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Development of drought Tolerant Temperate Rice Variety by Pyramiding QTLs, *Pup1* and *DTY4.1*

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[Abstract]

Sustainable agriculture is a potential strategy to enable agricultural cultivation systems to feed the growing population under climate change. Sustainable agriculture consists of environment-friendly farming methods that allow the production of crops with minimal harm to the ecosystem. Early establishment in rice might be helpful to adopt sustainable agriculture with less inputs, such as water and phosphorus fertilizer. Two QTLs conferring tolerance to abiotic stress and low nutrition condition, *DTY4.1* and *Pup1*, respectively, are effective for good establishment in the early growth stage under low water and phosphorus fertilizer application. We developed 'Sechanmi' and 'MS11-DTY' harboring *Pup1* and *DTY4.1* into MS11, a *japonica* rice variety adaptable to tropical regions, using Marker-Assisted Backcrossing (MABC). MS11-PD lines were developed to meet the demand for less water and P fertilizer application throughout the growth stage of rice. In the F₅ generation, water-saving or rainfed cultivation was performed in different P (phosphorus) content. Irrigation was applied only when severe drought was observed one month after transplanting. There was no significant difference observed between the parents and MS11-PD lines in low P conditions. However, MS11-PD lines had more tillers in P-supplied conditions compared to that of the parents 40 and 50 days after transplanting. Under the same amount of P, MS11-PD lines might have higher phosphorus uptake capacity than the parents, increasing the number of tillers and showing better early establishment. The better vegetative growth stage is one of the factors that can potentially increase production by way of higher number of panicles. Through this breeding strategy, it is possible to attain sustainable agriculture by applying less P and water to address the need of a growing population.

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