Gene-Based Manipulation of a Plant Hormone Regulating Drought Tolerance

Water supply is essential to all living organisms. Although animals can move to get water, plants have to regulate multiple cellular responses involving gene expression, and they control water vaporization by opening and/or closing stomata on the back side of leaves. A plant hormone, abscisic acid (ABA), plays a central role to control plant responses to dehydration stress. When the surrounding is getting dry, ABA biosynthesis is increased and plant responses are triggered as stomatal closing to keep water inside the plant body. Conversely, ABA is degraded to reach the basal level when plants are released from dehydration.

Gene Discovery Research Team in RIKEN Plant Science Center elucidated the mechanism of ABA degradation process (catabolism) at the molecular level. The research group found that a cytochrome P450 CYP707A3 is a major enzyme to maintain ABA content in plants under dehydration and rehydration process using knockout mutants or transgenic plants.

The team had also reported that a key enzyme for ABA biosynthesis, a 9-cis-epoxycarotenoid dioxygenase, was useful for controlling drought tolerance in plants. ABA has critical roles in seed dormancy, germination and several developmental processes as well as drought response. Therefore, this research topic will open the door to biotechnological application for controlling seed germination, enhancing seed preservation and generating drought-tolerant crops or trees.

The research details are reported in the reference; The Plant Journal 46(2):171-82, April (2006).
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