**The concept of plant breeding, Role of plant breeding in crop improvement**

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|  | *Plant breeding is the art and the science of improving the heredity of plants for the benefit of humankind.* |  |
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|  | **THE ART AND SCIENCE OF PLANT BREEDING** |  |
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The art of plant breeding lies in the breeder's skill in observing plants with unique economic, environmental, nutritional, or aesthetic characteristics. Before plant breeders possessed the scientific knowledge that is available to them today, they relied solely on skill and judgement in selecting novel plants which could be propagated through seeds or vegetative parts.

Thus, *selection became the earliest form of plant breeding*. The successful plant breeders were keen observers, quick to recognize variant plants of the same species which would improve performance in the field or garden. For them, plant breeding was purely an art. Many of the early breeders were amateursa cultivator who found an "off-type" plant in the field or a gardener who found a "sport" in the bed. Some, like Luther Burbank, were professionals who searched far and wide for unusual plant types that could be propagated and exploited for commercial gain

Plant breeding developed into a science as knowledge progressed in classical genetics and related plant sciences. The foundation of plant breeding was based on recognition of the gene as the unit of heredity, on procedures for gene manipulation, and on rules of genetic behavior that permitted accurate prediction of the results from gene manipulations. The genes were identified by their effects on the visible expression of plant traits, such as whether a plant was tall or dwarf, or the flower color was white or pink. Through systematic cross-pollination, particular combinations of genes for different meritorious traits could be combined into a single plant cultivar. *Hybridization then became the principal plant breeding procedure*. It was no longer necessary for the breeder to rely so completely on skill in finding chance variants with which to establish new cultivars. It now became possible to plan and synthesize new plant types more or less at will. Plant breeding became more of a science and less of an art

More recently, the science of *molecular genetics* proposes to advance plant breeding to an even higher level of sophistication. Molecular genetics was ushered in with the description of the chemical structure of deoxyribonucleic acid (DNA), the material that constitutes the gene. DNA carries the instructions for synthesis of specific enzymes, proteins that determine the visible expression of particular plant traits. According to the new technology, the DNA (gene) encoding for a desired trait would be identified, cloned, and inserted into the DNA of a plant reproductive cell line. There it would replicate and express its unique character in the transformed plant. As the new technology becomes routinely operational, it offers an opportunity to enhance performance of crop cultivars through the introduction of foreign genes from almost limitless sources genes not previously accessible through traditional hybridization breeding procedures

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|  |  The enhancement of cultivar performance through transformation with single units of DNA (genes), that encode for proteins that determine exotic plant characters, has exciting implications for plant breeding. But the new technology does not supplant nor diminish the importance or need for the traditional selection and hybridization procedures in the breeding of improved cultivars. Present cultivars have reached high levels of performance through refined selection and hybridization breeding systems that bring together multigenic combinations for performance of the whole plant. These breeding procedures will continue to be the basic source of high performing cultivars, albeit performance that may be further enriched through transformation by new biotechnology procedures. |   |
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|  | **Why Breed Plants?** |  |
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|  |  The goal of plant breeding is to change the plant's heredity in ways that will improve plant performance. Improved plant performance may be manifested in many ways. Improved yield and quality are usually the primary breeding goals, whether the product harvested is seed, forage, fiber, fruit, tubers, flowers, or other plant parts. Plants are the basic source of food for the world's people (Fig. 1.1). Higher yields of food plants contribute to a more abundant food supply, a more profitable agriculture, and a lower cost of food products for the consumer. Yields of the major food grains increased rapidly in the United States over the fifty-year period, 1941-1990 (Fig. 1.2). The yield increase resulted from improving the cultural environment in which the crops were grown and the genetic potential of new cultivars to produce in more favorable cultural environments. Breeding for improved quality in food plants may make the product more nutritious, increase the ease of processing, or reduce presence of toxic compounds. Improving health of the plant by breeding for disease or insect resistance increases the yield and quality of the product and is an environmentally sound practice as fewer protective chemicals will be utilized in the culture of the resistant plants. Plants may be adapted to a wider range of production areas by breeding for increased tolerance to drought, extremes of temperature,  |  |
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