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## A Comparative Study Between Hybrid and Inbred Rice in Relation to Their Yield and Quality

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**Abstract:** The difference between hybrid and inbred rice was studied in respect of their growth duration, yield and quality in Boro season, 1999. Among the varieties, Aalok 6201 had the highest grain yield followed by BRRI Dhan29 and IR68877H but statistically they were similar. BRRI Dhan28 had the lowest grain yield, which was statistically similar to Loknath503. BRRI Dhan28 and the tested hybrid rice had lower growth duration than BRRI Dhan29. Milling out turn varied from 67 to 70% among the tested varieties. Loknath 503 had the lowest milling out turn (70%) and, BRRI Dhan28 and BRRI Dhan29 had the highest milling out turn (70%) for unparboiled but parboiled rice the highest milling out turn (73%) were found in BRRI Dhan28 and IR68877H. All tested hybrid rice were medium bold, whereas BRRI Dhan29 and BRRI Dhan28 were medium slender and long slender, respectively in both parboiled and unparboiled condition. Among the varieties, amylose content (%) was higher in BRRI Dhan29 and protein content (%) was higher in IR68877H for both under parboiled and unparboiled condition. Alkali spreading value was higher in BRRI Dhan28. Cooking quality of all the varieties was more or less similar.

**Key words:** Milling out turn, parboiled rice, unparboiled rice, amylose content, protein content

### Introduction

Rice, the principal cereal crop in the country supplies food to the people and feed to the domestic animal. It covers 85 % of the country's total cropped area. Annual per capita consumption of rice in Bangladesh is the highest in the world and it provides about 70 % of total calorie requirement of the people (Nasiruddin, 1993). In spite of these, Bangladesh is one of the food deficit countries of the world. The population is increasing at the rate of 1.78%, which is almost the same as the increase of food grain production. The annual food deficit is 1.79 million metric tons (Uddin, 2001). This food shortage is a great challenge for the nation in achieving self-sufficiency in food. But cropping area under rice cultivation could hardly be increased rather some land should be released for other non-rice crops and farming practices. At the same, the yield of high yielding varieties has come to stagnation in spite of using relatively high inputs and standard management practices. So, it is deemed important to look for an alternative way to boost up the production. Scientists are quite optimistic to break the existing yield ceiling by introducing a new approach in rice production through the hybrid rice technology.

Rice is our major food, which supplies us more than 75% energy and protein requirement. It is also the source of some B vitamins such as thiamin, riboflavin, niacin etc. Along with nutritional quality, the physical, cooking and eating qualities of rice are also important. So when a researcher want to develop a new variety, it must take that its physical, cooking and eating qualities which are acceptable to farmers and consumers. Nutritional quality also take that can meet the minimum standard requirement.

Therefore, the present study was undertaken to find the performance of hybrid rice in respect of their grains yield and quality.

### Materials and Methods

A comparative study between hybrid and inbred rice was carried out at BRRI farm during Boro season of 1999. Thirty-days-old seedlings of three hybrid rice varieties viz. IR68877A, Aalok6201 and Loknath 503 and, two modern BR varieties like BRRI Dhan28 and BRRI Dhan29 were transplanted. The experiment was laid out in RCB design with 3 replications in a 4 x 4 m<sup>2</sup> plot spaced at 25 x 15 cm<sup>2</sup> using two seedlings per hill. All the cultural practices were done as per recommendation of BRRI (2000). For grain yield, 6m<sup>2</sup> area was harvested and expressed in ton per hectare at 14% moisture level.

All the varieties were milled raw and analyzed for physicochemical properties. Milling out turn was determined by dehulling 200g rough rice in a Satake Rice Mill, followed by 45 second polishing in a Satake Grain Testing Mill-05. Head rice out turn was determined

by separating broken head rice by hand. Milled and head rice out turn was expressed as percent. Slide calipers of graining was measured using length and breadth. Size and shape of milled rice were measured according to FAO standards as follows.

Size category	Length in mm
Extra long	Over 7.0
Long	6.0-6.99
Medium	5.0-5.99
Short	Less than 5.0
Shape category	Length/Breadth ratio
Slender	Over 3.0
Bold	2.0 – 3.0
Round	Less than 2.0

Amylose content was determined by the procedure of Juliano (1971) and alkali spreading value was determined following Little *et al.* (1958). Alkali spreading value was classified into three ranges i.e. 1.0-3.0 corresponds to high, 3.0-5.0 corresponds to intermediate and 6.0-7.0 corresponds to low gelatinization temperature. Protein content was determined by the micro kjeldahl nitrogen multiplied by a factor of 5.95, based on 16.8% nitrogen contained in the major rice protein fraction, glutelin. Volume of milled and cooked rice was measured by water displacement. Data presented in the tables are the mean of three replications.

