



GENETIC MODIFICATION OF CROPS

Would it surprise you to know that people have been genetically modifying crops since the beginning of agriculture, eight to ten thousand years ago? Of course, this was achieved without any knowledge of genes or DNA, but it was still highly effective in improving the quality and quantity of the food that was harvested. Most food crops grown today don't look much like their wild relatives, due to thousands of years of **selective breeding** (Figure 1).

Early farmers selected plants, or seeds from plants, that had desirable characteristics such as larger fruit or a longer growing season. By repeatedly selecting plants for improved **phenotype**, or physical characteristics, people unwittingly changed the genotype, or genetic makeup, of their crops. It's easy to understand how this works with our modern knowledge of genetics. The phenotype of all living things, including plants, is in large part determined by the activity of proteins that build and maintain the organism. In turn, a protein's structure and function is determined by the nucleotide sequence of its gene. When early farmers selected crops for desirable visible traits, they were really selecting for the invisible gene sequence that determined the protein activity that caused the trait. Over time, the genotypes of domesticated crops have been modified in lock step with their phenotypes.

Our knowledge of genetics is not just useful for understanding how selective breeding works. Crop scientists and plant geneticists can apply this knowledge to improve the process of **conventional plant breeding** with the tools of biotechnology. Genes can also be directly introduced into (or removed from) crop plants to change their phenotype very precisely, a process known as **genetic engineering**. Modern crops have been modified or engineered for traits such as increased yield, drought tolerance, increased nutrient content, insect resistance, disease resistance and herbicide tolerance.



Figure 1: Selective Breeding of Corn. The wild ancestor of corn is called teosinte, and is pictured on the left. Thousands of years of selective breeding have resulted in the cob of kernels that we recognize today.

Image link:

<http://commons.wikimedia.org/wiki/File:Teosinte.png>

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<http://www.plosbiology.org/article/info:doi/10.1371/journal.pbio.0000008>