



# Effect of Sowing Times on Yield Attributes of an Exotic (China) Hybrid Rice Variety in Bangladesh

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## Abstract

This experiment was conducted at the Agricultural Botany experimental field of Sher-e-Bangla Agricultural University (SAU), Sher-e-Bangla Nagar, Dhaka during the period from January to April 2014 to study the effect of sowing times on the yield attributes of an exotic (China) hybrid rice variety in Bangladesh. Five treatments were considered regarding 5 sowing dates or transplanting dates viz. (i) S1 = 1<sup>st</sup> sowing at 1<sup>st</sup> January 2014; transplanted at 21<sup>st</sup> January, (ii) S2 = 2<sup>nd</sup> sowing at 21<sup>st</sup> January; transplanted at 11<sup>th</sup> February, (iii) S3 = 3<sup>rd</sup> sowing at 11<sup>th</sup> February; transplanted at 3<sup>rd</sup> March, (iv) S4 = 4<sup>th</sup> sowing at 3<sup>rd</sup> March; transplanted at 23<sup>rd</sup> March and (v) S5 = 5<sup>th</sup> sowing at 23<sup>rd</sup> March; transplanted at 13<sup>th</sup> April. Data were recorded on different growth parameters to examine the effect of sowing times on the yield attributes of the tested variety. The studied parameters were significantly affected by different sowing times or transplanting times. Results revealed that different parameters regarding yield attributes, the seeds of the test variety sown at 1<sup>st</sup> January 2014 and transplanted at 21<sup>st</sup> January (S<sub>1</sub>) furnished the best results in respect of the weight of filled grain hill<sup>-1</sup> (38.87 g), weight of filled grain plot<sup>-1</sup> (2.18 kg), 1000 seed weight (36.00g), grain yield ha<sup>-1</sup> (3.64 ton) and the highest harvest index (43.46%) compared to the seedling transplanted on other dates or times. These findings can be used in further breeding program.

**Keywords:** Sowing dates; Yield attributes; Hybrid rice variety

## Introduction

Rice (*Oryza sativa*) belongs to the family Gramineae. In Asian countries, rice is a staple food for at least 62.8% of total planet inhabitants and it contributes on an average 20% of apparent calorie intake of the world population and 30% of the population. This calorie contribution varies from 29.5% for China to 72.0% for Bangladesh [1]. Around the world, it is the most important food crop and the foremost food for approximately more than two billion people in Asia [2]. All rice is grown 90% and consumed in Asia [3,4]. An alarming rate for Bangladesh is population increasing and reducing the cultivable land is due to urbanization and shortage of food due to industrialization. Every year about 2.3 million people to its total of 150 million people were added in the nation [5]. In Bangladesh, population growth demands continuously increase in rice production. So, the highest priority has been given to more rice production [6]. At least 60% increase production of rice has to be to meet up food requirement of the increasing population by the year 2020 [7]. So, scientists were concerned about various rice production technologies to augment the rice production. Hybrid rice technology is one of the most effective demands for mitigating tactics. Hybrid rice technology development in Bangladesh began in 1993. Hybrid rice yields about 15-20% more than the promising high yielding commercial varieties. The Government encouraged private sector companies to import hybrid rice seeds and try them with farmers. Some private seed companies imported rice hybrids and evaluated them through on-farm trials during 1997-98 in Boro season (winter rice) [8]. The Chinese hybrid rice has demonstrated that the yield capability of hybrid rice must be accomplished, on the off chance that each ecological zone builds up its own particular variety or screens variety created in different areas to meet particular nearby conditions [9]. Planting time affects not only growth and productivity of rice but also generally affects on seed quality. Planting time affects seed quality through affecting seed growth and development as it obtained different environmental conditions in the processes of seed development and seed maturation [10]. In spite of the fact that variation in climatic parameters makes it hard to choose ideal planting times for hybrid rice, however, endeavour is needed to discover the most fitting time of cultivating hybrid rice keeping in mind the end goal to maintain a strategic distance from the

