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Drought Stress in Maize (*Zea mays* L.)

Effects, Resistance Mechanisms, Global Achievements and Biological Strategies for Improvement

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Abstract

Drought is one of the most detrimental abiotic stresses across the world which is seriously hampering the productivity of agricultural crops. Maize is among the leading cereal crops in world, but it is sensitive to drought. Maize is affected by drought at different growth stages in different regions. Germination potential, seedling growth, seedling stand establishment, overall growth and development, pollen development, silk development, anthesis–silking interval, pollination, embryo development, endosperm development, and kernel development are the events in the life of maize crop which are seriously hampered by drought stress. Plants have developed numerous strategies which enabled them to cope with drought stress. Maize germplasms also have numerous features which enable some accessions to cope with drought stress in better ways. One of the adaptive strategies is the earliness which helps the plants to escape the drought stress. Some genotypes have the ability to avoid the drought stress either by reducing water losses or by increasing the water uptake. Drought tolerance is also an adaptive strategy which enables the crop plants to maintain the normal physiological processes and harbors higher economical yield under prevailing drought stress. Osmotic adjustment by accumulation of osmolytes, plant self-defense by accumulation of antioxidants, plant growth regulators, stress proteins, and water channel proteins, transcription factors and signal transduction pathways are involved in conferring the drought tolerance on maize. Maize genotypes have the differential capability to escape, avoid, or tolerate the drought stress. Great efforts were made by CIMMYT, IITA, and other multinational companies in the development of drought-tolerant maize open-pollinated varieties (OPVs) and hybrids. Drought-tolerant hybrids and OPVs of maize are being cultivated in numerous African countries. There is a need to further improve the level of adaptability against drought stress for combating the global issue of food security. Screening of available maize germplasms for drought tolerance, conventional breeding strategies, marker-assisted and genomic-assisted