

# Let's Get Together

## Grafting Fruit Trees and Pecan Trees

### Objective

Students will read about the practice of grafting trees and plants and learn how it benefits production. Students will conduct a grafting experiment with tomato plants.

### Background

Horticultural grafting is the process of connecting two plant parts (a stem and a root, also known as a scion and a rootstock) together in such a way that they will unite and continue to grow as one plant. The inner make-up of trees and plants is what makes grafting possible. The most important portion of the tree for grafting is the cambium layer that lies between the bark and the wood. The cambium is an area of actively dividing cells between xylem and phloem tissues that is responsible for the secondary growth of stems and roots. In order for grafting to be successful, the cambium of the scion and the rootstock must be in contact with each other.

In horticulture, the development of trees and plants is called propagation. Plant propagation is simply the reproduction of plants from a variety of sources including, seeds, bulbs, and other plant parts. The propagation of trees and fruit from seed is a form of sexual reproduction in which an exchange of genes results in offspring that have different characteristics than the parent. Grafting is a form of asexual reproduction, because there is no exchange of genetic material. Plants can be cloned directly from the parent plant and the offspring vegetation will be identical to that of the parent plant.

Grafting can be used to increase disease resistance or change the natural form of a plant. In Oklahoma, one of the most common production trees grown is the pecan tree. Grafting is very important in pecan production because pecan trees planted from seed will not produce nuts similar to the nut that was planted. Grafting is the only way to establish an orchard of improved (papershell) pecans. If trees are not grafted they are considered seedlings and take at least twice as long to come into production. Through grafting a grower knows what type of nut the trees will produce.

One type of grafting used for pecan trees is patch budding. With this technique, a small rectangle of bark is peeled from the rootstock tree, and a bud from the scion tree is put in its place with grafting tape secured over the joint.

Chip bud and T bud grafting are typical with apple and other fruit trees. For chip bud grafting, a slightly angled cut (or chip) is taken from the bark of the rootstock tree so the cambium layer is exposed. A chip

## Oklahoma Academic Standards

### GRADE 7

Science—MS.LS1.4,5, 3.1,2; 4.5  
English Language Arts—1.R.1,2,3;  
2.R.2,3; 6.R.2,3; 2.W.1; 3.W.2;  
6.W.1,2,3,4

### GRADES 9-12

Biology I—LS1.1,4; 3.1,2  
English Language Arts—1.R.1,2,3;  
2.R.2,3; 6.R.3; 2.W.1; 3.W.2;  
6.W.1,2,3,4

### Materials

young, well-established tomato plants of a hearty variety such as an heirloom (available in small containers during the spring season at local nurseries, hardware stores and home improvement stores.)

cuttings from another variety of tomato, such as cherry tomato or even yellow or purple tomato

small utility knife or razor blade

grafting clips (These are easy to make using narrow, clear plastic tubing. Using a tube about 1.5 inches long, cut up one side of it so that it can open up and close back around the tomato plant

cut plant materials, such as ornamental grasses, twigs from shrubs and trees, grapevines  
pruning shears

twine

## Slave Gardener Antoine was the first to successfully graft pecan trees

The grafting of pecan trees was suggested as early as 1810, but the pecan resisted efforts even though other fruits and nuts were easily propagated. A Louisiana slave gardener at

Oak Alley Plantation, remembered now only as “Antoine,” is credited with the first successful pecan grafting in 1847. Antoine had the reputation of being a great gardener.

A neighboring plantation owner, Dr. A. E. Colomb, brought the wood to the Oak Alley slave. He probably used the cleft graft method, which would have involved cutting off a limb, splitting it—possibly using a butcher knife and hammer—chiseling in two grafts, one a bit thicker than the other, and sealing the inserts, probably with paraffin.

Antoine succeeded where others had failed, somehow getting sixteen plants to live.

His trees—the first propagated orchard anywhere—were destroyed during the Civil War by Federal troops.

