Inheritance of grain quality in indica-tropical japonica rice hybrids

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ABSTRACT

Eight indica and japonica were crossed with two indica (IR-36 and IR-50) and two tropical japonica (J-7 and Akihikari) testers each. Out of 32 possible cross combinations made, only 28 were successful while four combinations failed because of hybrid mortality. Five hybrids were selected on the basis of better heterotic performance for quality analysis. Fifty individual F_2 seeds analyzed for protein content, L/B ratio, amylose content and gelatinization temperature. The hybrid IR-64446/IR-50 showed long slender grains, while IR-64446/IR-36, 9314/IR-36 and NPL-9/IR-50 possessed long and medium slender grain. Four hybrids and intermediate amylase content (20 to 25%) except J-7/Dular, which recorded, slightly less amylose content. The mean values for protein content and gelatinization temperature of the hybrids were within the parental limits.

Key words: *Indica, japonica, protein, amylose, L/B ratio, gelatinization temperature*

The cooking and eating quality characteristics are very important in rice breeding as it is predominantly consumed as a whole grain. The milling percentage, grain appearance, cooking quality and nutritional components constitute the quality traits. Juliano *et al.* (1964) reported that the amylose content and gelatinization temperature reflect the cooking quality. In general, long slender grains with intermediate amylose content, gelatinization temperature and gel consistency are preferred by consumers in the Indian sub-continent. Therefore, the present investigation was conducted to evaluate the cooking quality attributes of *indica-japonica* rice hybrids and their segregation in F_2 generation.

The genotypes utilized in the present study were obtained through the Directorate of Rice Research, Hyderabad (Table 1). Five *indica-japonica* hybrids were selected on the basis of yield heterosis and biochemical analysis was conducted on 50 individual F2 grains of hybrids and their parents for cooking and eating quality attributes like protein content, L/B ratio, amylose content and gelatinization temperature by adopting standard procedures.

Cooking and eating characteristics of rice are largely determined by the properties of the starch (polymer of glucose) constituting about 90% of the dry weight of milled rice. With the exception of other physico-chemical characteristics amylose content and gelatinization temperature are the principal determinants of cooking and eating qualities of milled rice.

The mean values for protein content varied from 7.6 to 8.5 and 8.2% to 8.6% in parents and hybrids, respectively. The variation between the individual seeds within parents is non significant as compared to that of the hybrids. Among the parents, Norin PL-9 (8.5%) showed highest protein content and lowest (7.6%) in J-7. Among the hybrids, highest protein content was

Table 1. Indica-japonica varieties used in hybridization programme

Genotypes	Type
IR-36	Indica (I) tester
IR-50	Indica (I) tester
Akihikari	Indica (J) tester
J-7	Indica (J) tester
Dular	Indica (I)
9310	Indica (I)
Nekken-1	Japonica (J)
Nekken-2	Japonica (J)
Norin PL-9	Japonica (J)
IR-65598-112-2	Tropical japonica (TJ)
9314	Tropical japonica (TJ)
IR-64446-7-3-2-2	Tropical japonica (TJ)

observed in Norin PL-9/IR-50 (8.6%) followed by IR-64446-7-3-2-2/IR-36 (8.5%), 9314/IR-36 (8.3%). The protein content in the hybrids was observed to be intermediate to the respective parents. In only two hybrids, *viz.*, NPL-9/IR-50 (8.6%) and IR-64446-7-3-2-2/IR-36 (8.5%) protein content exceeded the mean values of their parents and check Pusa Basmati (8.2%). Thus there is possibility of developing hybrid with desirable protein content.

Among the parents the mean values of L/B ratio varied from 1.67 to 3.67. The coefficient of variation among the parents varied between 3.3 (IR-50) and 7.8% (IR-64446-7-3-2-2). Relatively high coefficient of variation was found among the hybrids *i.e.*, 5.90 (9314/IR-36) to 8.39% (IR-64446-7-3-2-2/IR-36). The mean value of L/B ratio of check variety Pusa Basmati was 4.0 with a range of 3.8-4.1 and 3.0% coefficient of variation. Among the five hybrids, grains of IR-64446-7-3-2-2/IR-50 (3.1) were extra long and slender type, while IR-64446-7-3-2-2/IR-36 (2.7), 9314/IR-36 (3.49) and NPL-9/IR-50(2.6) were medium and long. However, medium bold grains were observed in J-7/Dular. Thus, *indica-japonica* hybridization could offer hybrids with extra long and slender, medium and long grain types for better consumer acceptance.

The amylsoe content varied from 18.0 to 27.1% among the parents. An intermediate and qualitatively superior amylose was found in Dular (25.0%) and IR-64446-7-3-2-2 (20.6%), while low amylose content was observed in J-7 (18.1%) and 9314 (19.2%). IR-36 and IR-50 recorded high amylose content. Among the hybrids, mean amylose content varied from 19.4 (J-7/dular) to 25.9% (IR-64446-7-3-3-2/IR-36). The variation between the individual F_2 kernels was higher as compared to that of parents. Three hybrids, IR-64446-7-3-2-2/IR-36 (25.9%), 9314/IR-36 (24.2%) and NPL-9/IR-50 (22.3%) recorded intermediate amylose content. The coefficient of variation in hybrids ranged from 13.4 to 51.6%. Maximum segregation between F_2 kernels was observed in NPL-9/IR-50 (51.6%), IR-64446-7-3-2-2/IR-50 (39.4%), J-7/Dular (37.9%) while less variation was observed in IR-64446-7-3-2-2/IR-36 (13.4%) and 9314/IR-36 (20.2%).

Intermediate amylose content varieties are preferred in major rice consuming regions of the world. Rice with intermediate amylose content (20 to 25%) remains non-sticky and tender after cooking. Khush *et al*. (1994) concluded that the cooking and eating quality of the hybrids would be poor, if their parents differ greatly in amylose content. It was inferred that the mean amylose content of F_2 bulk kernels should be within parental types. Similar findings were also reported by Bong and Singh (1993) and Dong *et al.,* (1998)

The gelatinization temperature was high in J-7(3.2) and IR-50 (3.3), low in 9314 (6.0) and intermediate in Dular, NPL-9, IR-36 and IR-64446-7-3-2-2. Among the 5 hybrids, three showed intermediate gelatinization temperature *viz.*, NPL-9/IR-50 (4.8), IR-64446-7-3-2-2/IR-50 (3.9) and IR-64446-7-3-3-3/IR35 (3.8), low in J-7/Dular (6.0) and 9314/IR-36 (6.1). The range was narrow among the parents, but wide in case of hybrids *i.e.,* 3 to 7 in IR64446-7-3-2-2/IR-36 and 3 to 6 in J-7/Dular.

Gelatinization temperature (GT), a physical property of starch is the range of temperature within which starch granules start swelling irreversibly in hot water. Rice varieties with high gelatinization temperature require more time to cook and expand very little. In five hybrids under study, the means were within the parental limits except in J-7/Dular which is of consumer's preference (Khush *et al.*, 1994 and Viraktamath, 1987). Unlike amylose content the variation among the hybrids was found to be less for GT. The results indicated that the inter sub specific hybrids did not vary much for alkali spreading value (Bong and Singh, 1993 and Dong *et al.,* 1998).

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