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WHEAT BREEDING PROGRAMME: OBJECTIVES AND STAGES

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Introduction

High grain yield, resistance to major diseases (rust, smut, bunt, Fusarium), tolerance to abiotic stresses (drought, salt, heat), early flowering and maturity, reaction to high fertilizer doses, dwarf and lodging resistance, and so on are the main challenges for wheat breeders and geneticists (Salam *et al*., 2018). Wheat can develop in a variety of climates, from irrigated temperate to dry to high rainfall zones, and from warm humid to dry cold (Sallam *et al*., 2015). As a result, solving the issue and establishing goals are critical components of every wheat breeding program's progress. The presence of genetic diversity is critical for breeding programmes to improve wheat crop for target traits. For a good breeding programme, Baenziger *et al.,* (2016) identified five key steps. A successful breeding programme requires each stage to be completed.

Addressing the Problem and Determining the Objectives

Wheat breeders work hard to genetically boost wheat crop to solve serious problems that hinder wheat production and productivity, despite the fact that wheat can be grown in a variety of environments. Drought stress, heat stress, salt stress, viruses, low input conditions, insects, and other issues are unique to each climate. As a result, determining the optimal breeding programme to develop the target traits requires first defining the issue. Furthermore, the breeding programme can vary depending on the stage of development. Improving drought resistance in wheat, for example, is dependent on the growth stage of wheat that is subjected to drought (Sallam *et al*., 2018).

Cultivar Release

The decision to release a cultivar if it is superior for at least one significant target trait is the final stage of a breeding programmed. Wheat grain yield can, in most situations, be one of the breeding program's target traits. The procedures for cultivar release vary by region.

