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Performance of IR68877H and IR69690H (BRRI Hybrid Dhan1) in the South-central Region of Bangladesh

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Abstract: On farm trials were established with two advanced hybrid rice lines, IR68877H and IR69690H during the boro season 2000-2001 in five locations-Fakirhat, Babuganj, Bhola sadar, Mothbaria and Nalchhiti upazilla under Bagerhat, Barisal, Bhola, Pirojpur and Jhalokathi districts, respectively. Near each hybrid rice field, BRRI dhan28 and BRRI dhan29 were also transplanted. The varieties BRRI dhan28 and BRRI dhan29 were used as check varieties for IR68877H and IR69690H, respectively. The performance of IR69690H was better than that of IR68877H. The grain yield of IR68877H varied between 6.5 and 9.30 t ha⁻¹ with an average yield of 7.85 t ha⁻¹ over the locations and that of IR69690H, it was 7.26 to 9.56 t ha⁻¹ with an average of 8.25 t ha⁻¹. The average yield advantage of IR68877H over the check variety BRRI dhan28 was 1.41 t ha⁻¹ and that of IR69690H over BRRI dhan29 was 1.51 t ha⁻¹. Great variations on grain yield were observed among the sites. The locations Babuganj and Bagerhat were the most productive, whereas the site Mothbaria was the least productive. Majority of the farmers preferred IR69690H, which was later released as hybrid rice variety named as BRRI hybrid dhan1 for Jessore and Barisal region. The farmers chose this line mainly due to its higher yield potential, larger panicle size, low shattering tendency of grain and good appearance.

Key words: Hybrid rice, grain yield, south-central region

INTRODUCTION

Bangladesh is one of the densely populated countries of the world and its booming population is a challenge for the rice scientists to feed them. To feed this ever-increasing population from declining cropland area, the agriculture sector will have much more pressure to produce more rice per unit area per unit time. At the present population growth, the growth in the rice production must increase from 2.6 to 3.6% per year. We have to produce 50 million tons of rice by 2020 to feed more than 18 million people in that time and to achieve this target; the rice yield should increase to 5.5 t ha⁻¹ compared to 2.8 t ha⁻¹ at present^[1]. Development of new high yielding genotypes and their optimum cultural techniques are urgently required because rice yield potential has not increased substantially in the tropics in the past three decades since the green revolution began^[2]. Julfikar *et al.*^[3] reported that hybrid rice seems to be an alternative to break the present yield ceiling of semi-dwarf modern varieties and for meeting up the increasing demand of rice in Bangladesh. Yuan^[4,5] noted that hybrid rice in China gave a yield advantage of 1.0 to 1.5 t ha⁻¹ (20-30%) over the conventionally bred modern varieties. Some other countries like India, Vietnam

and Philippines are also developing and popularizing hybrid rice technology. In Bangladesh, research and development of hybrid rice technology was initiated in 1993 with the introduction of rice hybrids and parent materials from International Rice Research Institute (IRRI). A number of IRRI developed hybrid lines were tested in different locations of Bangladesh. Among these, two hybrid lines-IR68877H and IR69690H were selected and tested under a pilot programme to observe the performance of these lines in different locations of the south-central region of Bangladesh.

MATERIALS AND METHODS

On farm trials were established with two advanced hybrid rice lines, IR68877H and IR69690H during the boro season 2000-2001 in five locations-Fakirhat, Babuganj, Bhola sadar, Mothbaria and Nalchhiti upazilla under Bagerhat, Barisal, Bhola, Pirojpur and Jhalokathi districts, respectively. These districts represent a major unfavorable agro-ecological situation in Bangladesh, due to tidal flush flood^[6]. In each location, 33 decimal land area was transplanted for each line. Near each hybrid rice field, BRRI dhan28 and BRRI dhan29 were also transplanted with the farmers' practice. The varieties BRRI dhan28 and

BRRi dhan29 were used as check varieties for IR68877H and IR69690H, respectively, because the growth duration of BRRi dhan28 and IR68877H were comparable and that of BRRi dhan29 and IR69690H. Transplanting was done between 5 and 15 January. Thirty to 35 day-old seedlings were used. Two seedlings per hill was transplanted maintaining 0.2x0.2 m spacing. The fertilizer rate was 120:28:60:10 and 4 kg ha⁻¹ of N:P:K:S and Zn, respectively. Phosphorus, Sulfur and Zinc fertilizers were applied one day before transplanting during final land preparation. Potash was applied in two equal splits, one at final land preparation and the other at maximum tillering stage. Nitrogenous fertilizer was applied in three equal splits, at final land preparation, at active tillering stage and just before panicle initiation stage. Weeding was done two to three times and insecticides were applied as and when necessary to keep the field free from insect-pests.

Three randomly selected areas of 10 m² each (treated as unit plot) were harvested from each lines/varieties in each site for grain yield. The yield obtained from this area was adjusted to 14% moisture content and converted to t ha⁻¹. Panicles⁻¹ was calculated from randomly selected 20 hills from each unit plot and then two hills having average panicle number were harvested, from where grains per panicle and sterility percentage were obtained. The data obtained were statistically analyzed by standard statistical procedure^[7].

