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# STUDY ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF ADVANCED HYBRID RICE LINES

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**Abstract**

This study was conducted to evaluate the performance of hybrid rice and some advance line based on yield and yield contributing character. Use of hybrid rice varieties may be an appropriate potential source for enhancements of rice production for becoming self-sufficiency in rice production. Heera dhan produced the tallest plant (120.3 cm) and advanced rice line HSLY-3 gave the shortest plant (85.1 cm). The advanced rice line HSG-6 produced the highest number of tillers hill$^{-1}$ (14.5) and the lowest was recorded in Heera dhan (9.2). Heera dhan produced the highest grain yield 7.19 t ha$^{-1}$. It was outcome of the highest number of grain panicle$^{-1}$ (122.6) and the lowest grain yield was observed in the advanced rice line HSLY-3 3.12 t ha$^{-1}$. Hybrid rice gave more yields with proper management but lacking of proper management yield of hybrid rice drastically reduced.

**Key words: Hybrid rice line, check varieties and yield**

## Introduction

Bangladesh is one the densely populated country in the world. At present, it is the home of 115 million and will swell progressively to 223 million by the year of 2030 which will require 48 million tons of food grains. Rice is the staple food for the people of Bangladesh. It provides 75% calories and 55% protein in the average daily diet of the people of Bangladesh (*Bhuiyan et al, 2002*). However, the yields of modern rice varieties are declining with the use of inputs and relatively high and standard management practices.

Yield is the product of some components, such as, number of effective tillers hill$^{-1}$, number of grains panicle$^{-1}$ and weight of individual grain. Studies have indicated that grain yield of rice could be improved by increasing the number and size of spikelets (*Venkateswark et al., 1981*) and individual grain weight. These components are directly related to the variety itself and prevailing environments in which it is grown. Grain yield depends mostly upon the accumulation of dry matter in different vegetative parts and its translocation to the developing panicle. Among the different phases of crop growth, ripening is the most in rice, where the stored carbohydrates and current assimilates are translocated to the panicle resulting in appropriate grain filling. Research organizations are recently trying to develop new rice varieties to maximize yield unit$^{-1}$ area. In this effort, they develop or isolate several lines either through conventional breeding methods or mutations breeding or using tissue culture or biotechnology. But all the lines are not similar in respect of plant characters and also not equally responsive to environmental situations, which have profound effect on yield. Variety is one of the most important factors for increasing yield. In general, it is understood that there are many differences in morph physiology aspects, among the modern varieties and advanced lines. Rice varieties in Bangladesh have a long growth duration (150-160 days in Boro season) with a low daily yield (Lower than 30 kg ha$^{-1}$ day$^{-1}$) while the hybrid one because of its hybrid vigor only needs 120-130 days to mature (Julfiquar et al., 1997). In the present study on yield and yield performances of seven advanced rice lines in comparison to check varieties were evaluated in the boro season with the following objective: to evaluate their yield and yield contributing characters.

## Materials and Methods

The experiment was conducted to studying on yield and yield contributing characters on advanced rice lines (HSCY-900, HSLY-106, HSLY-3, HSFZ-2, HSG-6, HSG-5 and HSSY-64 ) in comparison to check varieties (Hybrid Heera dhan and modern check varieties BRRI dhan28). The soil of the experimental unit belongs to the sonatola series of old Brahmaputra Flood Plain (AEZ-9), a non calcareous dark grey flood plain soil and sandy loam in texture. Soil p$^{H}$ value range from 5.9 to 6.5. Thirty day old seedlings were transplanted. The plot size was 4.0m X 2.5m. Nitrogen, phosphorous, potassium, sulphur and zinc fertilizer were applied as per recommendation of BRRI (1991). All the phosphatic, potassic, sulphur, zinc and one third of urea fertilizer were applied at the time of final land preparation and were mixed thoroughly with soil. The rest of the urea was top dressed in two equal splits. One at active tillering stage and the other at panicle initiation stage at 30 and 50-55 days after transplanting respectively. Weeding was done twice by hand pulling on 15 and 30 DAT. Dimacron 100EC @ 0.839 L ha$^{-1}$ was applied to control rice stem borer at tillering stage (30DAT). The crop was harvested when 80% of the seeds became golden yellow in color. Grains were sun dried and adjusted at 14% moisture

content to estimate grain yield. Data were collected on plant height (cm), Number of total tillers hill$^{-1}$, number of effective tillers hill$^{-1}$, panicle length (cm), Number of total spikelets panicle$^{-1}$, number of grains panicle$^{-1}$, 1000- grain weight and Grain yield t ha$^{-1}$ at optimum harvest date. The data were analyzed following the ANOVA technique and the mean differences were adjudged by the Duncan's Multiple Range Test (Gomez and Gomez, 1984) using a statistical computer package MSTAT.

