ROLES OF FOREST BIOTECHNOLOGY IN TREE IMPROVEMENT

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Abstract
Biotechnology is one of the areas of scientific investigation in which rapid improvements have been made in modern centuries. It plays a vital part in the improvement of tree species and can be of significant importance in the era of rise in human civilization. Biotechnology is the application of systematic and designing principles to the dispensation of materials by biological means to offer goods and services. Biotechnology includes the hereditary control and duplication of any living organism through novel strategies and innovations such as tissue culture and genetic engineering in order to yield novel organisms and or products that can be used in various ways. The major effect of recent biotechnological development in tree improvement includes; production of high yielding plants resistant to biotic and abiotic stress, improvement of nutritional value of plants and production of diseases resistant plants. The general purpose of this review is to give highlight on the significance of biotechnology towards realizing a harmless and viable improvement of tree species.

***Keywords**: Biotechnology, tree, improvement, Forest*

Introduction

Biotechnology provides a major role in sustainable development of forestry and agriculture and can be of major importance in meeting the food necessities of increasing urban population. The problems of food safety and sustainable forest management within the emerging world and especially in sub-Saharan Africa proceeded to control communal argument and have remained a problem of worldwide concern. As a result of overwhelmed population growth, economic insatiability, and rapid climate change, attaining sustainable forest management has become one intractable challenge for several nations of the world (Ohikere and Ajogwu, 2012). Sustainable forest management needs to be improved with modern and effective technology such as biotechnology in order to meet the growing demand of forest and forest products due to rapid growth of world population (Abah *et al.*, 2010). The word biotechnology was first invented to describe the commercial use of living organisms. Nevertheless, with the intensification in evidence of Deoxyribonucleic Acid (DNA) and introduction of recombinant DNA technology, all activities related to gene manipulation have also been involved in the domain of biotechnology. According to International Union of Pure and Applied Chemistry, biotechnology is the application of biochemistry, microbiology, biology and chemical engineering to manufacturing process and products and on environment (Dubey, 2012).

The arena of contemporary biotechnology is really considered as unique fields of systematic investigation in which the fastest developments have been made in modern years. Forest biotechnology contributed significantly towards the improvement of silvicultural and forest management practices (Gyanaranjan and Afaq, 2020). Biotechnology in forest has remained a unique prospect for producing trees that are resistant to biotic and abiotics stresses, improvement of nutritional value and production of diseases resistant plants.

Generating high-yielding plants resistant to the biotic and abiotic stresses

Stress in plants is the outward situations that unfavorably affect progress, improvement or output of plants (Verma *et al.*, 2013). Stresses in plants can lead to altered gene expression, plant cell metabolism, changes in development rates and crop harvests. Plant stress commonly imbibes certain rapid modifications in environmental situation. Nevertheless in stress lenient plant species, contact to a specific stress tips to acclimatization toward that particular stress with phase. Plant stress can be grouped in two key classifications viz:- abiotic stress and biotic stress. Abiotic stress forced on plants via environment can be physical or chemical, whereas biotic stress visible to the plants is a biological component like ailments and pests. Some stresses towards the plants damaged them in such a way that the plants display some metabolic disorders (Verma *et al.*, 2013). The plants may be improved from the damages if the stress is trivial whereas prolonged stresses can cause death of the plants (Zhu, 2002).

Biotic stress in plants is triggered by living organisms, especially viruses, bacteria, fungi, nematodes, pests and unwanted plant. The means triggering biotic stress unswervingly divest their host of its nutrients and may cause death to the plants. Abiotic stresses like water scarcity, excess water, very high or very low temperatures, salty water and mineral poisonousness harmfully influence progress, improvement, vintage and seed value of plants. In the upcoming years, it is projected that additional water shortage will rise and eventually the strength of abiotic stresses will also rise. Therefore, there is need to produce plant species that are strong to abiotic stresses to ensure sustainable forest management and care in future (Audil *et al.*, 2019). This would lead to rise in

international food production by dropping plants damage and increasing harvest, while safeguarding farmland and plummeting burden on unique natural resources such as rain forests. Similarly, it offer additional engagement chances for people and rise output.

