DBT-NIPGR studies effect of drought and salt stress on sucrose transport in rice

New Delhi, Oct 21: Drought and salt stresses are major abiotic stresses that limit crop yield and productivity by affecting plant morphology, physiology, and biochemistry. The cultivated land area encountering drought and salt stresses is continuously increasing. For example, drought is affecting about 42% of India’s land area.

Rice, a staple food for more than half of the world population, is a water-intensive crop, making it highly vulnerable to drought and salt stress. Photosynthesis and photoassimilate partitioning, which determine overall crop performance, are key physiological processes affected by drought and salt stresses. The molecular effects of such abiotic stresses on photosynthesis have been studied, however the effects on sucrose distribution and transport are largely unexplored.

Sucrose is the major form in which photosynthates are transported from the leaf to different sink tissues. Further, sucrose is not only required as an osmoprotectant for different tissues under drought and salt stresses but also required to meet the energy needs under the stress
conditions. Therefore, understanding the effects of drought and salt stresses on sucrose distribution and transport is imperative to maintain sugar homeostasis across the tissues, and thus optimal crop performance, under the stress.

A team of Scientists from DBT-National Institute of Plant Genome Research (DBT-NIPGR), New Delhi, has found that drought and salinity stresses increased the sucrose content in leaf and root tissues, and in the phloem sap of rice indica varieties, suggesting increased mobilization of sucrose in response to the abiotic stresses. Our experimental results showed that OsSWEET13 and OsSWEET15 were major sucrose transporters in rice regulating the sucrose mobilization and levels in response to the abiotic stresses.

They also found that ABA (abscisic acid), a stress hormone, induced the levels of OsSWEET13 and OsSWEET15. Further experiments showed drought- and salt- mediated induction of OsSWEET13 and OsSWEET15 expression involved direct binding of an ABA-responsive transcription factor OsbZIP72 to their promoters. Taken together, the results showed that the higher expressions of OsSWEET13 and OsSWEET15 genes, induced by binding of an ABA-responsive transcription factor OsbZIP72 to the promoters, potentially modulate sucrose transport and distribution in response to the abiotic stresses. The OsbZIP72-OsSWEET module could possibly be targeted for maintaining desirable sugar homeostasis in rice under drought and salinity stresses, and thus improving crop performance under the stress.

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