World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:13, No:03, 2019

Biotechnological Interventions for Crop Improvement in Nutricereal Pearl Millet

Authors : Supriya Ambawat, Subaran Singh, C. Tara Satyavathi, B. S. Rajpurohit, Ummed Singh, Balraj Singh

Abstract : Pearl millet [Pennisetum glaucum (L.) R. Br.] is an important staple food of the arid and semiarid tropical regions of Asia, Africa, and Latin America. It is rightly termed as nutricereal as it has high nutrition value and a good source of carbohydrate, protein, fat, ash, dietary fiber, potassium, magnesium, iron, zinc, etc. Pearl millet has low prolamine fraction and is gluten free which is useful for people having a gluten allergy. It has several health benefits like reduction in blood pressure, thyroid, diabe¬tes, cardiovascular and celiac diseases but its direct consumption as food has significantly declined due to several reasons. Keeping this in view, it is important to reorient the ef¬forts to generate demand through value-addition and quality improvement and create awareness on the nutritional merits of pearl millet. In India, through Indian Council of Agricultural Research-All India Coordinated Research Project on Pearl millet, multilocational coordinated trials for developed hybrids were conducted at various centers. The gene banks of pearl millet contain varieties with high levels of iron and zinc which were used to produce new pearl millet varieties with elevated iron levels bred with the high-yielding varieties. Thus, using breeding approaches and biochemical analysis, a total of 167 hybrids and 61 varieties were identified and released for cultivation in different agro-ecological zones of the country which also includes some biofortified hybrids rich in Fe and Zn. Further, using several biotechnological interventions such as molecular markers, next-generation sequencing (NGS), association mapping, nested association mapping (NAM), MAGIC populations, genome editing, genotyping by sequencing (GBS), genome wide association studies (GWAS) advancement in millet improvement has become possible by identifying and tagging of genes underlying a trait in the genome. Using DArT markers very high density linkage maps were constructed for pearl millet. Improved HHB67 has been released using marker assisted selection (MAS) strategies, and genomic tools were used to identify Fe-Zn Quantitative Trait Loci (QTL). The draft genome sequence of millet has also opened various ways to explore pearl millet. Further, genomic positions of significantly associated simple sequence repeat (SSR) markers with iron and zinc content in the consensus map is being identified and research is in progress towards mapping QTLs for flour rancidity. The sequence information is being used to explore genes and enzymatic pathways responsible for rancidity of flour. Thus, development and application of several biotechnological approaches along with biofortification can accelerate the genetic gain targets for pearl millet improvement and help improve its quality.

Keywords : Biotechnological approaches, genomic tools, malnutrition, MAS, nutricereal, pearl millet, sequencing.
Conference Title : ICGEB 2019 : International Conference on Genetic Engineering and Biotechnology
Conference Location : Singapore, Singapore
Conference Dates : March 28-29, 2019