### Results and Discussion

**Yield and yield component:** Grain weight is an important factor from the point of view of yield (Kaul *et al.*, 1982). Aalok6201 had the highest grain yield, which was statistically similar to IR68877H, and BRRI Dhan29 and, BRRI Dhan28 and Loknath503 gave the lowest grain yield (Table 1). The highest tiller and panicle number m<sup>-2</sup> was found in Loknath503 and lowest was observed in BRRI Dhan28. Aalok6201 had the highest filled grains panicle<sup>-1</sup> and Loknath503 had the lowest filled grains panicle<sup>-1</sup>. Sterility percent was the highest in Loknath503, which was statistically identical to IR68877H, and the lowest sterility percent was observed in BRRI Dhan28. Thousand-grain weight was highest in IR68877H, which was statistically identical to BRRI Dhan29. The lowest 1000-grains weight was found in Aalok 6201.

**Physicochemical properties:** Milling quality is the measure of rough rice performance during milling process. It is the total quality of head and broken grains recovered from unit quality of rough rice (Biswas *et al.*, 1992). Milling out turn of unparboiled and parboiled rice varied from 68 to 70 % and 70 to 73% respectively. More

# Siddiquee *et al.*: Yield and quality of rice

Table 1: Effect of variety on yields and yield components of rice in Boro season

Varieties	Tiller No./m <sup>2</sup>	Panicle No./m <sup>2</sup>	Filled grains/panicle	Sterility %	1000 grains weight (gm)	Grain yield (t/ha)
AAIOK 6201	327.3 bc	293.5 bc	128 a	23.05 a	19.33 c	5.9 a
LOKNATH 503	385.5 a	368.5 a	90 c	15.50 b	21.75 b	5.1 b
IR68877H	362.75 ab	316.75 b	105 b	27.0 a	22.45 a	5.5 ab
BRRI Dhan28 (ck.)	285.5 c	262.10 c	108 b	8.93 c	21.81 b	5.1 b
BRRI Dhan29 (ck.)	338.75 bc	307.50 bc	95 c	15.50 b	22.25 a	5.5 ab

Means followed by a common letter(s) within a column do not differ at 5% level by DMRT

Table 2: Milling qualities of hybrid rice

Varieties	Hull (%)		Milled rice (%)		Broken (%)	
	Unpar.	Par.	Unpar.	Par.	Unpar.	Par.
AAIOK 6201	22.0 b	21.5ab	69.0 ab	70.0 b	33.0 b	3.0 b
LOKNATH 503	23.3 ab	22.5 a	67.0 b	72.0 ab	30.5 c	4.5 a
IR68877H	20.8 c	19.5 b	68.0 b	73.0 a	40.0 a	4.0 a
BRRI Dhan28 (ck.)	22.3 b	20.9 ab	70.0 a	73.0 a	24.5 d	0.4 d
BRRI Dhan29 (ck.)	24.6 a	22.5 a	70.0 a	72.0 ab	21.2 e	1.0 d

Means followed by a common letter(s) within a column do not differ at 5% level by DMRT Unpar= unparboiled, Par= parboiled

Table 3: Physical characteristics of hybrid rice

Varieties	length (mm)		Breadth (mm)		length/breadth ratio		Size and shape	
	Unpar.	Par.	Unpar.	Par.	Unpar.	Par.	Unpar.	Par.
AAIOK 6201	5.6 a	5.6 a	1.9 a	1.9 a	2.9 a	2.9 a	MB	MB
LOKNATH 503	5.7 a	5.8 a	1.9 a	2.0 a	3.0 a	2.9 a	MS	MB
IR68877H	5.9 a	6.0 a	2.1 a	2.0 a	2.8 a	3.0 a	MB	LS
BRRI Dhan28 (ck.)	6.0 a	6.1 a	1.9 a	1.8 a	3.2 a	3.4 a	LS	LS
BRRI Dhan29 (ck.)	5.6 a	5.8 a	1.8 a	1.9 a	3.1 a	3.1 a	MS	MS

Means followed by a common letter(s) within a column do not differ at 5% level by DMRT Unpar= unparboiled, Par= parboiled

