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Detection and Evaluation of Low pH Tolerant CNDH Rice Line, Using QTL Analysis

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[Introduction]

Soil low pH is one of the most serious environmental constrain in intensive agricultural system. According to a recent report, about 30% of the world land is under acidic stress and around 12% of which is used for cultivation. Soil that have less than 5.5 pH consider as acidic soil as it reduces plant growth and yield. Plant cell perform normal function at the range of 7.0 to 7.5 pH of cell cytoplasm.

[Materials and Methods]

Here we screened 134 lines of Cheongcheong/Nagdong Double Haploid (CNDH) rice population against low pH to find candidate QTLs and to identify low pH resistant lines. Total 17 QTLs were identified on 8 chromosomes (1, 2, 6, 7, 8, 9, 10, 12) against shoot length, root length and standard evaluation score in response to low pH. A QTL related to shoot length qSL-6b on chromosome 6 with LOD 5, and QTL related to standard evaluation score qSES-9 on chromosome 6 with LOD 3 were further investigated for candidate genes.

[Results and Discussion]

Candidate genes were screen on qSL-6b between the markers RM1163-RM19621, and on qSES-9 between the markers RM278-RM3808. Total 24 genes i.e. 17 genes were predicted on qSL-6b and 7 genes were predicted on qSES-9 on the basis on closely related functional annotation using NCBI and RiceXpro databases. The proportion of phenotypic variation contributing to qSL-6b and qSES-9 was 26 % and 27 % respectively. The selected 24 genes were further evaluated by relative genes expression level (qRT-PCR) against low pH stress by using highly resistant and susceptible, and parental lines. We found four genes (Os06g0211200, Os09g0448200, Os09g0456200, and Os09g0472100) that were significantly expressed in resistant lines and reduced in the susceptible lines under the low pH stress. Our results concluded that, the K⁺ ion homeostasis and ABA regulation play a key role in the low pH tolerance of rice.

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