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Applications of Plant Breeding

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Perspective

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INTRODUCTION

The practise of choosing propagating plants with desirable qualities and removing or "culling" those with less desirable features is one of the most important techniques in plant breeding. The purposeful interbreeding (crossing) of closely or distantly related individuals to develop new crop varieties or lines with desirable traits are another strategy. Plants are crossed in order to introduce traits/genes from one variety or line into a different genetic background. A mildew-resistant pea, for example, might be crossed with a high-yielding but sensitive pea, with the purpose of introducing mildew resistance while maintaining high yield. The cross's progeny would next be crossed with the high-yielding parent to guarantee that the progeny resembled the high-yielding parent the most (backcrossing). The progeny of that cross would next be evaluated for yield (as indicated above) and mildew resistance, as well as high-yielding resistant plants. Plants can also be crossed with one another to create inbred breeding variants. By using pollination bags, pollinators may be kept out.

Selection by marker

In order to promote genetic variety, traditional breeding depends heavily on homologous chromosomal recombination. To develop variety and produce hybrid plants that would not occur in nature, the traditional plant breeder can utilize *in vitro* procedures including protoplast fusion, embryo rescue, and mutagenesis (see below).
In plant breeding, a desired characteristic might be influenced by a number of genes. Thousands of genes can be mapped using technologies like molecular markers and DNA fingerprinting. This enables plant breeders to shift through enormous populations of plants in search of those with the desired characteristics.

Rather than visual identification of the expressed characteristic in the plant, the screening is dependent on the presence or absence of a certain gene as verified by laboratory tests. Marker aided selection, also known as plant genome analysis, is used to determine the location and function (phenotype) of distinct genes throughout the genome. The genome sequence is obtained when all of the genes have been recognized. Plant genomes are of varied widths and lengths, with genes coding for different proteins, although many are the same. If the position and function of a gene are identified in one plant species, a very similar gene will most likely be located in a comparable location in the genome of a related species.

Human genome modification

Plants can be genetically modified by introducing a specific gene or genes, or shutting down a gene with RNAi, to obtain a desired phenotype. Plants that have had a gene added to them are known as transgenic plants. Genetical plants are those that employ genes from a species or a crossable plant under the direction of their native promoter for genetic alteration. Because the bulk of the plant's DNA is not changed, genetic modification can sometimes yield a plant with the desired characteristic or traits faster than traditional breeding.

To genetically edit a plant, a genetic construct must be created that will allow the plant to express the gene that is being added or deleted. To do this, the plant must be given a promoter to drive transcription and a termination sequence to halt it, as well as the gene or genes of interest. There's also a marking for identifying plants that have been altered. Antibiotic resistance is a typical laboratory marker: plants that have been effectively changed flourish on antibiotic-containing medium, whereas plants that have not been successfully transformed perish. Backcrossing with the parent plant may be used to eliminate selection markers before commercial distribution in specific cases. Genetic recombination with the microorganisms *Agrobacterium tumefaciens* or *Agrobacterium rhizogenes*, or direct techniques like the gene gun or microinjection, can be used to introduce the construct into the plant genome. Plant viruses can also be used to implant genetic constructs into plants; however the approach is restricted by the virus's host range. Cauliflower Mosaic Virus (CaMV), for example, infects exclusively cauliflower and related plants. Another drawback of viral vectors is that the virus is seldom transmitted on to the offspring, necessitating inoculation of each plant.

CONCLUSION

Currently, the bulk of commercially marketed transgenic plants are confined to those that have brought insect pest and herbicide resistance. Insect resistance is obtained by incorporating a gene from the *Bacillus thuringiensis* (Bt) bacteria, which encodes a protein poisonous to some insects. Herbicides generally operate by binding to and blocking the action of certain plant enzymes. The herbicide's target site refers to the enzymes that the herbicide inhibits. Herbicide resistance can be engineered into crops by expressing a non-herbicide-inhibited variant of the target site protein. By enhancing stress tolerance to a particular environment, genetic manipulation can enhance yields even further. Stresses, such as temperature changes, are sent to the plant through a cascade of signalling molecules, which activate a transcription factor to control gene expression. Overexpression of certain genes involved in cold acclimation has been demonstrated to result in increased freezing resistance, which is one of the most prevalent causes of yield loss. Pharming, or the genetic manipulation of plants to create medications (and industrial chemicals), is a relatively recent branch of plant breeding.