# DBT-NIPGR studies carbon partitioning between stem and grain in rice

New Delhi, April 06: Rice is a major staple crop for more than half of the global population of the world. Increasing the genetic yield potential and productivity of rice is imperative for exponentially increasing world population.

Photosynthesis and photoassimilate partitioning are keys to the overall performance of a crop plant in terms of biomass and yield. Plants fix atmospheric $CO_2$ in the form of sugars through photosynthesis in leaves, then photoassimilates are transported to different plant parts in the form of sucrose.

Sucrose is metabolized at the destination sink organs for either general growth, respiration or towards the storage in different organic forms. Therefore, understanding the sucrose transport and metabolism downstream to photosynthesis is crucial to balance grain yield and biomass in crop plants. Several factors, including growth stages and environmental factors, control sucrose transport and metabolism in crop plants. In addition, natural genetic variation in sucrose transport and metabolism leading to differential yield and biomass has also been evident in crop plants.

A team of researchers at DBT-National Institute of Plant Genome Research investigated the sucrose transport and metabolism differences and underlying basis using the cultivated-wild rice system. Wild relatives of rice produce excessive biomass with limited grain yield, whereas cultivated rice varieties have a high harvest index with higher grain yield and limited biomass.

The study has found that functions of sucrose transporters, SWEET and SUT transporters, along with features of vascular bundles promoted the mobilization of sucrose to panicles in the cultivated rice varieties. Sucrose, after reaching the stem in cultivated varieties is transiently stored as starch due to higher expression of starch biosynthetic genes. The stored starch is metabolized to sucrose at the time of grain filling for the mobilization to the grain in those varieties.

In contrast, vascular features and sucrose transporter functions limited sucrose mobilization to the grains in the wild rice. The sucrose was primarily used in the stems of the wild rice for the synthesis of structural carbohydrates due to the higher cleavage activity of the sucrose synthase enzyme and higher expression of cellulose synthase genes. The synthesis of more structural carbohydrates in the stems of the wild rice promotes higher biomass accumulation in those species.

Thus, sucrose transport, controlled by vascular features and sucrose transporter factions, and functions of sucrose metabolic enzymes, such as sucrose synthase and invertase, explained the grain yield and biomass differences between cultivated rice varieties and their wild relatives. These sucrose transport and metabolism traits could potentially be targeted for source-sink dynamics favoring either biomass accumulation in fodder crops or higher grain yield in cereal crops.

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