hazard in hybrid rice production. In Bangladesh Boro rice has been gaining much importance. The average per hectare yield of Boro rice is higher than that of aus and aman rice [11]. Among the three rice seasons of Bangladesh, it is the longest rice season, producing the highest grain yield [12]. More vital advantage of Boro season is the lower winter temperature amid the prior crop growth. This encourages the assimilation of photosynthates, subsequently expanding carbon: nitrogen proportion. Amid the maturing time, the temperature rises encouraging the procedure. Variation in these parameters clarifies variation in yields over the Boro growing territories [13]. The variety used for this experiment is completely new in Bangladesh even if it has enough proficiency in china. Based on the above importance, this research work is designed to evaluate the growth and yield performance of an exotic (China) hybrid rice variety in different planting time with the following specific objectives. First is to find out the response of this hybrid rice to different dates of planting in Boro season in Bangladesh. Second aim is to study the yield attributes of this hybrid rice variety and lastly to find out the appropriate planting time to have maximum yield.

## Methodology

This experiment was conducted at the experimental field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from January to August 2014 to study the effect of sowing times on the yield attributes of an exotic (China) hybrid rice variety in Bangladesh. Details of the materials and methods have been presented below:

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**Received** August 27, 2020; **Accepted** September 09, 2020; **Published** September 16, 2020

**Citation:** Begum S, Rahman Md H, Rashid Md M, Salahuddin AKM (2020) Effect of Sowing Times on Yield Attributes of an Exotic (China) Hybrid Rice Variety in Bangladesh. J Rice Res 8: 221.

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## Location

Experimental field of experiment is Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka. The location of the site is 23o74'N latitude and 88o35' longitude with an elevation of 8.2 meter from sea level.

## Climate

The geographical location of the experimental site was under the subtropical climate, characterized by three distinct seasons, winter season from November to February and the pre-monsoon period or hot season from March to April and monsoon period from May to October.

## Weather

Details of meteorological data in respect of average temperature is 19.10, 23.40, 31.60, 29.20 (°C), rainfall 3.00, 2.00, 3.00, 1.00 (mm), relative humidity 66.50, 61.00, 72.70, 68.50 (%) and sunshine hours 194.10, 221.50, 227.00, 194.10 during January, February, March and April 2014 respectively.

## Plant Material

An exotic (China) hybrid rice variety was used for the present study which was collected from Bangladesh Rice Research Institute (BRRI).

## Experimental Details of Treatments

Randomized Complete Block Design (RCBD) with four replications were performed.

Single factors: Sowing times

S<sub>1</sub> = 1<sup>st</sup> sowing at 1<sup>st</sup> January 2014; transplanted at 21<sup>st</sup> January

S<sub>2</sub> = 2<sup>nd</sup> sowing at 21<sup>st</sup> January; transplanted at 11<sup>th</sup> February

S<sub>3</sub> = 3<sup>rd</sup> sowing at 11<sup>th</sup> February; transplanted at 3<sup>rd</sup> March

S<sub>4</sub> = 4<sup>th</sup> sowing at 3<sup>rd</sup> March; transplanted at 23<sup>rd</sup> March

S<sub>5</sub> = 5<sup>th</sup> sowing at 23<sup>rd</sup> March; transplanted at 13<sup>th</sup> April

## Unit Plot Size

The size of each unit plot was 12 m<sup>2</sup> (4m x 3m). There were 20 plots in total.

## Growing of Crop

Seed sprouting and preparation of seedbed, preparation of main field, fertilizer and manure application were done as per recommendations of Bangladesh Rice Research Institute (BRRI, 2013).

## Intercultural Operation

Irrigation and drainage, weeding and gap filling, top dressing and other plant protection measures were taken as per necessity.

## Data Recording

The yield attributes of this experiment are filled grains hill<sup>-1</sup>, unfilled grains hill<sup>-1</sup>, weight of filled grain plot<sup>-1</sup>, weight of unfilled grains plot<sup>-1</sup>, weight of 1000 seeds, grain yield, Stover yield, harvest index etc. The data were collected from randomly selected 10 plots and separated into filled grain and unfilled grain. This data recording procedure is in conformity [14].

## Statistical Analysis

The mean values of all the characters were calculated and analysis of variance was performed. The significance of the difference among the treatments means was estimated by the Duncan's Multiple Range Test (DMRT) at 5% level of probability [15].

