

Mutation: Is It Useful or Harmful in Plant Breeding

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ABSTRACT

All mutations are not harmful or all are useful but some can transform the future of agriculture. In the past mutations are considered to be harmful and it leads to genetic disorders in human beings, but in plant breeding mutations have played a remarkable role in the development of diverse cum superior crop varieties. This article includes about what is mutation, how mutations are created, merits and demerits and its application in crop improvement.

INTRODUCTION:

Mutation term coined by a Dutch botanist Hugo de Vries in the year 1901, it can be defined as sudden heritable permanent change in the DNA sequence or genetic material of an organism (Bado *et al*, 2023). Mutations can arise spontaneously or can be induced by using both physical mutagens (gamma rays, X-rays thermal neutrons) gamma rays are the most commonly used mutagen (Beyaz, R., & Yildiz, M.2017) and chemical mutagens (base analogues, acridine dyes, alkylating agents) among this ethyl methane sulphonate (EMS)

can create changes at single nucleotide level and it is the most commonly used mutagen. Mutation breeding is the process of creating genetic variation through induced mutations and selecting plants with useful characteristics (Prasad, S., & Kumar, S. S., 2025). This can be done by

- Treating seeds or plant material with radiation or chemicals.
- Growing the treated plants.
- Screening thousands of plants for desirable traits.

- Selecting superior plants.
- Evaluating them over several generations.
- Releasing promising lines as improved varieties or using them in breeding programmes.

Advantages:

- ✚ Introduces new alleles that may not exist in the natural population.
- ✚ Useful mutations can enhance yield, disease resistance.
- ✚ It modifies one or more characters of an existing variety.
- ✚ It creates variations in self-pollinated crops and vegetatively propagated crops.
- ✚ Produces new plant types.
- ✚ It is a non-transgenic approach.

Disadvantages:

- ✚ Low frequency of useful mutations.
- ✚ Random nature of mutations.
- ✚ Large population size required to screen the beneficial mutations.
- ✚ Limited improvement.
- ✚ Risk of reduced vigour.
- ✚ Undesirable linked mutations.
- ✚ Requires specialized facilities.
- ✚ Time consuming validation.

Applications:

- ✚ Development of improved varieties
- ✚ Induction of male sterility

- ✚ Production of haploids
- ✚ Overcoming self-incompatibility
- ✚ Improvement in adaptation
- ✚ Improvement in nutritional quality

CONCLUSION:

Mutations evolved spontaneously or induced, it acts as a valuable tool in the breeding of new alleles, new plant types for the betterment of humankind. By using these mutations so many desirable characteristics were improved in the available established agronomically superior high yielding varieties. These are exploited in creation of novel colours in many flower and ornamental crops which are not existed in the nature. Development of disease resistance and pest resistance varieties and further quality of the crop also improved. Plant breeders act as careful selectors, keeping only those changes that benefit farmers and consumers. In this way, mutation becomes not a threat but a powerful tool for crop improvement. Nature provides the changes and science identifies those that can help to feed the world.

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