### Vocabulary

**graft**—a piece of living tissue from the shoot of a plant that is joined to the stem and root system of another plant, resulting in the growth of a single plant

**horticulture**—the science, skill, or occupation of cultivating plants, especially flowers, fruit, and vegetables, in gardens or greenhouses

**ornamental tree or shrub**—a plant grown for its beauty rather than for food

**rootstock**—a root or piece of root used as a stock in propagation by grafting

**scion**—a living shoot or twig of a plant used for grafting to a stock

**species**—a basic biological classification and containing individuals that resemble one another and may interbreed

**variety**—a specific type or kind within a general group

from the scion containing a bud is then placed over the open area on the rootstock, and the joint is covered with grafting tape. T budding uses a vertical cut about one inch long into the bark of the rootstock, then (forming a T) a horizontal cut is made about 1/3 of the way around the tree, creating flaps of bark that can be opened. A wedge of bark from the scion tree containing a bud is then pushed under the flaps, and the opening is wrapped with grafting tape to keep the flaps closed over the graft joint.

Splice grafting is typically used for horticulture research in a controlled setting. Forty five degree cuts are made in the stock and scion; then they are clipped together with grafting clips. This graft usually takes only 14 days to heal.

### English Language Arts

1. Read and discuss background and vocabulary
2. Invite a local pecan producer or orchard worker to speak to the class and demonstrate tree grafting.
  - Students will prepare for the speaker by pre-writing one or two questions for the speaker.
  - Students will listen and take notes on important points the speaker makes.
  - As a class, students will discuss the answers they received to their questions.
  - Based on the information, discussion and further research, if necessary, students will write short answers to the following questions:
    - How was the process of grafting invented?
    - What are some of the different types of grafting that can be used?
    - Why are some types of grafts better than others?
    - Why do people use grafting?
    - How long does it take for a graft to take hold?
3. Grafting can be used to grow desirable fruit from a tree that is stronger than the scion. However, the resulting fruit will show characteristics from the scion tree rather than the rootstock tree. There are many scientific reasons for this. Trees and plants are living organisms containing cells that grow and change through time. To better understand this concept, students will conduct short research projects using a variety of print and digital sources and online videos. Students will use the following questions to guide their research.
  - What structures of a tree or plant make it possible to graft other variations of the tree or plant together?
  - What type of plant reproduction is grafting?

- When fruit is produced from a grafted tree, will it show characteristics of the rootstock plant, or the scion plant? Explain your response.
- What are some of the internal and external structures of plants that support the grafting process?

## Science

1. Students will conduct a tomato grafting experiment. For safety, set up a cutting station where the cutting will be done by the teacher or other assistant. Allow one rootstock tomato plant and scion for every 2-3 students. The rootstock plant should stay in the planting container.
  - At the cutting station, use the utility knife or razor blade to cut cleanly across the rootstock about 1.5 inches up from the soil.
  - When all the plants have been cut, students will identify the cambium layer of cells. It is right beneath the outer bark layer.
  - Cut the scion portion at about a 60 degree angle, exposing the cambium. On the other side of the angle, cut another small angle, about 1/3 of the way down from the other side. This will maximize contact of the cambium layer of cells.
  - Take the rootstock portion and cut straight down into the middle of the stem about 1/2 inch.
  - Students will take the scion wedge and place it into the rootstock.
  - Wrap the grafting clips around the joint.
  - Place tomato plants on a window sill or in a greenhouse.
  - Water plants carefully through the bottom of the container or around the edges to reduce water stress on the graft union.
  - Students will maintain journals to record the growth of the tomatoes as well as the changes in the grafting site.

## Extra Reading

Marquez, Colleen D.C., *A Gift for Little Tree*, Cupola, 2014.

Smucker, Ann, *Golden Delicious: A Cinderella Apple Story*, Albert Whitman, 2008.

## Online Informational Videos (pecan grafting)

“Pecan Grafting: Texas Inlay Bark Graft, American Method,” Samuel Roberts Noble Foundation, <http://www.noble.org/video/ag/diy/texas-inlay-graft/>

“Pecan Tree Grafting: Four- flap (Banana) Graft, American Method,” Samuel Roberts Noble Foundation, <http://www.noble.org/video/ag/diy/banana-graft/>

## Ag Career: Landscape

A landscaper designs and maintains grounds for commercial and residential clients. They plant and care for grass and vegetation, install lighting and sprinkler systems, and build terraces, walkways, decks, patios and fountains. In addition to transporting and planting new vegetation, they transplant, fertilize, mulch and water flowering plants, shrubs and trees, as well as mow and water lawns.

Landscaping does not require a minimum level of education. However, many landscapers choose to own their own businesses; therefore a degree in a related field may be beneficial.

Landscapers must be able to work well with other people and understand many different aspects of business.