**Results and Discussion**

Yield generally refers to the economic out put of any crop. Incase of rice it is mostly grain. But the grain yield of rice depends on number factors like plant character; yield and yield contributing characters. However the salient features are discussed below along with the data obtained in the experiment

*Plant height*

Plant height differed significantly among the advanced rice lines at maturity. At harvest Heera dhan produced the tallest plants (120.3 cm) while advanced rice line HSLY-3 produced the shortest plants (85.2 cm) which was statistically identical to those of advanced rice lines HSSY-64 (90.2 cm). The advanced rice lines HSFZ-2 (107.3 cm) and BRRI dhan28 (109.7 cm) produced statistically similar plant height. The variation in plant height might be due to the genetic make up of the advanced rice lines. These results were agreement with those of Hossain and Alam (1991) and Mia (1993) showed that plant height varied significantly among the varieties (Table 1).

*Number of total tillers hill$^{-1}$*

There were statistically variations among the rice lines and varieties in the case of total tillers production hill$^{-1}$. The highest number of total tillers hill$^{-1}$ was counted in advanced rice lines HSG-6 (14.5) and lowest was Heera dhan (9.2) variable effect of rice line on number of total tillers hill$^{-1}$ was reported by Guowei et al (1998) who noticed that total tillers hill$^{-1}$ differed significantly among the advanced rice lines. These differences in the production of total tillers might be due to genetically variation, physiological functions and growth characters of the lines under study.

*Number of effective tillers hill$^{-1}$*

Number of effective tillers hill$^{-1}$ varied significantly among the advanced rice lines. The results indicated that the highest number of effective tillers hill$^{-1}$ was counted in HSFZ-2 (13.5) and lowest was Heera dhan (8.8). The probable reason of difference in producing effective tillers hill$^{-1}$ is the genetic make up of the variety which is primarily influenced by heredity. There findings corroborate with those reported by Chowdhury et al (1993). There are reports that percentage of effective tillers were higher in low tillering cultivars than in high (*Ramesh et al.,1999*). The results also indicated that a rice plant may produce a number of tillers during its early growth period but all of them may not become effective i.e., they donot bear panicles.

*Panicle length*

Panicle length of a variety of rice has a great influence on grain setting that determines yield of rice. Length of panicle was significantly influenced by line/ variety. The panicle length of HSSY-64 was the maximum (26.5 cm) and lowest was recorded in rice line HSLY-3 (20.5 cm). The rest of advanced rice lines and varieties had intermediate panicle length. This variation as assessed might be mainly due to genetic characteristics of the varieties which are primarily influenced by heredity. Although advanced rice line HSSY-64 produced the longer panicle length, it did not produce the highest grain yield. Because although it had the maximum spikelets panicle$^{1}$ (157.8) but it filled grains was lower panicle$^{-1}$.

*Number of total spikelets panicle$^{-1}$*

The variation due to line was significant for number of total spikelets panicle$^{-1}$. The highest number of total spikelets panicle$^{-1}$ was produced by advanced by rice line HSFZ-2 (80.7). Difference in number of total spikelets panicle$^{-1}$ due to lines/ varieties were also reported by BRRI (1994). Number of total spikelets panicle$^{-1}$ indicates grain density in the panicle and it is one of the major yield contributing characters. In the study varietals differences regarding the number of total spikelets panicle$^{-1}$ was probably due to their differences in genetic constituents and other biological factors like sink source variation.

*Number of grains panicle$^{-1}$*

Advanced rice lines/ varieties differed significantly in respect of number of grains panicle$^{-1}$. The maximum number of grains panicle$^{-1}$ was produced Heera dhan (122.6) and the lowest number (66.9) of grains panicle$^{-1}$ was observed at advanced rice line HSFZ-2, Kamal et al. (1998) reported variable number of grains panicle$^{-1}$ among the rice lines. Varietal variation regarding the number of grains panicle$^{-1}$ might be due to their variation of total spikelets panicle$^{-1}$ and also due to variation in photosynthetic assimilate accumulation especially after heading in the sink.

*1000-grain weight*

The 1000- grain weight showed significant variation among advanced rice lines. It was observed that the highest 1000- grain weight (27.66g) was in advanced rice line HSSY-64 and the lowest was (21.7 g) was found in advanced rice line HSFZ-2. The rest of advanced rice lines and varieties had values (24.29 to 27.50 g) presented in (Table 1).