## Results

The results of the study were presented by evaluating the yield performance of an exotic (China) hybrid rice variety by different dates of sowing of seeds maintaining the same interval of transplanting of seedlings. The experimental findings regarding yield attributes have been presented under the following headings:

### Weight of filled grain hill<sup>-1</sup>

Weight of filled grain hill<sup>-1</sup> (g) was significantly influenced by different transplanting dates (Table 1). Results showed that the highest weight of filled grain hill<sup>-1</sup> (38.87g) was achieved from S<sub>1</sub> (21 January 2014 transplanting) which was statistically similar to sowing date S<sub>2</sub> (11 February 2014 transplanting). While the lowest weight of filled grain hill<sup>-1</sup> (00.00 g) was recorded from S<sub>5</sub> (13 April 2014 transplanting) which was statistically similar to date of sowing S<sub>4</sub> (23 March 2014 transplanting). Studies also have shown that early sowing is beneficial for the improvement of filled grain. It was reported that more number of filled grains per panicle was visualized in the early seeding and declined gradually in the successive seeding dates.

### Weight of unfilled grain hill<sup>-1</sup>

Transplanting dates had significant effect on weight of unfilled grain hill<sup>-1</sup> (g) (Table 1). The finding revealed the highest weight of unfilled grain hill<sup>-1</sup> (6.83 g) which was achieved from S<sub>4</sub> (23 March 2014 transplanting) followed by S<sub>5</sub> (13 April 2014 transplanting) where as the lowest weight of unfilled grain hill<sup>-1</sup> (1.34 g) was recorded

Treatments	Weight of filled grain hill <sup>-1</sup>	Weight of unfilled grain hill <sup>-1</sup>	Weight of filled grain plot <sup>-1</sup>	Weight of unfilled grain plot <sup>-1</sup>
S1	38.87 a	1.34 e	2.18 a	0.06 c
S2	36.43 b	1.83 d	1.92 b	0.07 c
S3	29.93 c	4.28 c	0.94 c	0.07 c
S4	5.55 d	6.83 a	0.11 d	0.19 b
S5	0.00 e	5.98 b	0.00 d	0.60 a
LSD0.05	2.31	0.67	0.24	0.09

**Table 1:** Effect of sowing times on yield contributing parameters regarding weight of filled grains hill<sup>-1</sup>, weight of unfilled grains hill<sup>-1</sup>, weight of filled grains plot<sup>-1</sup> and weight of unfilled grains plot<sup>-1</sup> of an exotic (China) hybrid rice variety. In a column, same lettering indicate significantly same result and different indicate significantly different results among the treatments.

S<sub>1</sub> = 1<sup>st</sup> sowing at 1<sup>st</sup> January 2014; Transplanted at 21<sup>st</sup> January

S<sub>2</sub> = 2<sup>nd</sup> sowing at 21<sup>st</sup> January; Transplanted at 11<sup>th</sup> February

S<sub>3</sub> = 3<sup>rd</sup> sowing 11<sup>th</sup> February; Transplanted at 3<sup>rd</sup> March

S<sub>4</sub> = 4<sup>th</sup> sowing 3<sup>rd</sup> March; Transplanted at 23<sup>rd</sup> March

S<sub>5</sub> = 5<sup>th</sup> sowing 23<sup>rd</sup> March; Transplanted at 13<sup>th</sup> April

Treatments	1000 seed weight (g)	Grain yield tha <sup>-1</sup>	Stover yield tha <sup>-1</sup>	Harvest index (%)
S1	36.00 a	3.64 a	4.72 c	43.46 a
S2	34.80 b	3.04 b	4.63 d	39.62 b
S3	34.68 b	1.57 c	4.49 e	25.90 c
S4	33.14 c	0.18 d	5.60 b	3.11 d
S5	00.00 d	0.00 e	6.50 a	0.00 e
LSD0.05	1.13	0.16	0.18	2.23

**Table 2:** Shows the effect of sowing times on yield parameters regarding grain yield ha<sup>-1</sup>, Stover yield ha<sup>-1</sup> and harvest index (%).

In a column, same lettering indicate significantly same result and different indicate significantly different results among the treatments.

from S1 (21 January 2014 transplanting) followed by S2 (11<sup>th</sup> February 2014 transplanting). This high percentage of unfilled grains or panicle in these late sowing dates could be attributed by reduction of spikelet fertility or increase of spikelet sterility in this period. These results are similar to that obtained by previous studies.

