THE MAKING OF A NEW APPLE CULTIVAR

TIME Two 45-Minute Class Periods

ACTIVITY AT A GLANCE

The purpose of this lesson is to introduce students to apple growing and show them how selective breeding is used to benefit both the apple grower and consumer by producing a new and better-quality apple.

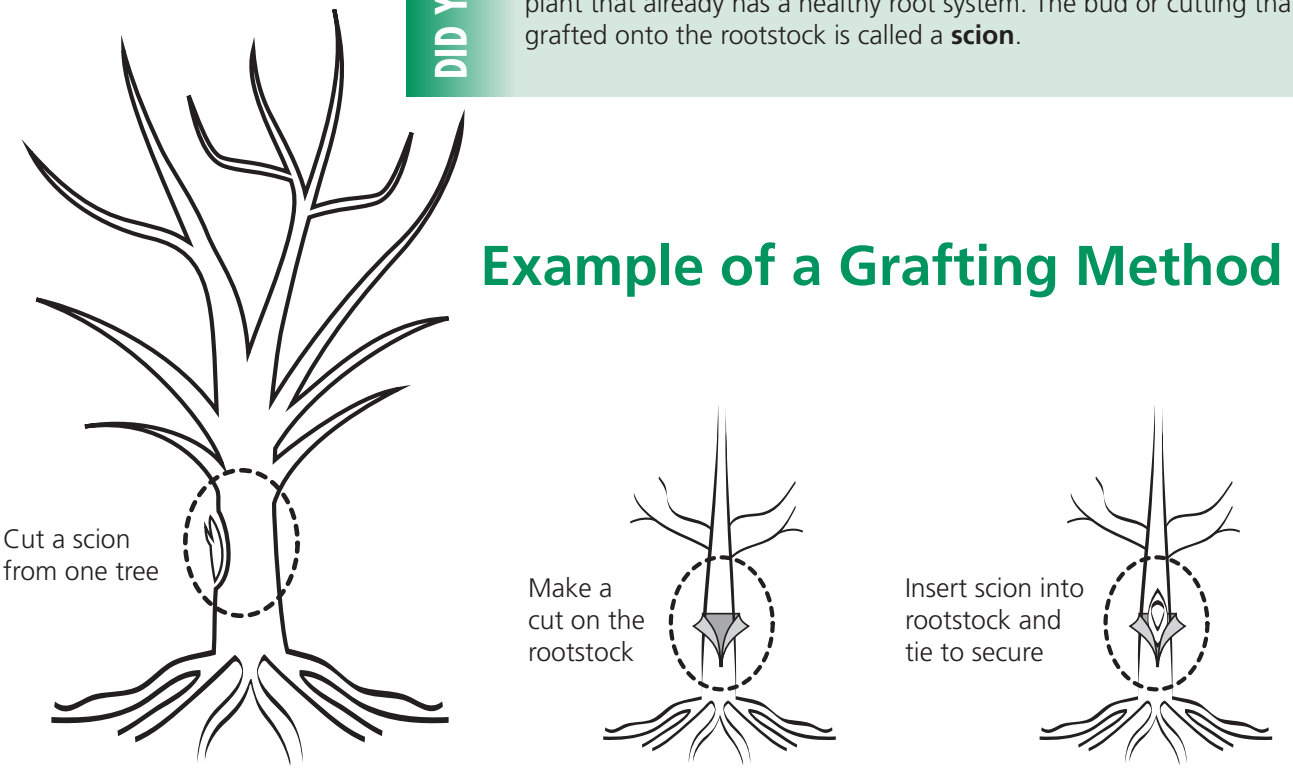
TIME TO TUNE IN

APPLE – How Does It Grow? (5:32)
www.youtube.com/watch?v=UWLmEh1HIBw

DID YOU KNOW?

Apples do not grow "true" from seed. This means that if you plant a seed from one kind of apple, the apple tree that would grow will not be the same variety as the apple that the seed came from. The only way to reproduce a specific desired apple variety is to graft a bud or cutting from a tree that previously yielded that variety onto a rootstock. A rootstock is a compatible plant that already has a healthy root system. The bud or cutting that is grafted onto the rootstock is called a **scion**.

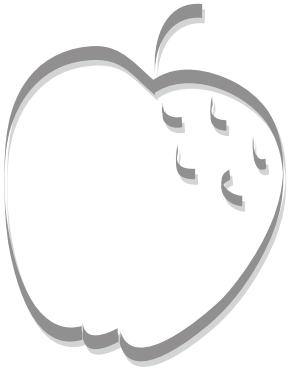
Example of a Grafting Method



BACKGROUND INFORMATION

The Development of the Cosmic Crisp® Apple

The apple is so common that it is very easy to take this fruit for granted. Yet, it has a very rich and interesting history. The wild apple trees that are thought to have come from ancient Asia thousands of years ago are believed to have produced hundreds of tiny fruits that were sour and consisted mostly of numerous dark brown seeds and a core. Over thousands of years, fruits that were more pest resistant and tolerant of geographical climate factors endured through natural selection. These apple trees were the earliest to be cultivated by humans.



Colonial America

In the United States, apples were first planted by colonists from the Massachusetts Bay Colony in the 17th century, and the first apple orchard was planted in Boston in 1625. One of our country's longest surviving apple trees was planted in 1647 in a Manhattan orchard. Unfortunately, the tree died after it was struck by a derailed train in 1866.

The only apples native to North America are crab apples, which were once called common apples. Apple **cultivars** (varieties) brought as seed from Europe were spread along North American trade routes, as well as cultivated on colonial farms. In 1845, one apple nursery catalogue offered 350 apple cultivars for sale.

