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Doubled Haploid Technology for Crop Improvement

B. Manasa[1], Sri Konda Laxman[1], K. Lavanya[2]
[1]M.Sc. (Horticulture), Telangana State Horticultural University, Hyderabad
[2]M.Sc. (GPBR), Prof. Jayashankar Telangana State Agricultural University, Hyderabad

Introduction

Conventional breeding methods for genetic improvement of crop plants involve an introduction, hybridization, selection of desirable plants, and evaluation. This is a tedious process that consumes at least 7-8 generations/years of inbreeding selection to get a desired level of homozygosity. Recent advances in the field of tissue culture have made it possible to get complete homozygous lines or varieties from crop plants in a single generation by haploidization via anther culture, pollen culture and wide hybridization, etc.

Haploid individuals possess only a gametic chromosome number of chromosomes, which makes them extremely useful for gametic and molecular studies. However, haploids (n) are sterile, more sensitive to abiotic and biotic stresses, and less vigorous than normal diploid (2n) plants. Therefore, to double the chromosome complement of haploid plants by using a chemical called colchicine to get double haploids (DHs). These double haploids are completely homozygous and their progenies will be homogenous for all loci, contrary to conventional breeding methods where even after several selection cycles, some heterozygous loci are present. Therefore, the DH system accelerates the breeding program.

Haploids become valuable when scientists double them and use them to produce homozygous breeding lines. In homozygous lines, all genes on each pair of chromosomes in every cell of the plant are identical. These homozygous lines are 100-percent inbred lines, which otherwise would have to be produced by repeated forced self-pollinations. The haploid method lets breeders produce inbred lines within just two generations, while traditional breeding takes 10 generations.

Double haploid not only accelerates conventional plant breeding programs and makes the early release of cultivars with superior and desirable traits possible but it has great utility in other research aspects of plant breeding, genetics, and genetic engineering (Hussain *et al*., 2012). DHs are extensively used

for genetic studies like studying the inheritance of Quantitative traits, Quantitative Trait Loci (QTL) mapping, Genomics, gene identification, whole-genome mapping, and production of stable transgenic plants.

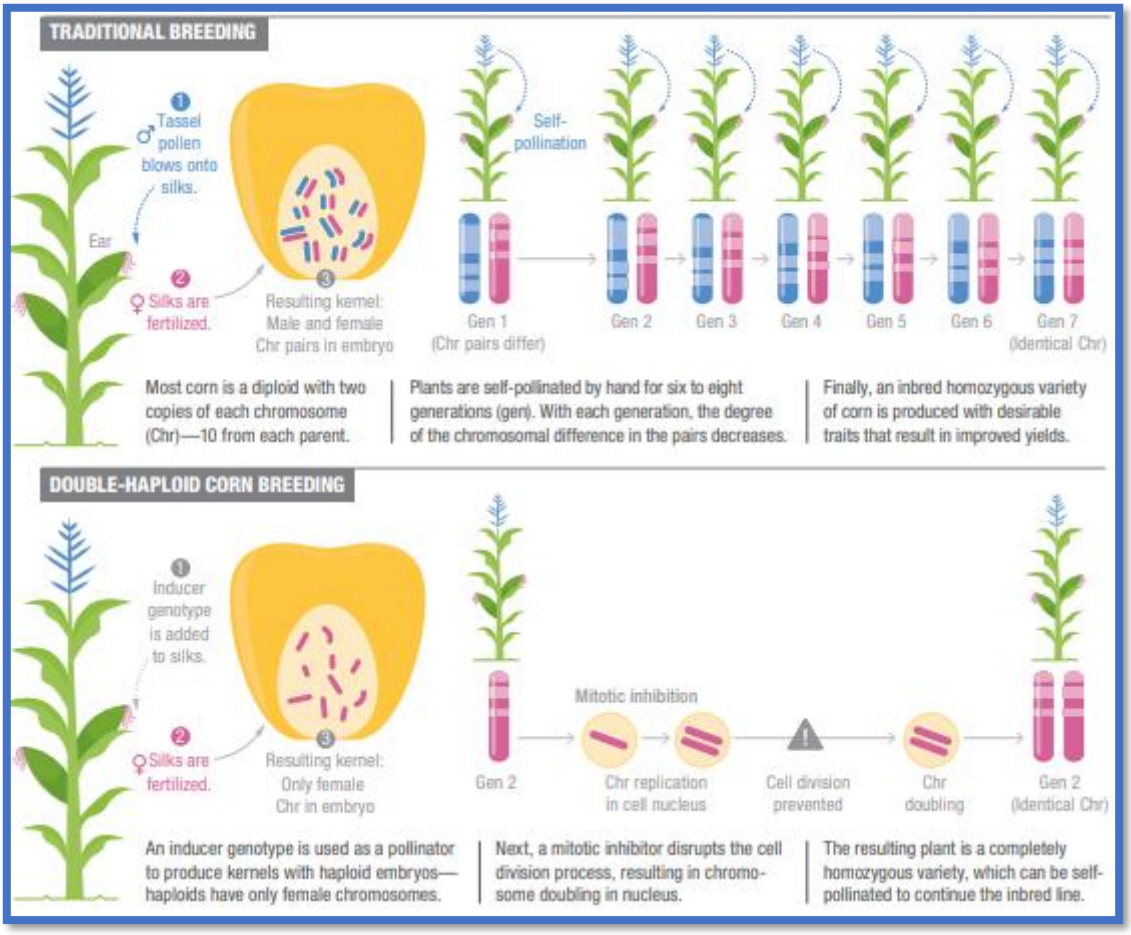

Figure 1: Scheme of Double Haploid Technology

Future thrust

- Making existing haploid-induction systems more efficient and thereby saving costs.
- Deploying the technology to other crops that do not have any doubled-haploid production system.