Grafting the Red Delicious!

Grade Level: 3-5

Essential Skills: 1, 2, 4, 5, 9

NGSS: 3-LS3-1, 4-LS1-1, 5-ESS3-1

CCSS: 3.RF.4, 3.RI.1, 3.W.8, 3.W.10, 3.SL.1, 4.RF.4, 4.RI.1, 4.W.8, 4.W.10, 4.SL.1, 5.RF.4, 5.RI.10, 5.W.8, 5.W.10

Time: 60 minutes

Materials:
Grafting the Red Delicious Kit*
Per Student
- (2) 12mm paper straws
- 12" of string
- 20 pom poms
- 10 popsicle sticks
- *Grafting the Red Delicious* Student Worksheet

***Materials Available from Oregon Agriculture in the Classroom.**

AITC Library Resources:
Books:
From Apples to Oregon
Up, Up, Up! It's Apple Picking Time
Johnny Appleseed
Apples of Your Eye

More Lessons:
Apple Farming Game
Apple Science: Comparing Apples and Onions
Walnuts: The Importance of Grafting

Description:
Explore the production of apples and the process of grafting. Students will be introduced to several varieties of apples and learn that each apple was grafted specifically for its genetic traits and resulting characteristics.

Background:
In Oregon, there are approximately 5,000 acres of apples grown. The majority of these orchards are grown in the Hood River and Milton-Freewater areas. In 2018, the farm gate value of apples in Oregon was $55 million. In the United States, there are approximately 7,500 apple producers. These apple producers grow many different kinds of apples. Each apple variety has it own set of characteristics which make some better for baking and other best consumed as a snack. Apple trees are **self-unfruitful** meaning they require the pollen of a different variety to produce fruit. This causes a mixture of traits to be passed on to the fruit on the tree when planting from seed, resulting in unpredictable quality of fruit. For this reason, apple trees are grafted instead of being grown from seed. **Grafting** is done by taking a cutting of the rootstock on one tree and fusing it with a budded stem of another plant(scion). This allows for consistency in apples produced, both in quality and traits.

Directions:
Part 1: Physiology and Production of Apples
1. Explain to students that today they will be learning about apples. Read the book, *The Apple Orchard Riddle* by Margaret McNamara.

2. Ask student the following questions:
   a. Why do you think there are so many different apple varieties? (each one is specialized for a specific purpose, some are good for pies, some are good to each fresh, and some store better in refrigeration)
   b. How do you think an apple tree is grown?

3. Introduce the apple production video to students. For example, "many of the apple varieties that you just saw in the book are grown right here in Oregon! We are going to watch a short video describing how farmers are able to grow so many different varieties of apples."

4. Watch the video *How Does it Grow? Apples* by True Food TV (https://youtu.be/UWLmEh1HIBw)

5. After the video, discuss the following questions.
   a. Why are apples not grown from seed? *(Apple seeds are genetically unique. When a seed is planted, the apples that grow will be different from those the seed came from.)*
   b. What is grafting? *(A cut stem from one apple tree plant is attached to a trunk of another tree allowing the plants to grow together.)*
   c. Why do apple farmers graft their trees? *(Grafting allows farmers to clone the apple trees that they want to produce fruit from. Grafting trees produces the same genetic makeup in the new plant.)*

6. Explain to students that many of the traits they talked about earlier are passed on to new plants through grafting.

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Part 2: Whip & Tongue Grafting

1. Distribute the *Grafting the Red Delicious* worksheet to students.

2. Read through page 1 as a class to help students grasp the idea of grafting.

3. Explain to students that they will have the opportunity to practice grafting a "tree" similar to apple tree farmers.

4. Review the directions on page 2 of their worksheet using the diagram to help explain the processes before providing supplies.

5. Distribute supplies to each student and have them begin.

6. As student complete their graft, review their work to make sure the graft is accurate.

7. After students have been able to "grow" apples on their trees allow students to walk around and see other's work with branch and apple placement.

8. Then, have students clean up their work stations.

9. Review key concepts using the following questions:
    a. Why is grafting important to apple tree farmers?
    b. How could grafting support the plants survival and growth?
    c. How does grafting support and protect the environment and our natural resources?

