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Plant Breeding: A Structural Frame Work In Agriculture

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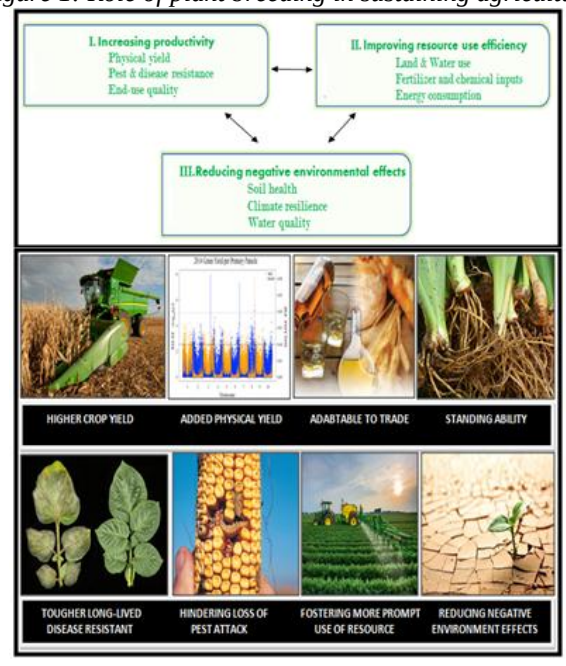
Abstract: ***Breeding in plants is recognized as one of the oldest tool of agricultural development initiated by humans over decades. The evolving of civilization manifested the achievement in plant breeding though not been acknowledged by common man, the reason being poor understanding of breeding concept. Inspite of good outcome from traditional methods; new technology with novel inventions are emerging consistently and furthermore advance research is necessary to fulfill the sustainability of human, thus producing improved cultivars by identifying the desirable ones with combination of characters for better expression pattern. This review talks about the principles, methodology, current approach and future outlook of plant breeding, more importantly in crop improvement.***

Keywords: Breeding, Agriculture, Genetics, Crop Improvement, DNA Technology

I. INTRODUCTION

Although the requirement of food is been rapidly increasing due to flourishing human population there needs to be an improvement in quality of food especially with enhanced nutritive value along with decreased farming inputs thereby avoiding the environment pollution especially triggered by emissions of CO_2 and nitrogenous fertilizers (Mark and Peter, 2000).The challenging efforts are being made these days to increase yield and resisting environmental threats with global change. This change in food security calls for exploitation of revised technologies to secure food supply, thus considering various criteria namely crop yield and expenditures (Goldman, 2013). Several molecular genetics parameters, recent advancement in integrative genomics, bioinformatics have into the domain of molecular breeding is been formulated (Ghanemi, 2013a; Young, 1999; Cardon and Palmer, 2003; Ramanna and Jacobsen, 2003; Chen et al., 2013; Whitford et al., 2013, Li et al., 2012). The plant breeding industry is a major contributor to more sustainable agriculture and food production (Figure 1). This review furnishes and highlights the current approaches along with future prospects in some of the instructive model leading to crop improvement and environmental stress resistance. Additionally plant breeding coupled with extensive genomic resources by understanding the concept of emerging model plant thus providing new oppurtunities, innovative approaches to meet challenges ahead.

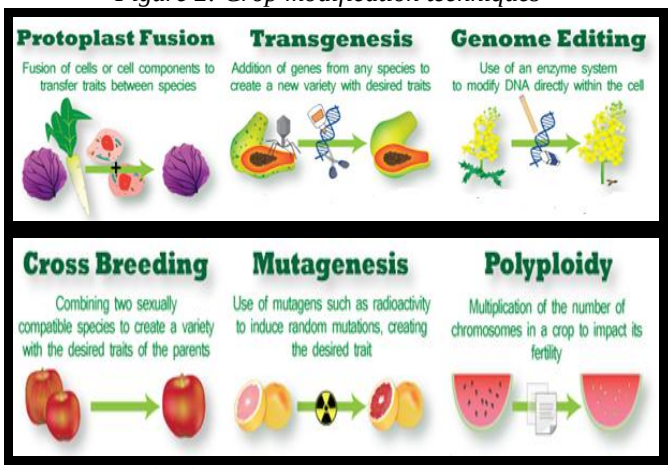
Figure 1: Role of plant breeding in sustaining agriculture



II. CURRENT APPROACHES

Several crop modification methods (Figure.2) in molecular genetics have been developed, while the existing advances have been equally adapted.