Apples as a Crop

Apples are an important agricultural crop. Today, worldwide, there are more than 7,500 known apple cultivars. Over 2,500 different apple cultivars are grown in the United States, but only 100 varieties are grown commercially. Washington and New York are the leading apple-growing states. Only China produces more apples than the United States.

The basic techniques of apple-growing haven't changed much over the years; however, some new technologies, such as using DNA analysis in choosing parents and seedlings, are providing some important new tools in apple propagation. In the wild, apples can grow easily from seeds; however, since the apple fruit is formed through cross-pollination, this fruit can be very different from its parents. For this reason, apples are ordinarily propagated asexually by grafting. Grafting involves inserting a bud or twig from one plant into a small cut in the bark of a rootstock, which is a compatible trunk with established roots.

Most new apple cultivars originate as seedlings, which were either formed by chance or have been bred by deliberately crossing cultivars with promising characteristics, such as flavor and climate tolerance. The Cosmic Crisp® apple was formed by crossing the Enterprise and Honeycrisp apples. This new apple was developed over a period of 20 years by Washington State University's Tree Fruit Research and Extension Center (WSU-TFREC).

DID YOU KNOW?

Why Do Cut Apples Turn Brown? Apple cells contain phenol and phenolase enzymes. When an apple is sliced or damaged in a way that allows the cells to come into contact with air, these chemicals are exposed to oxygen, and the phenol is converted to melanin that gives apples the brown color.

BACKGROUND INFORMATION

Selective Breeding

In 1998, seed resulting from a cross between Enterprise and Honeycrisp apples was germinated and raised in a greenhouse to produce the Cosmic Crisp® apple. The seedling was transferred to a nursery and budded into a rootstock in 1999. The resulting tree was planted in an orchard in 2001. Fruit from this single, budded tree was evaluated in 2002 and 2003, and apples (now called WA 38) were selected. (Note: The WA38 designation means it was WSU's 38th attempt to get a new cultivar.) In 2004, buds from this single seedling were propagated onto rootstock. Two years later, the trees were planted in three different locations in the state of Washington. In 2007, more trees were budded for a much larger scale planting the following year. The fruit from the original tree as well as fruit from the subsequent plantings continue to be evaluated. It takes approximately 2 or more years for a new tree to bear fruit.

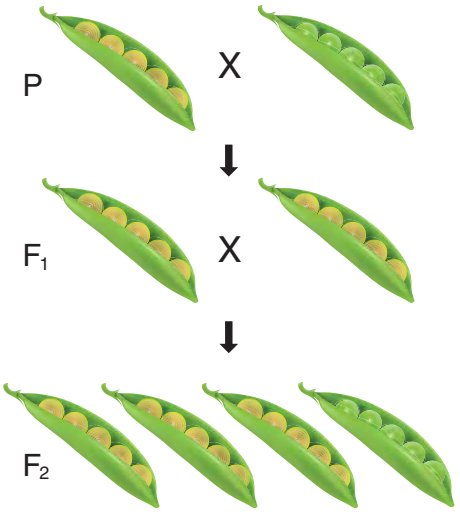
From that single seedling developed in 1998, just over 600,000 Cosmic Crisp® trees were in the ground in 2017, with some 7 million more planted in 2018 and another 6 million planned for planting in 2019. The apples became available to consumers in Fall 2019.

Genetics

The modern science of genetics began during the mid-1800s with the work of Gregor Mendel in what is now the Czech Republic. Mendel experimented with ordinary garden pea plants that were true-breeding, which means that the flowers were mostly self-pollinating, and producing offspring identical to the parents. In other words, the offspring of true-breeding tall pea plants would all be tall, and the offspring of true-breeding short pea plants would all be short. Mendel also discovered that some of the pea plant's alleles were dominant, while others were recessive. A pea plant that was a true-breed for tallness would have two alleles for tallness; and, conversely, one that was a true-breed for shortness would have two alleles for shortness.

To learn more about how traits were passed from parents to offspring, Mendel decided to cross-pollinate true-breeding tall plants with true-breeding short plants. To his surprise, all the offspring were tall. When he crossed these offspring, the plants produced were either tall or short. He observed multiple traits that had two forms, e.g., height (tall or short), pea color (green or yellow), seed shape (smooth or wrinkled). Further study of garden peas and their traits led Mendel to the conclusion that some traits have the ability to mask other traits. He called these traits dominant and those that were masked, recessive.

Pea Color Inheritance



However, in reality, not all traits behave as dominant and recessive. In some cases, the traits may express incomplete dominance where neither trait is dominant or recessive; and, the expressed trait is somewhere between the two traits. For example, some crossbred red and white flowers have pink flower offspring. In other cases, both the dominant and recessive traits may be expressed. This situation is called codominance. A sweet apple variety crossed with a tart apple variety may yield an apple variety that is both sweet and tart.

The techniques that Mendel used in the 19th century in studying genetics are still in use today.

Apple Facts

- Apples are a good source of Vitamin C, potassium, and fiber.
- Apples are fat, sodium, and cholesterol free.
- It takes the energy from approximately 50 leaves to produce one apple.
- Apples ripen 6 to 10 times faster at room temperature than if they were refrigerated.
- Apples have five seed pockets or carpels. Each pocket contains seeds. The number of seeds per carpel is determined by the vigor and health of the plant. Different varieties of apples will have different numbers of seeds.
- The science of apple growing is called **pomology**.

Source: **http://extension.illinois.edu/apples/facts.cfm**