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Issue Article

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GM CROPS AND GENETIC ENGINEERING

Abstract: *The field of agricultural biotechnology has grown significantly over the past 30 years due to our understanding of DNA as the chemical double-helix code for genes. Genetic engineering, a recombinant DNA-based method, allows for the manipulation of individual genes and the transfer of genes between species that would not normally interbreed. This differs from conventional plant breeding, which has limited advancements due to the random rearranging of genes. Genetic engineering techniques are used when desired traits are not present in the crop's germplasm, are difficult to improve through conventional breeding, or take a long time to introduce.*

Key words: *crops, genetic, chemical, organism, code, produced, engineering.*

Language: *English*

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Introduction

The field of agricultural biotechnology has grown significantly over the past 30 years as a result of our growing understanding of DNA as the chemical double-helix code that codes for genes. One of the recombinant DNA-based agricultural biotechnology methods available today is genetic engineering. The process by which the genetic composition of an organism can be changed using "recombinant DNA technology" is referred to as genetic engineering. The word is sometimes used interchangeably with terms like gene technology, genetic alteration, or gene manipulation. This entails the removal, insertion, and modification of DNA segments containing one or more target genes using specialized instruments and enzymes. Genetic engineering differs from conventional plant breeding in that it allows for the manipulation of individual genes as well as the transfer of genes between species that would not normally interbreed. Among the millions of crossings produced by normal plant breeding, there is little to no guarantee of receiving any specific gene combination. Because the genes of both parents are combined and more or less randomly rearranged in the offspring, undesirable genes may be passed along with favorable genes or one desirable gene may be acquired at the expense of another. These issues restrict the advancements that plant breeders can make, consuming resources and time in the process (1).

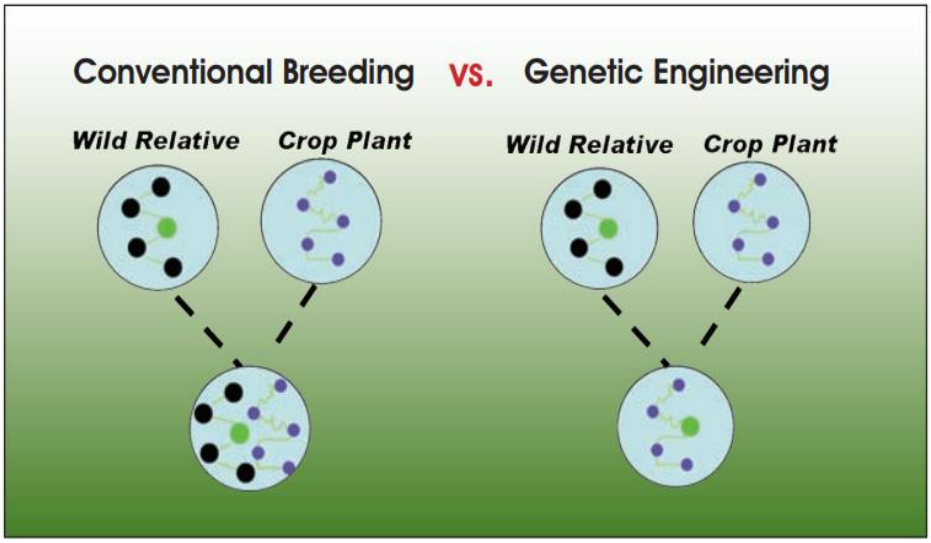

Figure.1 Conventional vs. genetic engineering (Biotech Mentor's Kit, 2003)

Genetic engineering, on the other hand, enables the direct transfer of one or a small number of genes between closely or distantly related animals. Not every genetic engineering method includes introducing DNA from other living things. Additional methods for altering plants include deleting or turning off specific genes and genetic regulators.

Genetic engineering techniques are only employed in the following situations: 1) the desired trait is not present in the crop's germplasm; 2) the desired trait is extremely difficult to improve through conventional breeding methods; and 3) it will take a very long time to introduce and/or improve such a trait in the crop through conventional breeding methods. These conditions must be met before using genetic engineering techniques (2).

