

Effects of a Dwarfing Gene sd1-d (Dee-Geo-Woo-Gen Dwarf) on Yield and Related Traits in Rice: Preliminary Report

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Abstract : The sd1-d allele at the sd1 locus on chromosome 1, originating from Taiwanese variety Dee-geo-woo-gen, has been playing important role for developing short-culm and lodging-resistant indica varieties such as IR36 in rice. The dominant allele SD1 for long culm at the locus is differentiated into SD1-in and SD1-ja which are harbored in indica and japonica subspecies's, respectively. The sd1-d of an indica variety IR36 was substituted with SD1-in or SD1-ja by recurrent backcrosses of 17 times with IR36, and two isogenic tall lines regarding the respective dominant alleles were developed by using an indica variety IR5867 and a japonica one 'Koshihikari' as donors, which were denoted by '5867-36' and 'Koshi-36', respectively. The present study was conducted to examine the effect of sd1-d on yield and related traits as compared with SD1-in and SD1-ja, by using the two isogenic tall lines. Seedlings of IR36 and the two isogenic lines were transplanted on an experimental field of Kochi University, by the planting distance of 30 cm × 15 cm with two seedlings per hill, on May 3, 2017. Chemical fertilizers were supplied by basal application and top-dressing at a rate of 8.00, 6.57 and 7.52 g/m², respectively, for N, P₂O₅ and K₂O in total. Yield, yield components, and other traits were measured. Culm length (cm) was in the order of 5867-36 (101.9) > Koshi-36 (80.1) > IR36 (60.0), where '>' indicates statistically significant difference at the 5% level. Accordingly, sd1-d reduced culm by 41.9 and 20.1 cm, compared with SD1-in and SD1-ja, respectively, and the effect of elongating culm was higher in the former allele than in the latter one. Total brown rice yield (g/m²), including unripened grains, was in the order of IR36 (611) □ 5867-36 (586) □ Koshi-36 (572), indicating non-significant differences among them. Yield-1.5mm sieve (g/m²) was in the order of IR36 (596) □ 5867-36 (575) □ Koshi-36 (558). Spikelet number per panicle was in the order of 5867-36 (89.2) □ IR36 (84.7) □ Koshi-36 (79.8), and 5867-36 > Koshi-36. Panicle number per m² was in the order of IR36 (428) □ Koshi-36 (403) □ 5867-36 (353), and IR36 > 5867-36, suggesting that sd1-d increased number of panicles compared with SD1-in. Ripened-grain percentage-1.5mm sieve was in the order of Koshi-36 (86.0) □ 5867-36 (85.0) □ IR36 (82.7), and Koshi-36 > IR36. Thousand brown-rice-grain weight-1.5mm sieve (g) was in the order of 5867-36 (21.5) > Koshi-36 (20.2) □ IR36 (19.9). Total dry weight at maturity (g/m²) was in the order of 5867-36 (1404) □ IR36 (1310) □ Koshi-36 (1290). Harvest index of total brown rice (%) was in the order of IR36 (39.6) > Koshi-36 (37.7) > 5867-36 (35.5). Hence, sd1-d did not exert significant effect on yield in indica genetic background. However, lodging was observed from the late stage of maturity in 5867-36 and Koshi-36, particularly in the former, which was principally due to their long culms. Consequently, sd1-d enables higher yield with higher fertilizer application, by enhancing lodging resistance, particularly in indica subspecies.

Keywords : rice, dwarfing gene, sd1-d, SD1-in, SD1-ja, yield

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