

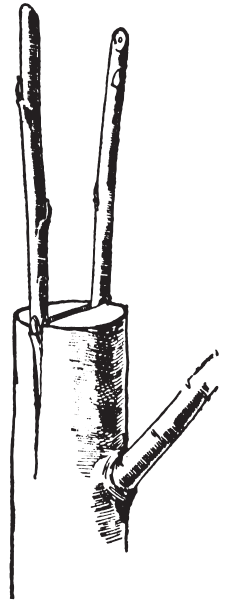
Kentucky Harvest of the Month

SEPTEMBER: APPLES



History

Apples were first discovered approximately 750,000 years ago! They were sour crab apples discovered in the forests of Kazakhstan. Apples weren't grown by farmers until much later - approximately 8,000 years ago, and those were wild apples. Apples have extreme heterozygosity, meaning an apple grown from seed won't necessarily be like its parents. In an effort to grow a consistent apple and to choose desirable characteristics, this led to the technique known as grafting, which was first discovered around 1000 BC (who discovered it is uncertain). Grafting is essentially the "cloning" of one tree - removing a branch of one apple tree and then connecting it to the rootstock and stem of another, or simply planting the cutting and it rooting on its own.



Ideas for your Classroom

Elementary:

- Watch [KY Farms Feed Me virtual field trip to an apple orchard](#) (KY Ag & Env in the Classroom)
- Apple Math Activity (attached)
- Read *Apples, Apples Everywhere* by Robin Koontz (or watch a reading [here](#))

Middle:

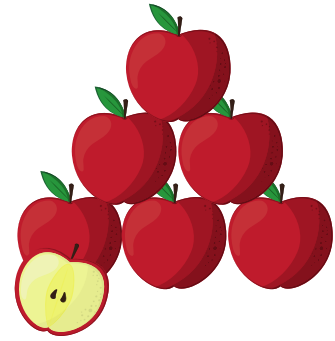
- [Grafting the Red Delicious Activity](#) (Oregon Ag in the Classroom Foundation) - *could also be used for high school*

High school:

- [Apples and the Science of Genetic Selection](#) lesson (National Ag in the Classroom)
- The Brown Apple Project (attached)

Name: _____

Apple Math



Today, we're going to learn about fractions! You will need an apple, a plate, and a butter knife to do this activity.

Carefully cut your apple in half. How many parts do you have? _____

Each part is called one-half. Write one-half as a fraction: _____

Cut each half in 2 parts. How many parts do you have now? _____

Each piece is called one-fourth. Write one-fourth as a fraction: _____

Take one part away. What fraction do you have left? _____

Now add that piece you took away back in. You should have 4 parts. Cut each part in half again. How many parts do you now have? _____

Each piece is called one-eighth. Write one-eighth as a fraction: _____

Now take 2 parts away. What fraction do you have left? _____

The Brown Apple Project



Required Time: 1 hr. 15 min.

Objectives:

As a result of participating in this activity, students will:

1. Learn how enzymatic browning occurs through designing their own experiment
2. Be able to explain at least two methods that can be used to stop or slow the process of enzymatic browning

Materials:

- apples
- cutting boards
- knives or apple slicers
- lemon juice
- water
- Fruit Fresh
- white vinegar
- apple juice
- baking soda
- milk
- any other ingredient that you want
- plastic bag
- tongs
- paper plates
- paper bowls
- paper towels

Introduction to the topic:

Say - *How many people are familiar with this scenario? - You bit into an apple or cut into one and do not eat the whole thing right away. Later, when you come back, the outside of the remaining apple is brown.*

- *Why do you think this happens?*
- *Did you know scientists have ways to prevent this reaction from happening?*
 - *This reaction is called enzymatic browning. The reason it is called that is because enzymes are responsible for the chemical reaction of turning fruit brown in color.*
 - *Enzymes are proteins that accelerate metabolic reactions. They are what activate processes to occur.*

Write on board the following reaction: Polyphenol Oxidase + O₂ -> Melanin (Brown Color)

Say - *The enzyme in the fruit called Polyphenol Oxidase is reacting with the oxygen from the air to create a compound called melanin, producing a brown appearance on the apple. Again, an enzyme is a protein that initiates a chemical reaction. This is why the reaction is known as "enzymatic browning".*

Say - Today I am going to present a group of materials to you and your job is to design an experiment that would block oxygen in the air from coming in contact with the apple slices to prevent enzymatic browning.

- Introduce the materials, emphasizing the students get to design the experiment and choose which materials they use! They can use all or just some of them, but remind them to have a control (one apple slice in the open air with nothing done to it) to use as comparison.
- Let them know there is no right or wrong design.

Allow participants to form a group, brainstorm, create an experiment, and carry it out (see attachment for group worksheet). This will take 30-45 minutes because you want to allow the fruit to have a chance to brown (or not brown); if you don't have enough time, leave the apples overnight and talk about it the next day!

After the experiments have been completed, discuss the following as a group:

- Have each group describe their experimental design and explain their observations and conclusions.
- Were your predictions correct?
- What ingredients worked the best at preventing browning? Why do you think that is the case?
- Why do we care about enzymatic browning? Do you think it's important in the food processing industry? Why?
 - Enzymatic browning is responsible for 50% of all losses during fruit and vegetable production.
 - Methods of prevention used in the food industry - 1. inactivate the enzyme through heat or acid; 2. remove the essential compound, oxygen, from the product
- Can you think of any scenarios where browning is desirable in the food industry?
 - Raisins, prunes, coffee, tea, cocoa - the browning of these products contributes to their flavor and color (note - most of the browning in cocoa and coffee comes from the roasting process)
- If you had to design your experiment over again, would you change anything?



Group Members: _____

Describe your experimental design.

What is your hypothesis? Why do you think that?

What are your results?

What is your conclusion?