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QTL for the Iron and Zinc Contents of the Milled Grains of a Doubled-haploid Rice (*Oryza sativa* L.) Population Grown Over Two Seasons

O-Young Jeong[1]*, Man-Kee Baek[1], Geon-Mi Lee[1], Chang-Min Lee[1], Jung-Pil Suh[1], Young-Chan Cho[1]

[1]National Institute of Crop Science, Rural Development Administration, Republic of Korea

[Introduction]

Iron and zinc deficiencies may ultimately cause stunted growth in children and may cause neuropsychological impairment and weaken immunity. Increasing the Iron and Zinc of rice varieties through breeding-based biofortification is a cost-effective intervention for iron- and zinc-deficient human diets. To detect stable QTL across environments and seasons, this population was phenotyped during the 2018 wet season (2018WS) and 2019 wet season (2019WS) at the International Rice Research Institute (IRRI) Headquarters, Philippines. The milled rice grains of the DH lines were used to identify QTL associated with Iron and Zinc; the interactions and genes that affect them.

[Materals and Methods]

A DH rice population comprising 107 lines was developed from a cross between Goami 2, a japonica cultivar with high Iron and Zinc, and Hwaseonchal, a japonica cultivar with low Iron and Zinc. The iron and zinc contents of the milled rice grains were determined through inductively coupled plasma optical emission spectrometry (ICP–OES). for genotyping with the 7k Infinium SNP genotyping platform using 7,098 SNPs. Candidate genes colocating with iron and zinc related QTL were also identified by using the Rice Genome Annotation Project (RGAP) browser.

[Results & Discussion]

three Iron and zinc-related QTL were consistent between 2018 and 2019. Among these QTL, two were related to iron (qFe9 and qFe11) and one was related to zinc (qZn7). All of these QTL were donated by the inferior parent Hwaseonchal. QTL mapping was performed to identify iron and zinc related QTL that were consistent between years and locations. The low polymorphism rate between Goami 2 and Hwaseonchal was expected because they are closely genetically related Korean japonica cultivars. Genes that may be useful for breeding rice with high iron and zinc were detected in regions on chromosomes 7, 9, and 11 encompassing QTL and nearby interacting loci. Twelve genes encoding products with functions related to iron and zinc homeostasis or interactions with iron and zinc were detected in these regions. Multiple copies of genes encoding oxidoreductase 2OG-Fe oxygenase family protein and zinc finger family protein were present at different loci on the same or different chromosomes.

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*Corresponding author: Tel. +82-63-238-5212, E-mail. joyoung@korea.kr