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Physiological role of signal molecules in improving plant tolerance under abiotic stress

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Abstract : A wide range of unfavourable environmental conditions may induce stresses in plants that alter plant growth, development and metabolism, and even may lead to plant death. These stresses include mechanical damage, herbicides, UV radiation, salt, low/high temperature, soil drought, flooding, high speed wind, nutrient loss and anaerobic conditions are very important stress factors limiting crop productivity. An unavoidable consequence of aerobic metabolism is production of reactive oxygen species (ROS). ROS include free radicals. In plants, ROS are always formed by the inevitable leakage of electrons onto O_2 from the electron transport activities of chloroplasts, mitochondria, and plasma membranes or as a byproduct of various metabolic pathways localized in different cellular compartments. All ROS are extremely harmful to organisms at high concentrations. When the level of ROS exceeds the defense mechanisms, a cell is said to be in a state of "oxidative stress." The enhanced production of ROS during environmental stresses can pose a threat to cells by causing peroxidation of lipids, oxidation of proteins, damage to nucleic acids, enzyme inhibition, activation of programmed cell death (PCD) pathway and ultimately leading to death of the cells. The sensing of biotic or abiotic stress conditions induces signaling cascades that activate production of reactive oxygen species (ROS), calcium (Ca^{2+}),nitric oxide (NO), accumulation of hormones such as abscisic acid, , ethylene, jasmonic acid, and salicylic acid. These signals ultimately induce expression of specific subsets of defense genes that lead to the assembly of the overall defense reaction. Plant responds to stresses as individual cells and synergistically as a whole organism. Stress signal is first perceived by the receptors present on the membrane of the plant cells. Following this the signal information is transduced downstream resulting in the activation of various stress responsive genes.

Key words: Abiotic stress, drought, growth, heat stress**,** salinity, signal molecules, yield.

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