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Improving Salt tolerance of Cotton through Breeding and Biotechnological Approaches

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Abstract

Cotton is widely used for fiber and oil production all over the world. It is classified as moderately salt-tolerant crop and at its seed yield and growth are greatly hampered by high salinity levels. Salinity is one of the major abiotic stresses that has a detrimental impact on plant development, growth and production processes, ultimately reducing yield. To counteract the oxidative and osmotic stresses caused by salinity, plants adopt specific mechanism and activate different salt tolerance genes to withstand saline environment. In order to increase the cotton productivity in saline conditions, a variety of approaches are proposed to improve plant breeding efficacy. Cotton cultivars that grow in saline conditions are developed using breeding techniques. Enhancing the specific alleles involved in cotton's ability to tolerate salinity is main objective of breeding programs for salinity tolerance. To increase the salinity tolerance in plants, one must have a thorough understanding of both conventional and modern breeding methods as well as biotechnological approaches. Traditional breeding methods are widely used in breeding programs to improve the salinity tolerance of cotton. These include (i) germplams screening for salinity tolerance in specific environments, (ii) making use of genetic variation already present in genotypes through backcross and pedigree methods of breeding, (iii), developing hybrids by best parental lines as a result of extensive germplams screening, (iv) mutation breeding; utilizing the variations produced by induced mutations, (v) interspecific hybridization, transferring the salinity tolerance related traits from wild relatives into well-known cotton cultivars to increase the level of tolerance. However, traditional breeding methods used to increase salinity tolerance have encountered issues, and the progress has been slow. The disadvantages of breeding approaches are mitigated by the use of Biotechnological tools for accurate genomics-assisted salinity breeding. Biotechnological approaches to enhance the salinity tolerance and fiber quality of cotton include Marker assisted selection, QTL mapping, genome editing through CRISPR-Cas9, RNAi, transgenic technology and transcriptome analysis.

Key Words: *Abiotic stresses, Genome editing, Breeding, Backcross, Marker assisted selection*