Comparing Methods of Genetic Modification in Plants

Modification Method	Advantages	Disadvantages/Limitations
Cross Breeding	• Widely accepted method of plant breeding. • Takes place in nature without scientific intervention, but can be manually carried out to provide more predictable results.	• Limited to the genes already found in the genome of a species. • Laws of inheritance may limit the inheritance of a trait, especially if it is recessive. • Limited ability to select individual traits. While selecting for one specific trait, other traits may also be adopted that could be negative, positive, or of no significant consequence.
Mutagenesis	• Creates random variation in the genes by promoting gene mutations.	• Traits produced are random, not selected in any way. There is little to no control over the traits that are produced. • Need to screen large populations of plants for a given trait to find a desired mutation. • Do not know how many mutations have actually been made in the genome.
Polyploidy	• Plants have the general advantage of heterosis and gene redundancy. • Plants can become sterile. In the case of a seedless watermelon, this is a desired trait.	• If plants are sterile (do not produce viable seeds), extra time and money is required by the farmer to produce plants. • With the increased genetic material of a polyploid, cells can be larger and may result in watery fruit with less flavor in some plant species.
Protoplast Fusion	• Helps create new hybrid plants and new plant varieties. • Allows cross breeding of two species.	• Doesn't always produce viable offspring plants that can reproduce.
Transgenesis	• Allows specific and defined changes to a genome to add or delete a trait or traits. • Can use genes found in other organisms as-is, or can make specific changes to them in a laboratory first.	• The desired gene often originates in another organism. • The science is rejected by some consumers.
Genome Editing (CRISPR)	• Allows specific changes to a genome by making additions, deletions, or specific changes to a DNA sequence (trait). • No need for transgenes (genes acquired from another species/genome).	• Although no foreign DNA is used, some consumers may still be concerned about the concept. • Due to the fact that the technology is new in the agricultural context, there isn't any food on the market that was developed using CRISPR.