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QTL Identification for Slow Wilting and High Moisture Contents in Soybean (*Glycine max* [L.]) and Arduino-Based High-Throughput Phenotyping for Drought Tolerance

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[Abstract]
Drought becomes frequent and severe because of continuous global warming, leading to a significant loss of crop yield. In soybean (*Glycine max* [L.]), most of quantitative trait loci (QTLs) analyses for drought tolerance have conducted by investigating yield changes under water-restricted conditions at the reproductive stages. More recently, the necessity of QTL studies to use physiological indices responding to drought at the early growth stages besides the reproductive ones has arisen due to the unpredictable and prevalent occurrence of drought throughout the soybean growing season. In this study, we thus identified QTLs conferring wilting scores and moisture contents of soybean subjected to drought stress in the early vegetative stage using an recombinant inbred line (RIL) population derived from a cross between Taekwang (drought-sensitive) and SS2-2 (drought-tolerant). For the two traits, the same major QTL was located on chromosome 10, accounting for up to 11.5 % of phenotypic variance explained with LOD score of 12.5. This QTL overlaps with a reported QTL for the limited transpiration trait in soybean and harbors an ortholog of the Arabidopsis ABA and drought-induced *RING-DUF1117* gene. Meanwhile, one of important features of plant drought tolerance is their ability to limit transpiration rates under high vapor pressure deficiency in response to mitigate water loss. However, monitoring their transpiration rates is time-consuming and laborious. Therefore, only a few population-level studies regarding transpiration rates under the drought condition have been reported so far. Via employing an Arduino-based platform, for the reasons addressed, we are measuring and recording total pot weights of soybean plants every hour from the 1st day after water restriction to the days when the half of the RILs exhibited permanent tissue damage in at least one trifoliate. Gradual decrease in moisture of soil in pots as time passes refers increase in the severity of drought stress. By tracking changes in the total pot weights of soybean plants, we will infer transpiration rates of the mapping parents and their RILs according to different levels of VPD and drought stress. The profile of transpiration rates from different levels of severity in the stresses facilitates a better understanding of relationship between transpiration-related features, such as limited maximum transpiration rates, to water saving performances, as well as those to other drought-responsive phenotypes. Our findings will provide primary insights on drought tolerance mechanisms in soybean and useful resources for improvement of soybean varieties tolerant to drought stress.

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