30*	51.11*	NS

* and ** Significant at 5% and 1% probability level respectively.

Table 2. Plant height and tiller dynamics of hybrid rice during boro 2011-12 season at Rajshahi

Genotypes	Plant height (cm)	Tiller dynamics (m ⁻²)			
		20 DAT	40 DAT	60 DAT	50% flowering
BIO-404	105	40	158	268	268
BIO-452	110	53	110	203	177
Alloran	104	43	142	287	293
Sathi	105	45	123	280	298
BRRI dhan28(Ck)	105	43	197	292	297
CV (%)	0.6	10.2	10.9	8.2	8.0
LSD	1.26**	8.68*	29.97**	40.91**	40.05**

* and ** Significant at 5% and 1% probability level respectively.

Growth duration was measured from the date of seeding to date of harvesting. At Gazipur, it was observed that BIO-404 took 150 days to harvest which was similar to other two check hybrids (Alloran and Sathi). But BIO-452 BRRI dhan28 were 7 and 13 days earlier, respectively than other hybrids (Table 3). At Rajshahi BIO-404 took 154 days to harvest which was 4-5 days later than other hybrids and 6 days later than the inbred check BRRI dhan28 (Table 4).

Number of panicle m^{-2} was calculated and at both sites highest number of panicle m^{-2} was measured in BRR1 dhan28 while the lowest in BIO-452 (Table 3 and 4). At both locations panicle length was found almost similar and statistically identical to each other. It varied from 23.60 - 25.23 cm (Table 3 and 4).

At Gazipur, maximum spikelet panicle-1 was observed in hybrid genotypes BIO-452 and minimum in hybrid check Sathi. But in Rajshahi, maximum was found in BIO-404 and minimum in Sathi (Table 3 and 4).

At Gazipur, the highest spikelet fertility was observed in hybrid check Sathi and the lowest in BIO-452 (Table 3). At Rajshahi the highest spikelet fertility was observed in inbred check BRR1 dhan28 while the lowest was observed in BIO-404 (Table 4).

At Gazipur, it was observed that the maximum 1000-grain weight was in hybrid check Sathi and minimum in BRR1 dhan28 while at Rajshahi the maximum 1000-grain weight was in hybrid check Alloran and the minimum in BRR1 dhan28 (Table 3 and 4).

The highest grain yield at Gazipur was measured for Alloran and lowest for BRR1 dhan28 and at Rajshahi maximum yield was for Alloran but minimum for BIO-452 (Table 3 and 4).

Table 3. Yield and yield components of hybrid rice during boro 2011-12 season at Gazipur

Genotypes	Duration (days)	Panicle m^{-2}	Panicle length (cm)	Spikelet Panicle ⁻¹	Spikelet fertility (%)	1000-grain weight (g)	Yield (t ha ⁻¹)
BIO-404	150	232	24.67	197	65.80	23.27	7.27
BIO-452	143	188	23.07	235	53.96	22.50	7.75
Alloran	150	195	24.02	150	74.37	28.32	7.95
Sathi	150	205	23.60	141	78.26	28.54	7.75
BRR1 dhan28(Ck)	137	247	23.47	160	69.41	21.28	6.87
CV (%)	-	12.80	2.50	7.0	10.00	2.40	3.50
LSD	-	51.55**	NS	23.45**	12.9*	1.12**	0.50**

* and ** Significant at 5% and 1% probability level respectively.

Table 4. Yield and yield components of hybrid rice during boro 2011-12 season at Rajshahi

Genotype	Duration (days)	Panicle m^{-2}	Panicle length (cm)	Spikelet Panicle ⁻¹	Spikelet fertility (%)	1000-grain weight (g)	Yield (t ha ⁻¹)
BIO-404	154	242	25.23	231	47.20	24.40	6.8
BIO-452	150	192	24.12	205	55.57	23.93	6.1
Alloran	149	233	24.37	150	71.10	28.17	7.6
Sathi	150	275	24.44	143	69.36	28.04	6.5
BRR1 dhan28(Ck)	148	325	24.10	155	77.47	21.87	6.5
CV (%)	-	12.80	3.50	7.0	4.90	10.5	7.50
LSD	-	61.06*	NS	26.09**	5.96**	NS	NS

* and ** Significant at 5% and 1% probability level respectively.

From the above results, it may be summarized that the hybrid rice variety Alloran had lower plant height in both locations among the tested genotypes. Tiller dynamics were also good in both locations. The variety also gave the highest yield in both Gazipur and Rajshahi which was attributed to higher spikelet fertility and individual grain weights. So considering all these results, Alloran could be one of the suitable hybrid varieties during rabi season to increase rice production and ensure food security.

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