ABSCISIC ACID: INTERACTIONS WITH ETHYLENE AND REACTIVE OXYGEN SPECIES IN THE REGULATION OF ROOT GROWTH UNDER WATER DEFICIT

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ABSTRACT

Abscisic acid (ABA) is involved in several responses to plant water deficits, including an important role in root growth maintenance. Studies of the ABA-deficient maize mutant *viviparous 14* (*vp14*) showed that ABA-deficiency under water deficit conditions causes impaired primary root growth, which was associated with excess production of ethylene and also a dramatic increase in intracellular reactive oxygen species (ROS) in the root growth zone, resulting in loss in membrane integrity and, ultimately, cell death. Several studies in other systems have shown that stress-induced ROS production can trigger ethylene production and, conversely, that ethylene can lead to excess ROS production. To further understand the interrelationships between ethylene, ROS and ABA in water-stressed roots, the *vp14* mutant was used to determine whether the increase in ethylene is the cause or result of the increase in ROS. A hydroponic culture system was used to allow controlled application of inhibitors of ethylene synthesis during the growth of ABA-deficient roots at low water potentials, and the effects on ROS levels in the root growth zone were measured by fluorescence microscopy. The results demonstrate that inhibition of ethylene synthesis prevents the increase in intracellular ROS levels and restores root growth in ABA-deficient water-stressed roots, indicating that the interaction of ABA and ethylene is upstream of, and results in, the production of ROS. Further analysis with this system will lead to a greater understanding of the signal transduction pathway and primary mechanisms involved in the regulation of root growth by ABA under water deficit conditions.