Vigyan Varta
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Vigyan Varta an International E-Magazine for Science Enthusiasts

Vol. 6, Issue 3

E-ISSN: 2582-9467
Popular Article
Dedeepya and Yamini (2025)

Role Of Mutations in Crop Improvement

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OPEN ACCESS

Keywords

Mutation, Crop improvement, Mutagens, Sustainable agriculture, Genetic pool

How to cite this article:

Dedeepya, K. and Yamini, A. 2025. Role Of Mutations in Crop Improvement. *Vigyan Varta* 6(3): 105-107.

ABSTRACT

The significance of mutations in enhancing crop species is essential, as they augment genetic variability and facilitate the creation of robust crop cultivars. The practice of mutation breeding, which encompasses the intentional introduction of mutations, has resulted in considerable progress in agricultural yield and food security. This approach not only enhances quantitative characteristics but also improves the nutritional attributes of crops, thereby increasing their resilience to diverse environmental challenges. The subsequent sections will elucidate critical dimensions of mutation breeding.

INTRODUCTION

Any abrupt, heritable alteration to an organism's genetic material (DNA) is referred to as a mutation. Physical (such as radiation) or chemical mutagens can be used to purposefully create these alterations, or they can happen naturally. The basis for crop improvement is genetic variety, which is created in large part by mutations.

Mutation breeding has been widely utilised in agriculture to create new crop varieties with desired characteristics like increased yield, resistance to disease and drought, and better nutritional value. Crop evolution has been aided by natural mutations over time, but artificial mutation breeding speeds up the process by causing specific modifications. Researchers employ methods such as X-rays, gamma rays, and chemical mutagens (such as EMS, or ethyl methane sulfonate) to alter plant DNA in order to produce advantageous features.

The creation of crops with high yields and resilience to stress is one of the notable results of mutant breeding. Radiation-bred mutant rice and wheat cultivars, for instance, have made a substantial contribution to the world's food security. In a similar vein, mutation techniques have been used to create seedless fruits, early-maturing crops, and variants with increased nutritional value (such as high-protein wheat).

Mutation breeding is very useful for enhancing crops with low genetic variety or in situations when conventional breeding techniques don't work. Mutations enable breeders create resilient crop types that can resist diseases, pests, and climate change by broadening the genetic pool, guaranteeing sustainable agricultural production.

Genetic Variation and Crop Resilience

Induced mutagenesis facilitates the creation of genetic diversity that is fundamental for breeding initiatives, thereby enabling the cultivation of crops that possess the ability to endure diseases, drought, and salinity (Kapila, 2024; Animasaun & Oguntoye, 2024).

A total of 3,362 mutant plant varieties have been catalogued globally, illustrating the wide-ranging utilization of this methodology (Kapila, 2024).

Advancements in Techniques

Contemporary mutation breeding utilizes physical, chemical, and biological mutagens, employing methodologies such as irradiation and chemical treatments that are extensively implemented (Animasaun & Oguntoye, 2024; Ali & Suryakant, 2024).

The combination of molecular methodologies with conventional approaches has improved the ability to identify advantageous characteristics within mutant populations (Ali & Suryakant, 2024).

Economic and Nutritional Benefits

Mutation breeding has led to the creation of crops with enhanced nutritional profiles, addressing food security challenges and improving the bioavailability of essential nutrients (Naik *et al*., 2024; Antwi-Boasiako *et al*., 2024).

This approach allows for the enhancement of existing cultivars without compromising their agronomic qualities, making it a valuable tool in modern agriculture (Ali & Suryakant, 2024).

CONCLUSION:

Although mutation breeding offers a plethora of benefits, it is imperative to evaluate the possible hazards linked to genetic alterations, encompassing ecological repercussions and societal views. The equilibrium between advancement and safety continues to pose a significant challenge within the domain of agricultural enhancement.

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