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Breeding of Rice with Improved Response to Cold Stress at Seedling Stage by CRISPR/Cas9

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[Introduction]

Rice accounts for most of the calories for the world's population. Rice is basically a tropical region. However, mostly in temperate regions, rice is grown and exported worldwide. Rice responds sensitively to the temperature response, and the degree of resistance differently for each growth stage. Most cold stress-related researches were conducted at 4°C. However, the cold stress actually applied in the field is 18°C. Therefore, in this study, rice was breeding when subjected to cold stress at 18°C.

[Materials and Methods]

The domain sequence of *OsCS511* was used to breed rice cultivars with improved cold tolerance with CRISPR/Cas9. Three independent sgRNAs were designed for the domain sequence. CRISPR/Cas9 vector for genome-editing was induced into Ilmi callus by *Agrobacterium*-mediated transformation. The generation was advanced in the field. Under cold, ROS, agricultural traits, transcription expression level, cell wall were analyzed.

[Results and Discussion]

In the regeneration plant, *OsCS511* editing lines were selected. Then, lines from which T-DNA was removed were selected, and finally 5 genome-editing lines were obtained. When subjected to 18°C cold stress at the seedling stage, the *OsCS511* genome-editing lines showed less ROS accumulated than Ilmi. And the cell wall were analyzed, cellulose and pectin were increased compared to Ilmi. Therefore, it improves cold tolerance by regulating ROS and cell wall components. Genome-editing lines provide an opportunity to breed rice cultivars that can be responsible for human food in response to climate change.

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