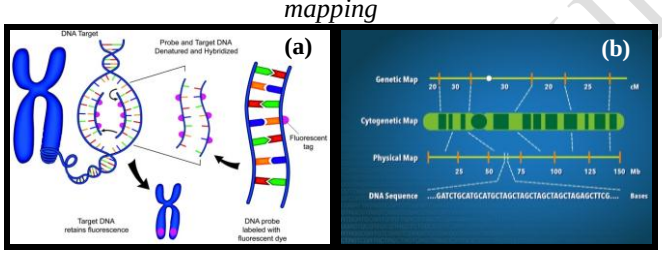
Figure 2: Crop modification techniques



Source: www.biofortified.org

The most important techniques DNA in-situ hybridization and gene mapping techniques (Figure 3(a) & (b)) were employed to detect genetic polymorphism providing the genome composition of polylpoid progenies (Ramanna and Jacobsen, 2003). The bloom in genomic resources and technology with other advances have been utilized in developing in new plant species with dominant characters, such studies was implemented in wheat breeding for exploring new molecular based techniques (Whitford et al., 2013).

Figure 3: (a) DNA in-situ Hybridization and (b) Molecular mapping



Potentiality of the molecular methods conversely enabled in efficiently and routinely engineering the genotypes of Panicum virgatum popularly known as switchgrass (King et al., 2013). Further interesting molecular facts has led in identifying a novel calcium-dependent protein kinase gene from Populus euphratica (Chen et al., 2013) contributing towards development of cold stress resistant plant, and for the quantitative aspects, genotypic strategies might probably ameliorate the biomass yield in triticales (Alheit et al.,2013).Understanding gene regulation in Rubisco activase (RCA) possibly result in enhancing plant productivity (Chao et al., 2013). For crop improvement and identifying genes, site-specific genetic approach may be highly successful (Alessandro et al., 2013). Integrating genomics with bioinformatics can be designed as a latent tool across molecular breeding (Li et al., 2012; Young, 1999).

In addition, in elite common wheat varieties, it is also important to include the analysis of genomic loci more intensively in grain weight control (Zhang et al., 2013). Many crop species viz., alfalfa, apple, carrot, cauliflower, celery, cotton, cucumber, flax, horseradish, lettuce, maize, potato, rapeseed, rice, rye, sugarbeet, soybean, sunflower, tomato, tobacco and walnut are already proved to be efficient hosts for transformation. Genetically engineered crops including maize, tomato, canola, squash, potato, soybean and cotton are in pipeline to be released into large-scale agriculture, presently focusing on altering oil composition, starch, vitamin and vaccines for quality. All the examples from varied species outline the potency of molecular and genetic tools, thence, further predictions to other species would be owing to bring more applications prospectively. The applications and benefits from such technology rely mostly on how useful are they and the way we introduce them to agriculture.

III. FUTURE OUTLOOK

These techniques and approaches of developing plants benefits not only the agriculture but also to other fields that involves plant usages, in paper wood and medicinal with reliability of promising natural products like, traditional Chinese medicines (Hull, 2014; Ghanemi, 2013b; Boubertakh et al, 2013; Cheng et al., 2013; Lee et al., 2013). However developing new species can also have role in ecology in reducing pollution through plant that produce higher oxygen and exhaust more of carbon dioxide. Methods employed for Plant breeding and investigations associated with negative issues needs to be evaluated from botany, biochemistry, molecular biology, ecology, genetics and toxicology. Thus plant breeding will remain hooked with classical techniques by addition of new approaches parallelly, in expanding range of techniques benefiting by integrated exploitation.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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