RESULTS AND DISCUSSION

The performance of hybrid rice was better compared to the check varieties. Between the hybrids, the line IR69690H was better than that of IR68877H. The panicle number m⁻² and grain number panicle⁻¹ were higher in IR69690H compared to IR68877H over the locations. The panicle number m⁻² varied from 315 to 410 for IR68877H (Table 1) and that of IR69690H from 385 to 447 (Table 2). The panicle number of IR69690H was significantly higher than that of BRRi dhan29 in all the sites, whereas the panicle number m⁻² of IR68877H was higher significantly compared to BRRi dhan28 only in two locations- Bagerhat and Barisal. The grain number panicle⁻¹ varied from 113 to 155 and 128 to 153 for IR68877H and IR69690H, respectively. In most of the sites, grain number of both the hybrid lines was significantly higher compared to the check varieties (Table 1 and 2). The sterility percentage was higher in IR68877H and was varied from 26 to 34 in IR68877H and 10 to 28 in IR69690H. Shattering tendency of ripened grains were more in IR68877H than that of IR69690H. The grain yield of IR68877H varied between 6.5 and 9.30 t ha⁻¹, with an average yield of 7.85 t ha⁻¹ over the locations (Fig. 1) and that of IR69690H, it was 7.26 to 9.56 t ha⁻¹ with an average of 8.25 t ha⁻¹ (Fig. 2). The average yield advantage of IR68877H over the check variety BRRi dhan28 was 1.41 t ha⁻¹ and that of IR69690H over BRRi dhan29 was 1.51 t ha⁻¹. Chowdhury^[8] and Julfikar *et al.*^[3] also reported that these two lines

Table 1: Yield and yield contributing characters of IR68877H and BRRi dhan28 in different sites of the south-central region of Bangladesh, Boro 2000-2001

Site	Panicle (No. m ⁻²)			Grain (No. panicle ⁻¹)			Sterility (%)		
	IR68877H	BRRi dhan28	Difference	IR68877H	BRRi dhan28	Difference	IR68877H	BRRi dhan28	Difference
Babuganj	410a	300.0a	110**	139ab	98.0a	41**	26a	30.0a	4ns
Bagerhat	367ab	291.0a	76*	113b	101.0a	12ns	34a	32.0a	2ns
Bhola sadar	336ab	289.0a	47ns	119ab	105.0a	14ns	32a	35.0a	3ns
Mothbaria	315b	279.0a	36ns	115b	101.0a	14ns	33a	26.0a	7*
Nalchhiti	320b	285.0a	35ns	155a	99.0a	56**	33a	29.0a	4ns
Average	350	289.0		128	101.0		32	30.0	
CV (%)		12.1			8.9			12.3	

Means followed by similar letter(s) in a column did not differ significantly at 0.05 level by DMRT

*, ** indicate significant difference between IR68877H and BRRi dhan28 at p≤0.05 and 0.01, respectively

Table 2: Yield and yield contributing characters of IR69690H and BRRi dhan29 in different sites of the south-central region of Bangladesh, Boro 2000-2001

Site	Panicle (No. m ⁻²)			Grain (No. panicle ⁻¹)			Sterility (%)		
	IR69690H	BRRi dhan29	Difference	IR69690H	BRRi dhan29	Difference	IR69690H	BRRi dhan29	Difference
Babuganj	422.0ab	312.0a	110.0**	138a	114a	24**	22ab	27a	5ns
Bagerhat	385.0b	299.0a	86.0**	153a	108a	45**	10b	34a	24**
Bhola sadar	447.0a	310.0a	137.0**	128a	111a	17ns	28a	33a	5ns
Mothbaria	425.0ab	295.0a	130.0**	152a	99a	53**	18ab	36a	18**
Nalchhiti	413.0ab	299.0a	114.0**	147a	109a	38**	17ab	32a	15**
Average	418.0	303.0		144	108		19	32	
CV (%)	5.1	9.3	12.8						

Means followed by similar letter(s) in a column did not differ significantly at 0.05 level by DMRT

*, ** indicate significant difference between IR69690H and BRRi dhan29 at p≤0.05 and 0.01, respectively

Table 3: Cropping patterns of the experimental fields in different sites of the south-central region

Sites	Cropping pattern
Babuganj	Boro-Fallow-Fallow
Bagerhat	Boro-Fallow-Fallow
Bhola sadar	Boro-T. Aus-T. Aman
Mothbaria	Boro-Fallow-T. Aman
Nalchhiti	Boro-Fallow-Fallow

