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Editorial Note

Genetic Improvement of Crops under the Climate Resilience

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The basic requirement of plant breeding is the exploitation of natural and induced genetic diversity in developing plant varieties for sustainable food production. Plant breeders are handicapped due to lack of availability or non-existence of desired genotypes. However, they have successfully recombined the desired genes from the existed available gene pool, and successfully develop new cultivars; faced with new challenges such as climate change, human population growth, etc., which threaten to sustain food production worldwide. Some of the factors having a great impact on climatic change are gaseous pollution, depletion of atmospheric ozone, increase in UV-B radiation level, increased atmospheric CO_2, extreme variability of rainfall time and locations, irregular growing season lengths, intermittent dry spells, global warming, high temperatures, degradation of water and soil resources. Global warming may become disastrous to agriculture production especially by the appearance of new insects and pests and diseases and some existing ones may disappear. The increase in atmospheric CO_2 levels and potential global climate change can alter growth rates, distribution of weeds and insect pests, and their impact on agricultural productivity. There are visible signs of the negative impact on world food production and the rise in food prices. The developing countries will have a greater adverse impact of climate changes on food and fibre production environmental services, and rural livelihoods; faced with urgent needs to improve food security, and reduce the poverty. Moreover, nearly 80% of the populations of poor countries depend on agriculture on their livelihoods and therefore are more vulnerable to climate changes. Moreover, they lack infrastructure, trained manpower, shortages of funds, dependence on imports increase the costly food supply chain.

Induced mutations are exploited to enhance the mutation frequency rate for the selection of appropriate variants for plant breeding. The mutation frequency rate of spontaneous mutations is rather very low and difficult to exploit in plant breeding. Traditionally mutations are induced by physical, e.g., gamma radiation, and chemical, e.g., Ethyl methanesulfonate (EMS), mutagen treatment of both seed and vegetatively propagated crops. Additionally, plant breeders are required to exploit new innovative tools, such as somatic cell hybridization, genetic engineering, gene editing, functional genomics, molecular marker-assisted selection and breeding, and in vitro culture techniques together with traditional breeding for sustaining food and nutritional security to feed the world. TILLING (Target induced local lesions in genomes) is a new strategy for reverse genetics It follows traditional chemical mutagenesis followed by high-throughput screening for point mutations. Furthermore, TILLING does not involve transgenic modifications or cell culture manipulations In vitro culture techniques have been effectively used for clonal propagation and in vitro selection and mutagenesis mostly in vegetatively propagated crops. Doubled haploids and micropropagation have been effectively used in crop improvement. By induced mutations, over 3600 mutant varieties (www.iaea.org) have been released worldwide enabling sustainability in food production. The major advantage of mutagenesis is the selection of mutants with multiple traits ideal for growing under climate change. By transgenic approach, single-gene trait transgenic plants have been produced. Moreover, consumers are not ready to accept genetically modified food (GM). To begin with some of the following recommendations that could be followed to address food production under the climate change-

1. Collection of information on the existing available seeds of mutants, arrangements for multiplication and exchange/supply of mutant seeds and plant material.

2. Study genetic diversity, erosion, utilization of local germplasm for developing new mutant varieties, basic research in gene discovery and functional genomics.
3. It is difficult to predict the impact of climate changes on global or regional or national agriculture and therefore new varieties must be developed and distributed regularly at the national and regional levels for sustainable crop production.
4. Develop new varieties that can be readily adapted in a short period on different locations with varying agro-climatic growing conditions, and low available resources.
5. Study root architecture and root growth of plants to withstand abiotic and biotic stress conditions.
6. Mutation-based functional genomics to identify genes from induced mutants and study their functions either as a single or cluster of genes.

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