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## Improvement of Pre-harvest Sprouting Resistance in Korean *japonica* Varieties through a Precision Marker-based Breeding

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### [Abstract]

Pre-harvest sprouting (PHS) on rice panicles is getting problematic in recent several years in Korea due to climate changes such as high temperature and more frequent typhoons during harvesting season. PHS negatively affects grain quality severely and also yield. Genetic improvement of Korean varieties (*Oryza sativa* ssp. *japonica*) through a marker assisted-backcross breeding (MAB) with the known PHS resistant genes must be one of ideal solutions. However, the final breeding products of MAB occasionally exhibit unwanted traits, especially the cross between genetically distant parents. This might be caused by linkage drag and/or presence of the gene-unlinked donor introgressions, resulting that the final products could not be released to the farmers. The major PHS resistance gene, *Sdr4* (*Seed dormancy 4*) originated from an *indica* cultivar, Kasalath was selected as a donor gene. In order to avoid unexpected phenotypes in the breeding products, we performed a precision marker-based breeding (PMBB) consisting of foreground, recombinant, and background selections (FS, RS, and BS) which aim to develop ‘single small introgression lines’ (~100 kb introgression). Korean varieties (Ilpum and Gopum) were crossed with Kasalath. We developed *Sdr4*-allele specific markers for FS and a set of polymorphic flanking markers near the *Sdr4* (-350kb and +420kb) for RS. To minimize linkage drag, the small introgression (< 125kb) containing *Sdr4* was selected in Ilpum background (BC<sub>2</sub>F<sub>4</sub>) through 1<sup>st</sup> RS with ~1,200 F<sub>2</sub> or BC<sub>1</sub>F<sub>2</sub> plants (one side trimmed) and then 2<sup>nd</sup> RS with ~1,000 progenies from the 1<sup>st</sup> RS selected plants (another side trimmed). After RS, the selected lines were genotyped by using Infinium 7K SNP chip to detect other donor introgressions and the lines were backcrossed. Currently BS is on-going from the backcross-derived progenies with BS markers to remove residual introgressions. During the PMBB process, genetic effect of *Sdr4*-Kasalath allele was confirmed in Ilpum and Gopum backgrounds by PHS phenotyping using the segregating BC<sub>2</sub>F<sub>3</sub> or BC<sub>1</sub>F<sub>4</sub> materials. The *Sdr4* PMBB lines in Ilpum background (< 125kb introgression) will be valuable genetic resources to improve PHS resistance in modern popular temperate *japonica* varieties.

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