MB = Medium bold, MS = Medium slender, LS = Long slender

Table 4: Chemical characteristics of hybrid rice

Varieties	Amylose (%)		Protein (%)		Alkali spreading value
	Unpar.	Par.	Unpar.	Par.	
AAIOK 6201	23.6 b	24.4 c	7.3 b	7.4 b	4.9 a
LOKNATH 503	26.4 ab	25.6 b	6.0 c	6.3 c	3.1 b
IR68877H	24.3 b	25.0 bc	8.5 a	8.8 a	4.9 a
BRRI Dhan28 (ck.)	26.4 ab	26.7 a	7.3 b	7.3 b	5.0 a
BRRI Dhan29 (ck.)	27.0 a	27.3 a	7.5 b	7.4 b	3.3 b

Means followed by a common letter(s) within a column do not differ at 5% level by DMRT Unpar= unparboiled, Par= parboiled

Table 5: Cooking qualities of hybrid rice

Varieties	Cooking time (mm)		Elongation ratio		Volume expansion	
	Unpar.	Par.	Unpar.	Par.	Unpar.	Par.
AAIOK 6201	17 bc	21 c	1.4 a	1.4 a	3.6 b	4.0 a
LOKNATH 503	17 bc	21 c	1.5 a	1.6 a	4.5 a	4.3 a
IR68877H	20 a	24 a	1.4 a	1.5 a	3.7 b	3.4 b
BRRI Dhan28 (ck.)	16 c	22 b	1.4 a	1.5 a	4.5 a	4.0 a
BRRI Dhan29 (ck.)	18 b	22 b	1.5 a	1.5 a	4.5 a	3.7 ab

Means followed by a common letter(s) within a column do not differ at 5% level by DMRT Unpar= unparboiled, Par= parboiled

than 70% milling out turn, which is acceptable to millers and farmers. At that point of view BRRI varieties are more profitable and preferable than hybrid varieties (Table 2). Broken percent in milled rice was higher in hybrid rice than BRRI varieties at both parboil and unparboiled conditions. Head rice out turn is the proportion of whole grain in milled rice. It depends on varietal characteristics and drying condition (Wasserman and Calderwood, 1972; Witte, 1972).

Grain size and shape are among the first criteria of rice quality that breeders consider in developing new varieties for release for commercial production. Grain length is an important physical property, which attracts consumer's attention. The people of Bangladesh like long, slender, shiny grain. A high portion of broken grains is undesirable (IRRI, 1979). It also influences the grain quality. Length breadth ratio of the grains indicates the fineness of the grain. The length and breadth of all the varieties were more or less similar. But tested BR varieties were finer than hybrid rice (Table 3).

The amylose content of nonwaxy rice ranges from 7 to 34% of

the milled rice on dry weight basis or 8 to 37% of the starch itself glutinous or waxy varieties contain virtually no amylose (Webb and Stermar, 1972). The majority of the people of Bangladesh prefer rice with high amylose containing rice. High amylose rice is favored in most of the tropical Asia, including Bangladesh (Kaul *et al.*, 1982). Amylose content influences the properties of cooked rice, sticky if the quantity is low. Amylose content influences volume expansion, water absorption, tenderness and stickiness of cooked rice. All the hybrid varieties except Loknath503 had intermediate amylose. Loknath503 and all tested BRRI varieties had high amylose (Table 4). Biswas *et al.* (1992) found similar results in his experiment. Rice having 20-25% amylose gives soft and comparatively sticky cooked rice. It is very important that rice is one of the major sources of protein for our people. Protein in rice is important from nutritional point of view. All the tested varieties except Loknath 503 had similar protein. Loknath 503 had lower protein.

Amylose content in rice is used as the single most important characteristic in describing and predicting the rice cooking quality

(Kaul *et al.*, 1982). Cooking time is important as it determines the tenderness as well as stickiness of cooked rice to great extent. Milled rice that has a high protein content or a high gelatinization temperature required much water and a longer time to cook than rice with lower values. Cooking time of rice grain depends on coarseness of the grain and its gelatinization temperature. Alkali spreading value is inversely related to gelatinization temperature. Alkali spreading values of most of the varieties were 3.1 to 5.0. It indicates that all the test varieties had intermediate gelatinization temperature. Rice grains having intermediate gelatinization temperature produces good quality cooked rice. IR68877H needs more time for cooking than the other varieties in parboiled and unparboiled condition. Elongation ratio is also an important parameter for cooked rice. High elongation ratio during cooking is preferred. The elongation ratio and imbibition ratio ranged from 1.4 to 1.5 and 3.6 to 4.5 respectively for both the groups (Table 5).

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