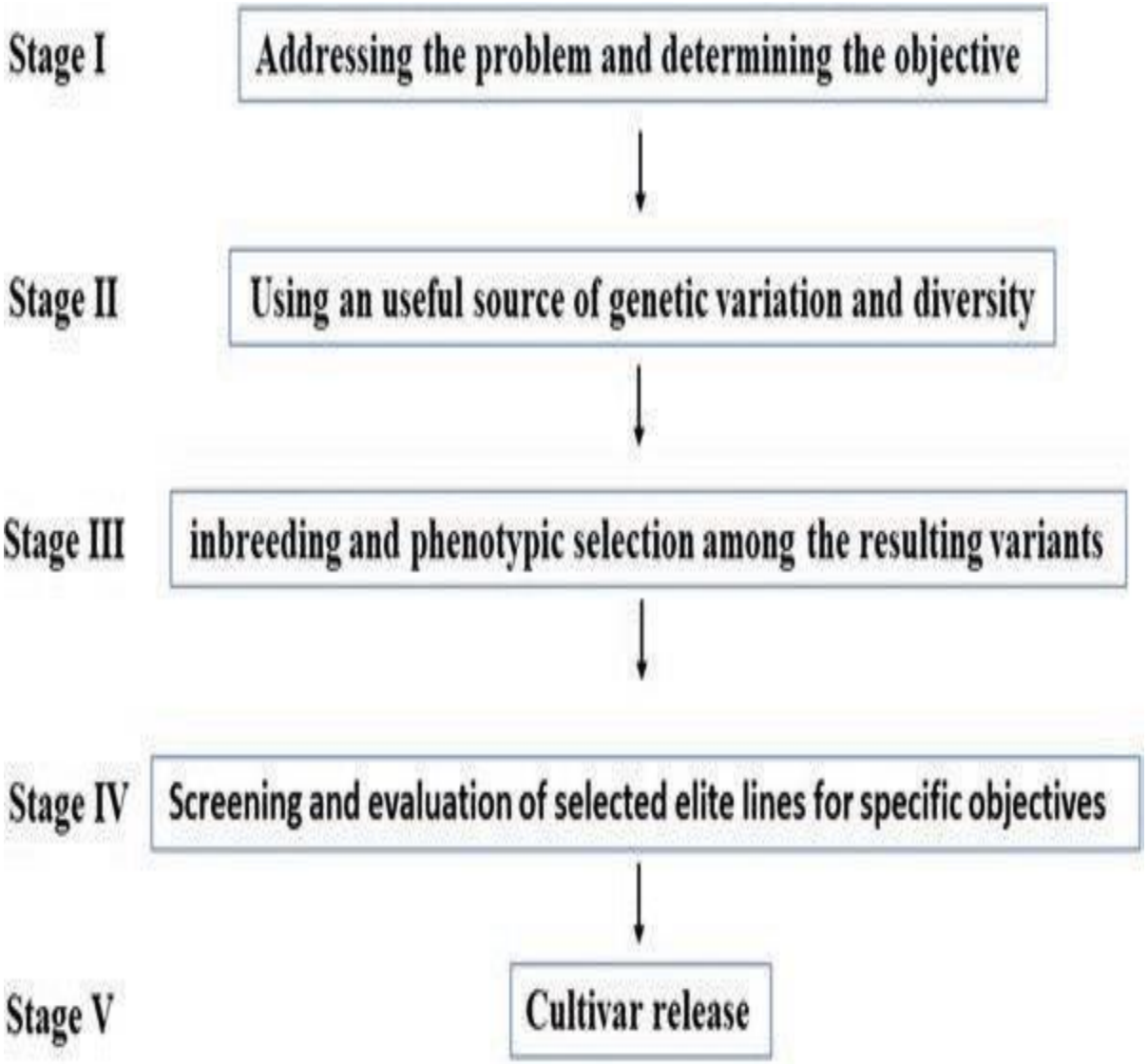

Fig.1: Stages of a plant-breeding program (Amira et al., 2019)

Using a Useful Source of Genetic Variation and Diversity

After identifying the issue and deciding the goal, the next step is to find suitable germplasm with variance in the desired traits in order to determine if they are inherited. The germplasm includes**:**

- Landraces are ancient cultivars that have been grown and planted by farmers for several centuries. Landraces have a high degree of genetic variation, and is a significant source of biotic resistance and abiotic stress tolerance.
- Obsolete cultivars, which are older, common varieties that have been replaced by newer ones.
- Modern cultivars are high yielding varieties that have been cultivated. They are commonly used as parents in breeding programmes to increase yield and other characteristics.

- Heavily homozygous breeding lines are advanced breeding lines. Plant breeders create them in order to improve target traits by plant breeding programmes.
- Cultivated plants in their natural state.
- Wild relatives are important and useful for genetic diversity, and they are viewed as a promising source of biotic resistance and abiotic stress tolerance. They are native plant species that are similar to cultivated crops genetically.
- Mutant genetics can be used to create mutants.

Germplasm should have a high degree of genetic diversity among plant materials to achieve the goals of any breeding programmed (Eltaher *et al.*, 2018).

Inbreeding and Phenotypic Selection Among the Resulting Variants: Wheat breeders must now decide which selection and inbreeding strategies they will employ. Inbreeding converts heterozygous genotypes to homozygous row. After that, selection selects a small number of superior homozygous lines to be used in the breeding program's later stages. The breeding scheme eliminates unselected lines. One of the most basic techniques of conventional plant breeding is selection. It may be artificial (created by humans) or normal (by the power of nature). Selection in breeding programmes varies depending on the area in which the plant will be raised, so wheat breeders should be cautious when testing plant content (Baenziger *et al.*, 2016). If the goal is to pick wheat genotypes for winter hardiness, for example, selection can take place in conditions that enable breeders to have a variety of traits of interest within the genotypes tested.

Screening and Evaluation of Selected Elite Lines for Specific Objectives: While all five steps are necessary for a good breeding programmed, the most important phase before launching a cultivar is screening and assessing germplasm for the particular goal. The selection process necessitates the collection of detailed phenotypic results. Plant content should be screened and analyzed over a period of years, replications, sites, and conditions. This move is solely dependent on the breeding program's goals. A chosen trait should have a high heritability likelihood in order to have a fruitful range and genetic enhancement of the wheat crop. The evaluation could be done at any point of development or at several stages of growth (Sallam *et al.*, 2016). For example, a biparental population was evaluated for drought tolerance at the seedling and grain filling stages to select genotypes with high tolerance at both growth stages (Salam *et al.*, 2018). The genotype environment relationship should be taken into account before making a decision.

Conclusion

Bread, or common wheat, is unquestionably one of the most important cultivated plants; in reality, the cereal, in addition to its ancestry, forms a significant part of the history of agriculture. Wheat is now a major part of the world's diet, supplying a vital source of calories (approximately 20% of global population demand), protein (also approximately 20%), vitamins, and other useful compounds, not just for humans but also for animal feed. Thus, the breeding programmed of wheat should be given a good importance for the sustenance of mankind.

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