

Maintenance Breeding: Importance and Its Role in Crop Productivity

Duddukur Rajasekhar*¹; Manjunath P² and B. Nandini Priya Yadav³

¹ Ph.D. Scholar, School of Crop Improvement, College of Post Graduate Studies in Agricultural Sciences, Umiam, Meghalaya

² Ph.D. Scholar, Department of Genetics & Plant Breeding, College of Agriculture, Central Agricultural University, Imphal

³ Ph.D. Scholar, Department of Genetics & Plant Breeding, Agriculture college, Bapatla, ANGRAU, Andhra Pradesh

ARTICLE ID: 038

Introduction:

Maintenance breeding refers to germ plasm improvement for overcoming diseases, improving grain quality, or eliminating other defects that may constrain production and grain marketability. It deals with principles and methods of nucleus, breeder seed production and maintenance. It also deals with the maintenance of genetic and physical purity of released or notified varieties.

The main features of maintenance breeding includes:-

- It deals with principles and methods of pure seed production.
- It deals with continuous breeder seed production of released and notified varieties.
- It also undertakes breeder seed production of the parental lines of released hybrids.
- Genetic purity, physical purity and germination percentage(s) are the main points taken into account.
- Seed health is also taken into consideration.
- The main objective of maintenance breeding is to enhance the life span of released and notified varieties and commercial hybrids.
- The major emphasis is the planting quality seeds of a crop species rather than milling quality seeds.
- For prevention of varietal deterioration.

In India, more than 900 high-yielding varieties and hybrids of rice have been released for commercial cultivation, but about 318 are in the active seed production chain. One of the main constraint(s) is deterioration of seed quality when multiplied for long duration and

unavailability of quality seeds. Some of the times lack of knowledge for method of seed production. The improved varieties are maintained as nucleus seed, the practices vary from crop to crop, mainly depends on the mode of reproduction and nature of variety to be maintained. Henceforth, the crops can be classified into four categories:

1. Typical cross-pollinating crops:

Cross/Open-pollinated species like maize are genetically narrowed populations, with high frequencies of the desired genes. They are hard to maintain.

2. Self-pollinating crops with a substantial amount of out crossing:

Improved cultivars of crops of category, like Sorghum, Cotton, faba bean etc., are difficult to maintain.

3. Typical self-pollinating crops with very little out crossing:

Improved cultivars of crops of category like rice, wheat, barley, and common bean, consist of very similar desirable genotypes, and their maintaining is fairly simple. Mostly isolation distance of 3m is required to prevent out crossing and care is taken to avoid the mechanical mixture

4. The vegetatively reproduced crops:

Improved cultivars of crops of the last category, such as potato, are a clone, and its genetic purity is easily maintained. Here, two types of source or parental materials are used

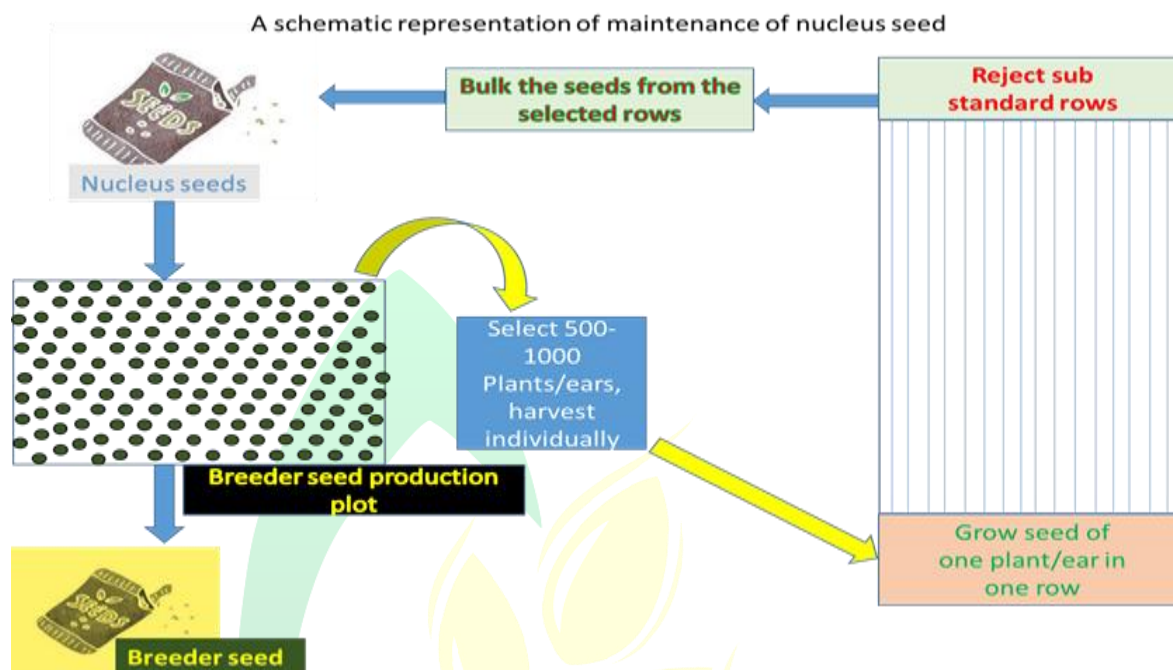
✚ **In-breds:** The hybrid and synthetic varieties are maintained as inbreds and these are maintained by the strict self-pollination. The stock seeds are planted in the isolated field and adequate care must be paid during the land preparation, isolation, rouging, harvesting to maintain the maximum genetic and physical purity.

✚ **Non-in-breds:** For maintaining the non-in-breds like populations, the field should be isolated from the same crop and also large population is planted and maintained by random mating then off-types are removed periodically and harvested seed is bulked.

Maintenance of seed of established varieties:

One of the method for maintenance of established cross-fertilized crop varieties is by raising the breeder seed crop in isolation, thoroughly rouged at various stages. The second method is by mass selection in which the crop is raised in isolation and rouged off-types. At maturity, several thousands (2000-3000) true to type plants are selected and harvested

carefully and then bulk the harvested seed. Care should be taken while selecting the true to type plants.



Maintenance of Marker Assisted Selection (MAS) derived varieties:-

The successful adoption of Marker Assisted Selection (MAS) derived varieties depends on the appropriate after-release follow-up, particularly in maintenance breeding. Unlike other varieties, the maintenance breeding of MAS-derived varieties involves testing of genetic purity of the seeds through gene-based/ gene-linked markers for the homozygosity of the target allele(s) for tolerance or stress resistance (Singh *et. al.*, 2019). This follow-up step is very important not only at the nucleus and breeder seed production levels but also in the certified seed production as it will ensure the maintenance of the seed quality.

References:

- Peng, S., Huang, J., Cassman, K. G., Laza, R. C., Visperas, R. M., & Khush, G. S. (2010). The importance of maintenance breeding: a case study of the first miracle rice variety-IR8. *Field crops research*, 119(2-3), 342-347.
- Singh, A. K., Krishnan, S. G., Vinod, K. K., Ellur, R. K., Bollinedi, H., Bhowmick, P. K., & Nagarajan, M. (2019). Precision breeding with genomic tools: A decade long journey of molecular breeding in rice. *Indian J. Genet*, 79(1), 181-191.