Improvement of nutritional value of plants

Plants contain bioactive constituents that can utilize physiological effects such as nutrition, supporting fitness and human safety. Improvement of nutritional value of plants especially fruits and vegetables help in reducing the risk of ailments to consumers (Nieves, 2017). In order to gratify the diet requirements of the worldwide population, agriculturalists of all the nations employed the green revolution skill, which has triggered harmful effects on the environment and which also denotes a hidden delinquent for human wellbeing (Baez-Rogelio *et al.,* 2017). Hence, biotechnology need to pool dual intentions that appear to be commonly fashionable; to fulfill the dietary requirements of a growing populace and to lessen the harmful effect on the environs (Duhamel and Vandemn, 2013). These dual purposes are comprised in the objective of the 2030 Program for Sustainable Development of the United Nations; 'End hunger, accomplish food safety and better nutrition'.

Significant development to biotechnological advance of nutritional value has been prepared in the previous years. In order to successfully plan a particular metabolic characteristic in plants, information of the biosynthetic and/or passage trails involved are vital. Well-designed genomics and additional gene finding approaches are valued for clarifying such pathways. It is also required to know the interactions between altered biosynthetic pathways since modification of individual pathways can have effects on related pathways. Since ample of the investigation on biosynthetic pathways is piloted on typical plants, like Arabidopsis, it is vital that this information be conveyed to argonomically significant crops. Investigation on the bioavailability of the composite and the actual dosage for a biological outcome are important to assess nutritional value. Bioavailability can be influenced by numerous causes such as biochemical procedure of the nutrient, solubility in food background, co-presentation with nutritional garnishes or anti-nutritional mixtures and food handling circumstances. A remarkable case is on the investigation on bioavailability of lycopene in tomato (Unlu *et al*., 2007). However the cis-isomer stood to be favorably fascinated by individuals, all-trans-lycopene stood to be the major isoform in treated and fresh tomatoes. Treatment of the tomato matrix in high temperature in the presence of oil boosts cis-isomerization and hints to better bioavailability, stressing the need to reflect all potential contributors to bioavailability. Vitamin A bioavailability of Golden Rice indicated that β-carotene is conveniently improved to vitamin A when used up by individuals (Tang *et al.,* 2012). A moment ago, β-carotene in Golden Rice was revealed to be as active as β-carotene in oil to offer vitamin A for progenies (Tang *et al.,* 2012). Nevertheless, the intelligences on the bioavailability of phytonutrients are inadequate. Biotechnology has demonstrated positive result in improving the nutritional significance of a extensive assortment of tree classes, however merely a few of such tree classes are permitted for human intake. (ISAAA, 2012).

Production of diseases resistance plants

Plant ailments are a risk to biosphere food production and overall food safety. Essential harvest fatalities payable to the outbreak of pathogen happen in most of the cultivated and gardening crop species. For Instance; in Nigeria, twenty five million Naira was missing after about 70 % of the cocoa made was missing to black pod infection in 1995. Additional 75% of all key crops illnesses are triggered by fungi. Old plant breeding approaches have been recycled to improve cultivars resistant to several ailments. Yet, this progression is time intense and inadequate means to obtain the genetic materials for most of the crops has left insignificant scope for improvement (Mehrotra and Aggarwal, 2003).

Several plant species, which spread through vegetative means, are systematically infested by bacteria, nematodes, virus and fungi. The inoculum of such plant species are carried over numerous generations leading to constant antagonistic effect of production and quality harvests. In demand to certify maximum potential harvest and quality in plants, it is essential to offer disease free standard plants to farmers. Tissue culture procedures have resolved the delinquent and reduced the period of biological challenges. Recent skills such as metabolics, proteomics and transcriptomics are currently verified to be beneficial in understanding metabolic pathways in plants and the role of main genes linked with their regulation. Hence, this enabled novel visions towards the intricate metabolite areas that leads to a specified phenotype and can permit detection of novel target genes to adjust a particular pathway. Such genes can then be a theme to fresh metabolic engineering efforts and uses. It has become predictable to relocation genes from unique organism to another. The transfer of such gene might be consummate by direct approaches. Examples include the gene or biolistic technique and agrobacterium mediated method. Biotechnology allows the precise analysis of plant ailment. PCR and ELISA play a vital role in the identification of viral and bacterial diseases.

Conclusion

Biotechnology has several ecological and social remunerations. Plants established via biotechnology will nurture faster and plays a significant role in the improvement of tree species through lessening the request for wood harvested from old trees and natural forest trees. Biotechnology contributes to the forest production in advancement of its objectives of providing wood harvests for humanity while guarding the natural forests that offer attractiveness and vital ecological benefits.

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