

Principle and application of plant mutagenesis in crop improvement: a review

ABSTRACT

The first step in plant breeding is to identify suitable genotypes containing the desired genes among existing varieties, or to create one if it is not found in nature. In nature, variation occurs mainly as a result of mutations and without it, plant breeding would be impossible. In this context, the major aim in mutation-based breeding is to develop and improve well-adapted plant varieties by modifying one or two major traits to increase their productivity or quality. Both physical and chemical mutagenesis is used in inducing mutations in seeds and other planting materials. Then, selection for agronomic traits is done in the first generation, whereby most mutant lines may be discarded. The agronomic traits are confirmed in the second and third generations through evident phenotypic stability, while other evaluations are carried out in the subsequent generations. Finally, only the mutant lines with desirable traits are selected as a new variety or as a parent line for cross breeding. New varieties derived by induced mutagenesis are used worldwide: rice in Vietnam, Thailand, China and the United States; durum wheat in Italy and Bulgaria; barley in Peru and European nations; soybean in Vietnam and China; wheat in China; as well as leguminous food crops in Pakistan and India. This paper integrates available data about the impact of mutation breeding-derived crop varieties around the world and highlights the potential of mutation breeding as a flexible and practicable approach applicable to any crop provided that appropriate objectives and selection methods are used.

Keyword: Crop improvement; Economic impact; Induced mutations; Mutagens; Mutant value