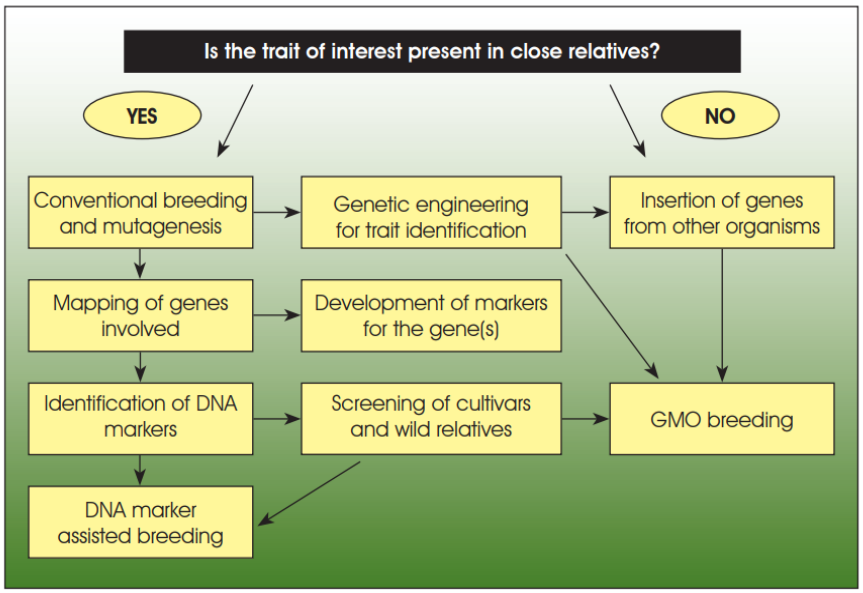

Figure.2 Integration of conventional and modern biotechnology methods in crop breeding (DANIDA, 2002)

A wide range of instruments and components from traditional breeding methods, bioinformatics, biochemistry, molecular genetics, molecular biology, and genetic engineering are used and integrated in the multidisciplinary, coordinated process of modern plant breeding.

Cloning genes is the second stage. Any cloning experiment consists of four main steps: creating DNA fragments, attaching to a vector, growing inside a host cell, and choosing the necessary sequence. All of the target organism's DNA is extracted during the DNA extraction process. In order to enable its cloning into

bacterial vectors, this genomic DNA is processed with particular enzymes known as restriction enzymes, which cleave it into smaller fragments with predetermined ends. After that, several distinct genomic inserts will be carried by copies of the vector. Following their transformation into bacterial cells, thousands of copies of these vectors are created (3).

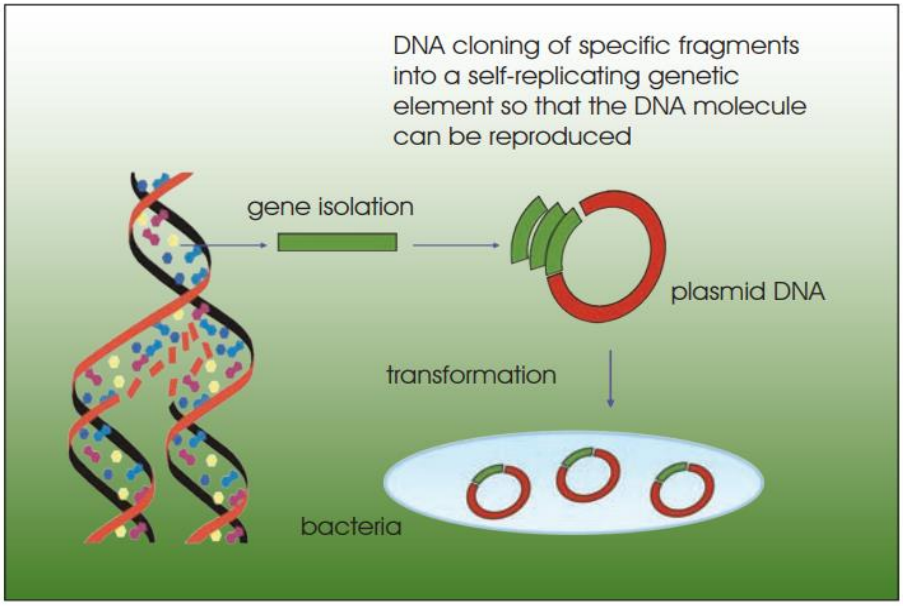

Figure.3 Gene cloning (Tabien, R. 2000)

Genes can express themselves differently thanks to promoters. Certain promoters, for example, cause the inserted genes to express continuously throughout the entire plant (constitutive), while other promoters only permit expression during specific plant growth stages, in specific plant tissues, or in response to cues from the outside environment.

The promoter also regulates the amount of the gene product that is expressed. While some promoters are strong, others are weak. Developing genetically modified plants has the benefit of controlling gene expression.

In order to make it easier to recognize the gene of interest once it is inside plant tissues, selectable marker genes are typically connected to it. This saves a great deal of money and labor by making it possible to identify the cells that have successfully integrated the desired gene.

To identify cells that have the inserted gene, genetic engineers employed flag genes resistant to herbicides and antibiotics.

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