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Responses of Grain Yield, Anthocyanin and Antioxidant Capacity to Water Condition in Wetland and Upland Purple Rice Genotypes

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Abstract : Wetland and upland purple rice are the two major types classified by its original ecotypes in Northern Thailand. Wetland rice is grown under flooded condition from transplanting until the mutuality, while upland rice is naturally grown under well-drained soil known as aerobic cultivations. Both ecotypes can be grown and adapted to the reverse systems but little is known on its responses of grain yield and qualities between the 2 ecotypes. This study evaluated responses of grain yield as well as anthocyanin and antioxidant capacity between the wetland and upland purple rice genotypes grown in the submerged and aerobic conditions. A factorial arrangement in a randomized complete block design (RCBD) with two factors of rice genotype and water condition were carried out in three replications. The two wetland genotypes (Kum Doi Saket: KDK and Kum Phayao: KPY) and two upland genotypes (Kum Hom CMU: KHCMU and Pieisu1: PES1) were used in this study by growing under submerged and aerobic conditions. Grain yield was affected by the interaction between water condition and rice genotype. The wetland genotypes, KDK and KPY grown in the submerged condition produced about 2.7 and 0.8 times higher yield than in the aerobic condition, respectively. The 0.4 times higher grain yield of upland genotype (PES1) was found in the submerged condition than in the aerobic condition, but no significant differences in KHCMU. In the submerged condition, all genotypes produced higher yield components of tiller number, panicle number and percent filled grain than in the aerobic condition by 24% and 32% and 11%, respectively. The thousand grain weight and spikelet number were affected by water condition differently among genotypes. The wetland genotypes, KDK and KPY, and upland genotype, PES1, grown in the submerged condition produced about 19-22% higher grain weight than in the aerobic condition. The similar effect was found in spikelet number which the submerged condition of wetland genotypes, KDK and KPY, and the upland genotype, KHCMU, had about 28-30% higher than the aerobic condition. In contrast, the anthocyanin concentration and antioxidant capacity were affected by both the water condition and genotype. Rice grain grown in the aerobic condition had about 0.9 and 2.6 times higher anthocyanin concentration than in the submerged condition was found in the wetland rice, KDK and upland rice, KHCMU, respectively. Similarly, the antioxidant capacity of wetland rice, KDK and upland rice, KHCMU were 0.5 and 0.6 times higher in aerobic condition than in the submerged condition. There was a negative correlation between grain yield and anthocyanin concentration in wetland genotype KDK and upland genotype KHCMU, but it was not found in the other genotypes. This study indicating that some rice genotype can be adapted in the reverse ecosystem in both grain yield and quality, especially in the wetland genotype KPY and upland genotype PES1. To maximize grain yield and quality of purple rice, proper water management condition is require with a key consideration on difference responses among genotypes. Increasing number of rice genotypes in both ecotypes is needed to confirm their responses on water management.

Keywords : purple rice, water condition, anthocyanin, grain yield
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