### Weight of filled grain plot<sup>-1</sup>

In the present study transplanting dates significantly affected by weight of filled grain plot<sup>-1</sup> (kg) (Table 1). Results showed that the highest weight of filled grain plot<sup>-1</sup> (2.18 kg) was achieved from S<sub>1</sub> (21 January 2014 transplanting) which was statistically similar to sowing date S<sub>2</sub> (11<sup>th</sup> February 2014 transplanting). While the lowest weight of filled grain plot<sup>-1</sup> (00.00 g) was recorded from S<sub>5</sub> (13 April 2014 transplanting) which was statistically similar to sowing date S<sub>4</sub> (23 March 2014 transplanting). Among the yield attributes, tiller number per plant, 1000-seed weight and grain number per year had a positive and significant correlation with yield which was obtained by studies done previously.

### Weight of unfilled grain plot<sup>-1</sup>

There was significant variation in results for different transplanting dates on weight of unfilled grain plot<sup>-1</sup> (kg) (Table 1). Results showed that the maximum weight of unfilled grain plot<sup>-1</sup> (0.605 kg) was recorded from S<sub>5</sub> (13 April 2014 transplanting) which was same as the results of sowing date S<sub>4</sub> (23 March 2014 transplanting) where as the lowest weight of unfilled grain plot<sup>-1</sup> (0.065 kg) was obtained from the sowing date S<sub>1</sub> (21 January 2014 transplanting) and S<sub>2</sub> (11 February 2014 transplanting). This result has the similarity with the results of study in 2010.

### Weight of 1000 seeds

Transplanting dates exerted significant effect on 1000 seed weight (g) (Table 2). The findings showed that the highest 1000 seed weight (36.00g) was achieved from S<sub>1</sub> (21<sup>st</sup> January 2014 transplanting) followed by S<sub>2</sub> (11 February 2014 transplanting) and S<sub>3</sub> (3<sup>rd</sup> March 2014 transplanting) where the lowest 1000 seed weight (g) (00.00 g) was recorded from S<sub>5</sub> (13 April 2014 transplanting) followed by S<sub>4</sub> (23 March 2014 transplanting). The result as found from studies has shown the conformity with the present study. Study in 2008 reported that different yield parameters like 1000 grain weight were significantly affected by transplanting time. Similar findings were obtained by the study in 2006, 2001, 2000 and 1989. Early seeding (15 June) had the maximum 1000 grain weight and decreased as sowing time was delayed. 1000-grain weight was lowered gradually with late in planting time.

### Grain yield ha<sup>-1</sup>

There was highly significant variation among the results of different transplanting date treatments for grain yield ha<sup>-1</sup> (ton) (Table 2). Results showed that the highest grain yield ha<sup>-1</sup> (3.64 ton) was achieved from S<sub>1</sub> (21<sup>st</sup> January 2014 transplanting) followed by S<sub>2</sub> (11<sup>th</sup> February 2014 transplanting) on the other hand the lowest grain yield ha<sup>-1</sup> (00.00 ton) was recorded from S<sub>5</sub> (13 April 2014 transplanting) followed by S<sub>4</sub>

(23<sup>rd</sup> March 2014 transplanting). Studies reported that rice planted on first December significantly reduced the grains per panicle and January planted rice significantly reduced the panicle per unit area. Different yield and yield parameters also significantly affected by transplanting time. These results are also in conformity with the findings who found out that seeding of 15<sup>th</sup> June recorded significantly the maximum grain yield and decreased with the late in sowing. The highest grain yields (4530, 4030 and 4530 kg ha<sup>-1</sup>) were found in early sown rice group in 2006. Rice grain yields declined as seeding date was delayed.

### Stover yield ha<sup>-1</sup>

In the present study transplanting dates effectly affected Stover yield ha<sup>-1</sup> (ton) (Table 2). It was found that significant variation in results weight for Stover yield ha<sup>-1</sup> (ton) was seen among all the treatments. Results showed that the highest Stover yield ha<sup>-1</sup> (6.50 ton) was achieved from S<sub>5</sub> (13<sup>th</sup> April 2014 transplanting) followed by S<sub>4</sub> (23<sup>rd</sup> March 2014 transplanting) where as the lowest Stover yield ha<sup>-1</sup> (4.49 ton) was recorded from S<sub>3</sub> (3<sup>rd</sup> March 2014 transplanting) followed by S<sub>2</sub> (11<sup>th</sup> February 2014 transplanting).

