

Category	: International Rice Research Conference
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Keyword 1	: Submergence and flood tolerance
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Title of Entry	: Effects of AG1 and AG2 QTLs Introgression on Physiological Processes and Grain Quality during Early Flooding Stress in Direct-Seeded-Rice Systems
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Select only one type of presentation	: 15 minute oral presentation
Abstract	: Flooding induces anaerobic condition during germination in direct seeded rice systems, severely reducing crop stand establishment in both rainfed and irrigated areas. Rice seeds in flooded soils encounter hypoxia or even anoxia in severe cases, and this hinders germination and seedling growth. This study was conducted to quantify the effects of incorporating two major QTLs, AG1 and AG2, associated with tolerance of flooding during germination and to assess their interactive effects on enhancing crop establishment. A greenhouse and a field experiments were conducted at the International Rice Research Institute (IRRI), Los Baños, Philippines, using elite lines incorporating AG1, AG2 and AG1-AG2 in the backgrounds of the popular varieties PSBRc82 (PSBRc82-AG1, PSBRc82-AG2, PSBRc82-AG1-AG2) and Ciherang-Sub1 (Ciherang-Sub1-AG1, Ciherang-Sub1-AG2, Ciherang-Sub1-AG1-AG2), along with the donors Kho Hlan On (for AG1) and Ma-Zhan Red (AG2) and the recipients PSBRc82 and Ciherang-Sub1. The experiments were conducted using a RCBD with three replications. After direct seeding, the soil was flooded with 10 cm (greenhouse) and 3-5 cm (field) water depth. Seedling survival, germination rate, and root-shoot growth were measure at early growth stage and grain quality was measured after harvesting. The germinating seedlings were used for assaying nonstructural carbohydrate (NSC), ascorbate concentrations, lipid peroxidation, total phenolic concentration, reactive oxygen species and total amylase enzyme activity. Flooding reduced overall survival, though survival of AG1+AG2 introgression lines was greater than other genotypes. Soluble sugars increased, while starch concentration decreased gradually under

flooding especially in the tolerant checks and AG1+AG2 introgression lines. Less lipid peroxidation and higher amylase activity, reduced-ascorbate (RAsA) and total phenolic contents (TPC) were observed in the tolerant checks and in AG1+AG2 introgression lines. Lipid peroxidation correlated negatively with ascorbate, total phenolic concentrations and with reactive oxygen species scavengers (ROS). Introgression of AG1+AG2 QTLs upregulated total amylase activity causing rapid starch degradation and increase in soluble sugar, ascorbate and total phenolic concentrations resulting in higher germination and seedling growth in flooded soils. Moreover, there was no negative impact on grain physical and chemical quality due to AG1-AG2 QTLs introgression. Key words: Amylase, anaerobic germination, ascorbate, direct-seeded rice, flooding, grain quality, lipid peroxidation.

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