Physical quality characteristics of high yielding two-line hybrids in rice (*Oryza sativa*. L)

D. Dhivyapriya* and R. Kalaiyarasi

Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore -641003, Tamil Nadu, India
*Corresponding author's E-mail: dhivyaraj.89@gmail.com

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ABSTRACT

The physical quality characteristics of rice grains are important indicators of grain yield. Grain quality characteristics were studied for fifteen promising hybrids along with its parents. Hulling percent ranged between 68.75 % to 88.70 %. The hybrids namely TS09 22 X CO 43, TS09 22 X CB05/501, TS09 22 X T1408.10, TS09 410 X ADT 38 and TS09 410 X WGL 14 had the highest values of hulling, milling and head rice recovery percentage. Highest kernel length of 5.80 mm was observed in TS09 12 X CB05 911/884. Among all the hybrids analyzed, two hybrids viz., TS09 12 X CB05 911/884 (5.80mm) and TS09 22 X T1408.10 (5.60mm) were seen with medium kernel length category. Out of fifteen hybrids observed, three hybrids were found with medium kernel breadth. Comparing the Length /Breadth ratio, the hybrids namely TS09 22 X T1408.10, TS09 28 X CO 43 were categorized under the medium slender type.

Key words: Rice, Hulling, Milling, Head Rice Recovery and Kernel length

Rice is the staple food for the largest number of people on the earth. Global production reached 800 million tons from the present 629 million tonnes in 2006 to meet the future demand in 2025 (Shukla and Pandey, 2008). Hybrids have shown 15-20 per cent higher yields than the best semi-dwarf inbred varieties, not only in China but also on other countries. (Lin and Yuan, 1980; Yuan, 1994; Yuan *et al.*, 1994 and Virmani, 1994). Hybrid rice developed in China had a yield advantage of more than fifteen per cent over conventional pureline varieties. Heterosis breeding has been successfully utilized to enhance the productivity of rice crop.

However, rice hybrids when introduced into other countries, were rejected due to their larger grain size, excessive chalkiness and low milling yield (Virmani and Zaman, 1998). The emphasis on breeding for quality has assumed greater significance in recent years due to varied consumer preferences and the market demand for the quality rice. The physical grain characters that determine the appearance and market value of rice and non-chalkiness of endosperm and grain dimension. Hybrids must also have grain quality that is at least comparable, if not superior to that inbred check varieties grown by the farmers. However, limited offers have been made in the improvement of grain quality of hybrid rice. Quality is a complex phenomenon governed by physico-chemical properties of starch. It is difficult for breeders to improve rice grain yield and quality using conventional methods, due to a lack of discrete phenotypic segregation in the progeny.

As rice quality is an endosperm trait, its inheritance can be more complicated because the genetic expression of an endosperm trait in cereal seeds is conditioned not only by the triploid endosperm genotype, but also by the diploid maternal genotype and any additional possible cytoplasmic differences (Pooni *et al.*, 1992; Zhu and Weir, 1994 and Mo, 1995). In pure lines, all the individual kernels are more or less uniform with respect to different grain quality characteristics. In hybrids, seed borne on F1 plants represent the F2 seeds which are intermediate to the parents and uniform in shape but different in cooking quality characteristics. This affects the quality of cooked rice. Size and shape are important factor to farmer. Preference for grain size and shape vary from one group of consumers to others (Khush *et al.*, 1979). Rice grain quality includes the milling, appearance, cooking and nutritional qualities. Among these, people pay more attention to the appearance and cooking quality (Huang *et al.*, 1998).

The present study aimed to analyze and evaluate the physical properties of some promising two line rice hybrids which were selected based on the criteria of grain yield per plant.

MATERIALS AND METHODS

Physical quality characters

Rice Technical Working Group RTWG (1997) recommended ≥ 75 per cent hulling percent, ≥ 65.1 percent for milled rice and ≥ 48 per cent for head rice recovery.

Kernel length measurement

On the basis of the average length, kernels were classified as follows

Size category	Scale
Extra long (more than 7.5 mm)	1
Long (6.61 to 7.5 mm)	3
Medium (5.51 to 6.60 mm)	5
Short (5.50 mm or less)	7

Kernel length/breadth ratio

The ratio of kernel length / breadth was worked out. Based on the ratio, the following categories were made for grain shape.

Scale	Shape	L/B ratio
1	Slender	over 3.0
3	Medium	2.1 - 3.0
5	Bold	1.1 – 2.0
9	Round	1.0 or less

RESULTS AND DISCUSSION

Physical quality parameters

The hulling percent ranged between 68.75 (TS09 410 X T 360) to 88.70 (TS09 22 X CB05/501) (Table 3). The hybrid TS09 22 X CB05/501 had the highest hulling per cent than the parents (Table 3). Milling is the measure of rough rice recovery during milling. Milling recovery is one of the important criteria of rice quality especially from the stand point of marketing. Milling recovery depends on grain shape and appearance, which has direct effect on the percentage of hulling, milling and head rice recovery. The hybrids namely TS09 22 X CO 43, TS09 22 X CB05/501, TS09 22 X T1408.10, TS09 410 X ADT 38 and TS09 410 X WGL 14 had the highest values of hulling, milling and head rice recovery percentage. The appearance of milled rice is important to the consumer, which inturn makes it important to the producer and the miller. Thus grain size and shape are the first criteria for rice quality that the breeders consider in developing new varieties for releases of commercial production (Adair *et al.*, 1966). A quality rice variety should have head rice out-turn at least 48 %. Head rice out turn is the proportion of the whole grain in milled rice. Only one hybrid had about 70.96 (TS09 22 X CB05/501). Kernel length, shape, size and uniformity determine the consumer preference. Highest kernel length of 5.80mm was observed in TS09 12 X CB05 911/884. But in parents it had ranged from 7. 40mm in case of G14 to 4.60mm (TS09 28). Among all the hybrids analysed, two hybrids TS09 12 X CB05 911/884 (5.80mm) and TS09 22 X T1408.10 (5.60mm) were seen with medium kernel length category.

Out of fifteen hybrids observed, three hybrids were found with medium kernel breadth. In general, medium to long grains are preferred in the Indian subcontinent while the country is also replete with hundreds of short grain domestic types and long grain basmati types the latter commanding highest premium in both domestic and international markets. In the present study, the hybrids namelyTS09 22 X T1408.10 (3.11mm), TS09 28 X CO 43(3.25mm) categorized under the medium slender type. Among the parents, TGMS line TS09 22 had the medium slender type (3.11mm) and G 14 had the highest L/B ratio of 4.11 mm (long slender type).

CONCLUSION

The present study revealed that five hybrids had the highest values of hulling, milling and head rice recovery percentage. These varieties could be effectively utilized in quality improvement programme which would be helpful to develop high yielding varieties with better grain quality. It is now time to highlight the improvement of the productivity of rice including its quality. Thus, the knowledge may be utilized for quality improvements for developing high yielding hybrids.

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