*Grain yield*

There was significant variation in grain yield among the advanced rice lines. The results showed that Heera dhan produced the maximum grain yield (7.19 t ha$^{-1}$). Biswas et al. (1998), Gupta et al. (1998) and BINA (1992) recorded variable grain yield among rice lines. The highest grain yield of Heera dhan was the consequence of highest number of grains panicle$^{-1}$, percentage of grain and the second highest number of total spikelets panicle$^{-1}$. It was found that grain yield had positively correlated with yield contributing character's like number of grains/panicle (R2=0.4869), weight of 1000- grain (R2=0.1078) number of panicles hill$^{-1}$ negatively correlated with yield (R2=0.1186) Figure (1, 2, 3). These relationships indicated that with the increasing number of grain panicle$^{-1}$ and weight of 1000-grain yield was increased. On the other hand grain yield was decreased with the increasing number of panicle hill$^{-1}$.

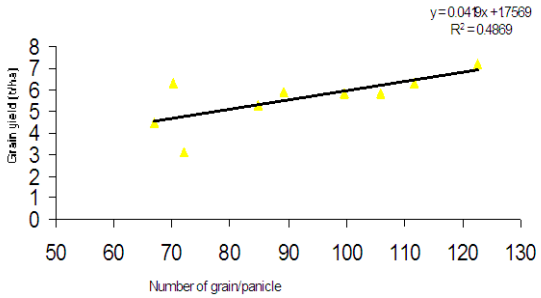


**Fig. 1 Correlation between grain yield and number of grains/ panicle of different advanced rice lines and check varieties**

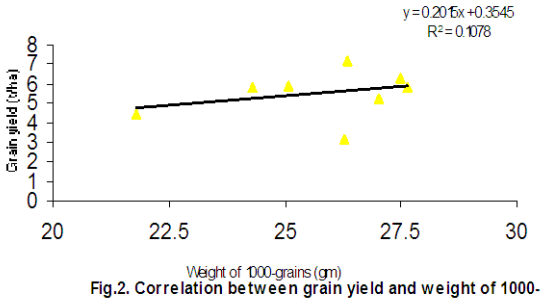


**Fig.2. Correlation between grain yield and weight of 1000-grains of different advanced rice lines and check varieties**

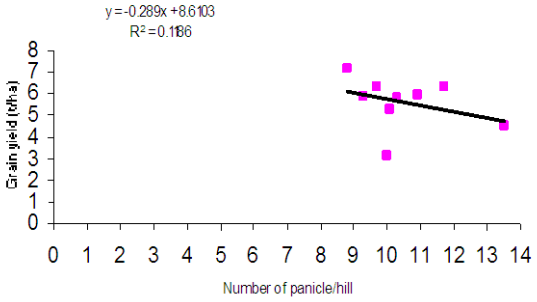


**Fig.3. Correlation between grain yield and panicles/hill of different advanced lines and check varieties**

## Conclusion

It could be said that the advanced rice lines had lower plant height than Heera dhan and BRRI dhan28. So, these lines did not lodge up to at harvest. The advanced rice lines HSCY-900, HSLY-106, HSG-6 and HSSY-64 produced comparable grain yield to Heera dhan (99-5). So, these lines have to be further evaluated for growing in boro season and confirmation of yield.

Table 1. Yield contributing characters on advanced rice lines in comparison to check varieties

| Treatments (Advance lines) | Plant height(cm) | No. of total tillers/hill | No. of bearing tillers/hill | Panicle length (cm) | No. of total spikelets /panicle | No. of grains/ panicle | 1000 grain weight (gm) | Grain yield (t/ha) |
|---|---|---|---|---|---|---|---|---|
| HSCY-900 | 103.1 | 12.0 | 10.9 | 23.80 | 130.0 | 89.2 | 25.09 | 5.93 |
| HSLY-106 | 97.3 | 10.6 | 9.7 | 24.0 | 129.4 | 111.6 | 27.5 | 6.30 |
| HSLY-3 | 85.1 | 11.1 | 10.0 | 20.5 | 84.9 | 72.0 | 26.3 | 3.12 |
| HSFZ-2 | 107.3 | 14.0 | 13.5 | 23.07 | 80.7 | 66.9 | 21.79 | 4.47 |
| HSG-6 | 92.9 | 14.5 | 11.7 | 23.2 | 91.7 | 70.1 | 27.5 | 6.31 |
| HSG-5 | 100.1 | 10.4 | 10.1 | 23.8 | 102.8 | 84.8 | 27.02 | 5.26 |
| HSSY-64 | 90.2 | 10.6 | 9.3 | 26.5 | 157.8 | 105.8 | 27.66 | 5.84 |
| Heera (99-5) | 120.3 | 9.2 | 8.8 | 24.6 | 137.8 | 122.6 | 26.34 | 7.19 |
| BRRI dhan28 | 109.7 | 11.17 | 10.3 | 24.6 | 112.6 | 99.6 | 24.29 | 5.82 |
| CV (%) | 3.15 | 11.41 | 12.53 | 2.73 | 5.64 | 7.05 | 1.84 | 8.47 |
| Level of significance | 0.01 | 0.01 | 0.05 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

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