Activity Page

Grafting the Red Delicious!

Name: _____

Background

Apple trees are most commonly grafted using the whip and tongue method that you will explore in this activity. **Grafting** allows for traits such as yield, quality, shape, size and disease and pest resistance to be passed on from the parent plant. The traits that apple seeds contain vary greatly from seed to seed even within the same variety. Apple trees are self-unfruitful meaning they require the pollen of a different variety to produce fruit. Planting by seed causes a mixture of traits to be passed onto the fruit resulting in unpredictable fruit quality. For this reason, apple trees are grafted instead of being grown from seed. Grafting of apple trees creates a genetically identical plant. Grafting is done by taking a cutting of the rootstock from one tree and fusing it with a budded twig of another tree (**scion)**. This allows for consistency in quality and traits of apple varieties. The scion will be taken from the variety of apple tree that the producer would like to grow. The **rootstock** is chosen based on several factors such as soil type, root structure and disease resistance.

The Whip and Tongue Graft joins the rootstock and scion together through spliced ends. When selecting a scion and rootstock it's important that their diameters are the same size. To begin the grafting procedure, a farmer would cut the ends of the rootstock and scion in a diagonal direction with the total cut length being about four times the width. Then, both cut ends are cut once more in the center of the diagonal cut. The center cut in the rootstock and scion are then connected. This creates a locking mechanism when the two parts are put together. This procedure allows the cambium layers to align. The rootstock and the scion are then held in together by a grafting strip that is wrapped around the spliced junction creating the graft union. Wax is then applied to the open wound on the top of the scion and graft union providing protection similar to a band aid.

Vocabulary

Axillary Bud: buds that form laterally at the stem of a leaf.

Cambium: a layer of cells that form the xylem and phloem of the plant.

Graft: two different plants connected together to form one plant.

Graft Union: the point at where the rootstock and the scion are joined together.

Terminal Bud: main bud at the tip of the plant where most growth will take place.

Rootstock: the root system of a plant that is grafted to the upper section of a different plant.

Scion: the upper portion of a grafted plant bearing the leaves and buds of the plant to grow.

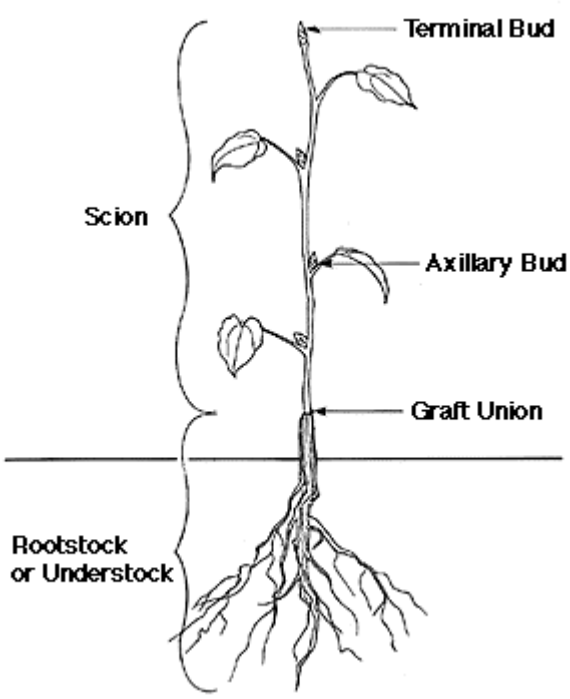

Figure 1. Single-worked graft, by Ted Bilderback Director, JC Raulston Arboretum and Cooperative Extension Nursery Specialist Horticultural Science, R. E. Bir, T. G. Ranney, retrieved from https://content.ces.ncsu.edu/grafting-and-budding-nursery-crop-plants

Now, it's your turn!

Using the materials provided by your teacher, create a whip and tongue graft using the directions below. After creating the graft, you will have the opportunity to test the stability of your graft through a fun activity.