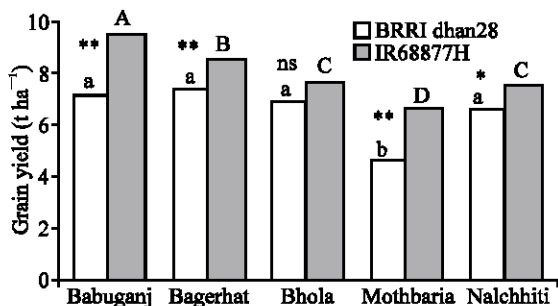


Fig. 1: Yield performance of IR68877H and BRRIdhan28 in different sites of the south central region of Bangladesh, Boro 2000-2001

*, **, ns: Significant at 5%, 1% and not significant, respectively, between the varieties in each location. Mean grain yield expressed as bar graph followed by similar letter(s) did not significantly differ among the sites at 5% level by DMRT. Small letter for BRRIdhan28 and capital letter for IR68877H

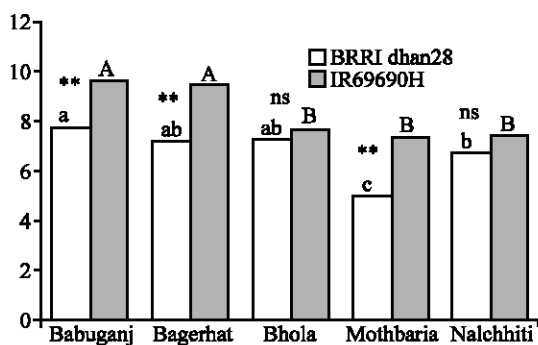


Fig. 2: Yield performance of IR69690H and BRRIdhan28 in different sites of the south-central region, Boro 2000-2001

*, **, ns: Significant at 5, 1% and not significant, respectively, between the varieties in each location. Mean grain yield expressed as bar graph followed by similar letter(s) did not significantly differ among the sites at 5% level by DMRT. Small letter for BRRIdhan28 and capital letter for IR69690H

had an average yield advantage of more than 1 t ha⁻¹ over the check variety of the same growth duration in multi location and on station trials in various regions of Bangladesh. In this experiment, a great variation in yield

was observed both in inbred and hybrid varieties/lines (Fig. 1 and 2). This was an agreement with Chowdhury [8]. The location Babuganj and Bagerhat were the most productive sites, whereas the site Mothbaria was the least productive. Lower yield was also recorded in Bhola, where three crops were usual practice and that might be the cause of lower yield (Table 3). On the other hand, at Nalchhiti, the irrigation facilities were inadequate and crop management practices were poor. These were the probable reasons behind the low yield in Nalchhiti, although it was a single boro area. The Mothbaria site was under saline zone that might cause the low yield of both inbred and hybrid rice, even though, it paved a new opportunity to increase rice yield in that area, where yield advantage of hybrid rice cultivation was about 2 t ha⁻¹. From these results, it was also evident that hybrid rice was most suitable in single Boro area, where soil conserved more organic matter and other mineral nutrients due to flood-water during rainy season. Therefore, special attention should be given to increase high input loving hybrid rice production in that area.

During the crop cut, the farmers' reaction was investigated. In each crop cut, about 50 farmers were present. Most of the farmers showed their keen interest to cultivate hybrid rice, as the yield was more than 1 t ha⁻¹ higher as compared to the inbred variety with the same growth duration. Majority of the farmers preferred IR69690H, which was later released as hybrid rice variety named as BRRIdhan1 for Jessore and Barisal region. The farmers chose this line mainly due to its higher yield potential, larger panicle size, low shattering tendency of grain and good appearance. The line IR68877H although over yielded the inbred check variety BRRIdhan28 by more than 1 t ha⁻¹ but the farmers were reluctant to accept it due to its high shattering tendency of grain and partially opened seed coat (leama and palea were not completely closed).

At present, the area under Boro cultivation is about 1,27,100 ha in this region [9]. Primarily, if 30% of the total boro area could be brought under hybrid rice cultivation and if the average yield could increase to 5 t ha⁻¹, which is only 65% of the average yield (8.25 t ha⁻¹) obtained from hybrid rice experiments in different locations of this region, then more than 95,000 MT of additional rice could be produced. This additional rice will be able to feed about 0.51 million people annually (423.3 g rice per head per day) [10] and that could be one-step advancement for the national food security [11]. In Bangladesh perspective, the total area covered by boro cultivation is 3.83 M ha. Provided that 25% of the total boro area is brought under hybrid rice cultivation, then around 1.5 million MT additional rice will be produced which would be a great achievement to boost up the national rice production [12].

The growing demand for rice for teeming the huge population could not be met from the present level of yield of conventional high yielding varieties. The performance of IR69690H (later released as hybrid rice variety for cultivation in Jessore and Barisal region) was better in respect of yield and other qualities compared to its inbred check variety, BRRI dhan29 of similar growth duration. However, this is not enough. Moreover, there is no suitable hybrid rice variety for other regions of Bangladesh. A technical breakthrough by developing new hybrid rice varieties having yield potential of more than 10 t ha⁻¹ of rough rice is a must for sustainable food security in foreseeable future.

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