

# Modern Methods of Plant Breeding



## Traditional Breeding

Cross-pollination between different plants within the same species. Crossing these “parent” plants produces progeny (“children”). This method creates new plants that contain a mix of the genes from their parents. Scientists are looking for a “child” plant that combines many favorable traits from the parents. As an example, at UF/IFAS, citrus scientists crossed a Clementine mandarin and Minneola tangelo to produce the tasty and more disease-resistant Sugar Belle® mandarin.



## Modern Breeding

- **Genetic Engineering:** The use of specific laboratory techniques to move one or more of the genes associated with a specific trait from one organism to a completely different organism from the same or a different species. For example, a UF/IFAS researcher used genetic engineering to develop a more disease-resistant papaya.
- **Genetically Modified Organism (GMO):** An organism developed through genetic engineering. With genetic engineering, scientists insert a gene from one organism into another organism’s genetic code to give it a specific new trait.
- **Gene Editing:** A precise technology where small, targeted genetic changes are created that mimic what might occur naturally through spontaneous mutations. Usually this is used only on one gene, or a small number of genes. With gene editing, nearly all the traits originally possessed by the organism remain unchanged; only those very few targeted, unwanted characteristics are changed

for the better. When done properly, there is only the DNA that already existed naturally in the organism; no foreign DNA is to be found. For example, by editing a gene from a strawberry that results in a sour flavor, you could make the fruit tastier and sweeter, something everyone loves. One type of gene editing technology is called CRISPR. This acronym is the name of the most commonly used molecular technique to edit a gene. Using CRISPR technology, scientists can “turn off” a gene so the organism has better levels of the target trait, which is beneficial for humans and plants. For example, UF/IFAS researchers are trying to use CRISPR to fight the deadly citrus greening disease, by turning off the genes that make citrus trees susceptible.

- **Directed Evolution:** Directed evolution harnesses the natural processes of mutation and selection in bacteria or yeast to improve genes containing instructions for enzymes or other proteins at a much faster rate than could ever occur in a plant. The improved genes can then be transferred to a plant by using technologies like CRISPR to edit the plant’s genome.