### Harvest Index

In the present study the results showed that delayed transplanting dates influenced in decreasing on the harvest index (%) (Table 2). Results revealed that the highest harvest index (43.46 %) was achieved from S<sub>1</sub> (21<sup>st</sup> January 2014 transplanting) followed by S<sub>2</sub> (11<sup>th</sup> February 2014 transplanting) on the on the hand the lowest harvest index (%) (4.49 ton) was recorded from S<sub>5</sub> (13<sup>th</sup> April 2014 transplanting) followed by S<sub>4</sub> (23<sup>rd</sup> March 2014 transplanting). Seeding rice before the predicted optimum periods would lengthen the time between seeding and emergence; increase production costs from the use of recommended seed treatments, higher seeding rates; a longer period for pest control and possibly result in poor stand establishment as reported in 2015.

### Discussion

Result from the present study on different parameters as weight of filled grain hill-1, weight of unfilled grain hill-1, weight of filled grain plot<sup>-1</sup>, weight of unfilled grain plot-1, 1000 grain weight (g), grain yield tha<sup>-1</sup>, Stover yield tha<sup>-1</sup>, Harvest index (%) were significantly affected by different sowing date or transplanting date. Result revealed that weight of filled grain hill-1, weight of filled grain plot<sup>-1</sup>, 1000 grain weight and grain yield showed an increasing trend with early transplanting. There was significant variation in results for different transplanting dates on weight of unfilled grain plot<sup>-1</sup> (kg) (Table 1). Results showed that the maximum weight of unfilled grain plot<sup>-1</sup> (0.605 kg) was recorded from S<sub>5</sub> (13 April 2014 transplanting) which was same as the results of sowing date S<sub>4</sub> (23 March 2014 transplanting) where as the lowest weight of unfilled grain plot-1 (0.065 kg) was obtained from the sowing date S<sub>1</sub> (21 January 2014 transplanting) and S<sub>2</sub> (11 February 2014 transplanting). Results showed that the highest Stover yield ha<sup>-1</sup> (6.50 ton) was achieved from S<sub>5</sub> (13 April 2014 transplanting) followed by S<sub>4</sub> (23 March 2014 transplanting) where as the lowest Stover yield ha<sup>-1</sup>

(4.49 ton) was recorded from S<sub>3</sub> (3 March 2014 transplanting) followed by S<sub>2</sub> (11 February 2014 transplanting).

## Conclusion

Result revealed that different sowing date have significant effects on the described exotic hybrid rice. the highest weight of filled grain hill<sup>-1</sup>, weight of filled grain plot<sup>-1</sup>, 1000 seed weight, grain yield ha<sup>-1</sup> and the highest harvest index was achieved from S<sub>1</sub> (Transplanting on 21 January 2014) and the highest weight of unfilled grain plot<sup>-1</sup> and the highest Stover yield ha<sup>-1</sup> was achieved from S<sub>5</sub> (Transplanting on 13 April 2014) but the highest weight of unfilled grain hill<sup>-1</sup> was achieved from S<sub>4</sub> (Transplanting on 23 March 2014). Another way, the lowest weight of filled grain hill<sup>-1</sup>, filled grain plot<sup>-1</sup>, 1000 seed weight (g), grain yield ha<sup>-1</sup> and the lowest harvest index was recorded from S<sub>5</sub> (Transplanting on 13 April 2014) and the lowest weight of unfilled grain hill<sup>-1</sup> and the lowest weight of unfilled grain plot<sup>-1</sup> was recorded from S<sub>1</sub> (Transplanting on 21 January 2014) but the lowest Stover yield ha<sup>-1</sup> was recorded from S<sub>3</sub> (Transplanting on 3 March 2014). From the above findings it can be concluded that the results from different parameters regarding yield attributes, the treatment S<sub>1</sub> (Transplanting on 21 January 2014) gave the best results in respect of the weight of filled grain hill<sup>-1</sup>, weight of filled grain plot<sup>-1</sup>, 1000 seed weight, grain yield ha<sup>-1</sup> and the highest harvest index compared to the seedling transplanted on other dates.

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