Materials

- (2)12mm paper straw
- 12" string
- Liquid glue
- 10 popsicle sticks
- 20 pom poms
- Scissors
- Ruler
- Marker

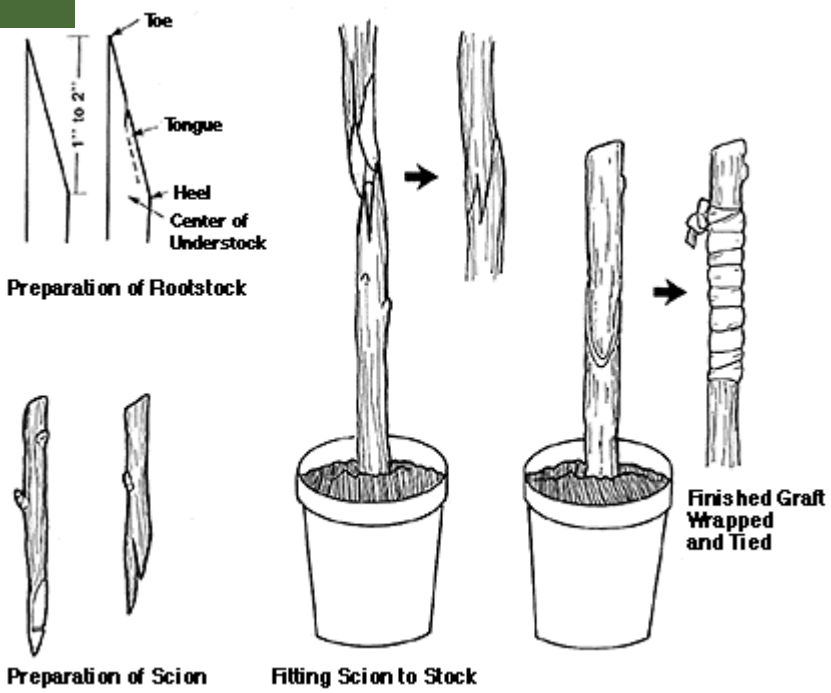

Figure 2. Whip and tongue graft, by Ted Bilderback Director, JC Raulston Arboretum and Cooperative Extension Nursery Specialist Horticultural Science, R. E. Bir, T. G. Ranney, retrieved from https://content.ces.ncsu.edu/grafting-and-budding-nursery-crop-plants

Directions

1. Measure and mark 1-½ inches from one end on both straws.

2. Using scissors, cut one end of the straws with a 1-½ inch diagonal cut. This piece of straw is your rootstock.

3. On the opposite end of the rootstock, make several vertical cuts to create a root like effect for the rootstock. You will want this straw to be able to stand on its own and support the scion that you will cut next. You can continue to adjust your roots to determine accurate length after attaching the grafted scion in the upcoming steps.

4. Take the other straw and cut a 1-½ inch diagonal cut on the end you marked. This is your scion, which contains buds for future growth.

5. Using the scissors, cut a small notch in the middle of the diagonal cut on each straw.

6. Connect the straws end to end aligning the diagonal cuts and notches together as shown in the diagram.

7. Place the middle of the string in the middle of the graft. Carefully wrap the string around the graft and tie the ends together in a knot.

8. Using glue, you will rub glue on the plant over the string and over the top of the scion, this acts as a bandage protecting open wounds on the plant.

9. After your teacher has reviewed your work, you will now test the stability of your graft. If your "plant" can stand on its own using its root system, stand it upright. If not, try to cut the roots a little longer to see if you can get it to stand on its own. If needed you can add weight on top of the roots to help support it such as a pair of scissors on one side and a box of crayons on the other.

10. You will now stack popsicle sticks on the grafted "plant" that will act as the tree's branches, the goal is to get as many branches as possible on the plant. Next, you will place red pom poms on the branches of the tree that will represent apples. You may only have three apples on each popsicle stick, one on each end and one in the middle. Too many apples on one branch that are not spaced out correctly can lead to reduced quality in your fruit. Farmer's thin their trees to ensure quality in their fruit. Your goal is to get the most apples on the tree without knocking over the plant. Record the amount of fruit your apple tree produced here _____.