Horticulture

*Lesson Plan for Grade 3, Science*

*Prepared by NAITC*

*Modified by Mississippi State University, School of Human Science*

*for Mississippi Farm Bureau Federation - AITC*

# OVERVIEW & PURPOSE

Students will explore heredity concepts by comparing observable traits of apples and onions, collecting data on the traits of different apple varieties, and learning about apple production.

EDUCATIONAL STANDARDS

**Mississippi College-and-Career Readiness Standards:**

L.3.2.4 Obtain and communicate data to provide evidence that plants and animals have traits inherited from both parent organisms and that variations of these traits exist in groups of similar organisms (e.g., flower colors in pea plants or fur color and pattern in animal offspring).

ELA-W.3.8– Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

**NALOs:**

T4.3-5 d Provide examples of science being applied in farming for food, clothing, and shelter products.

# OBJECTIVES

* Students will compare traits of apples and onions
* Students will collect data on traits of apples

# MATERIALS NEEDED

Introduction:

* 1 red apple (for the whole class)
* 1 red onion (for the whole class)

Activity 1: Apple Exploration

* Gala apples (or other slow-to-brown variety like Empire or Cortland), 1 per group
* Granny Smith apples (or other tart, green variety like Crispin or Pippin), 1 per group
* McIntosh apples (or other soft-flesh variety like Braeburn or Red Delicious), 1 per group
* Measuring tapes, 1 per group
* Scales that weigh in grams, 1 per group
* *Apple Data Sheet,* 1 per student

Activity 2: Apples in the Orchard

* [*How Does it Grow? Apples*](https://www.youtube.com/watch?v=UWLmEh1HIBw) video

Essential Files (maps, charts, pictures, or documents)

### [Apple Data Sheet](https://drive.google.com/file/d/1uw2D_sMP2j--N74Y4mo7YCBlms0PFUjL/view?usp=drive_link)

Essential Links

* [*How Does it Grow? Apples*](https://www.youtube.com/watch?v=UWLmEh1HIBw)

# Lesson Set Up:

1. Have a red apple and an onion ready to display to the students.

Activity 1:

1. Predetermine groups of students (small groups 2-4).
2. Have Gala, Granny Smith, McIntosh apples, a measuring tape, a scale, ready for each group.
3. Print and provide each student with an Apple Data Sheet.
4. Have something ready to cut the apples open for the groups.

Activity 2:

1. Pull up and display the How does it grow? Apple video.

# VOCABULARY

**grafting:** a plant that has a twig or bud from another plant attached to it so they are joined and grow together

**heredity:** the passing on of characteristics from parents to offspring

**plant breeding:** the purposeful manipulation of plant species in order to produce desired characteristics

**trait:** a quality or characteristic that makes one person, animal, or thing different from another

# Ag Facts:

* At last count, more than 7,500 apple varieties have been identified worldwide.
* More than 2,500 varieties are grown in the United States – 100 of which are grown for commercial sale.
* Apples ripen or soften ten times faster at room temperature than if they were refrigerated

# Background information for teachers:

If you take the time to observe, similarities can be found even between an apple and an onion. And certainly you will notice many **traits** that make them different too. Close observation of the traits of living things is the first step to understanding **heredity**.

Apples have been selectively bred for thousands of years to produce the varieties that we know today. Honeycrisp, Gala, Red Delicious, Granny Smith, and the many other apples in the grocery store all come from the same species of tree, but they have distinctly different characteristics. Some are sweet and others are tart. Some are good for baking, while others are best eaten fresh. Some store well for a long time, but others need to be used soon after ripening. Knowledge of how traits are inherited in apples has allowed breeders to develop the many different varieties found in orchards and grocery stores around the world.

Apples can reproduce by seed, but farmers almost never grow apple trees from seed. In order for apple fruit and seeds to form, the flowers of the tree must first be pollinated. Some fruit trees can self-pollinate, but apple trees must be cross-pollinated with pollen from a different variety of apple tree. This means that each apple seed is genetically unique, and there is no guarantee that the tree it grows into will produce fruit anything like that of its parents. If a farmer started an apple orchard by growing trees from seed, each tree would produce apples with different flavors, colors, and ripening times, making it difficult to manage and market the crop. So, most apple orchards begin by **grafting** a desirable apple variety onto a strong rootstock. A section of a stem with leaf buds is inserted into the trunk of another. The two will fuse together and the stem section will grow and produce apples just like the tree it was taken from.

While wild variability is not desirable to farmers, it is the working palette of **plant breeders**. Breeders plant apple trees from seed in order to bring out new characteristics and combine characteristics from desirable varieties. Breeders work not only to provide consumers with new, tasty varieties of apples, but also to create apple trees that are resistant to disease and pests and have other traits that make it easier for farmers to grow a healthy, reliable crop. The process of selective breeding takes many, many years, but modern biotechnology provides innovative techniques that allow breeders to develop new traits more quickly.

In 2015, the first genetically modified apple varieties were approved for sale in the United States. The Arctic Apples contain a trait that prevents them from turning brown when they are sliced or bruised. The flesh of most apples will turn brown when exposed to air. This is due in large part to an enzyme called polyphenoloxidase, which causes many fruits to produce brown pigment when exposed to oxygen and may change their texture and flavor. Methods like cooking or lowering the pH of cut apples can minimize the activity of this enzyme and prevent browning. In Arctic Apples, a gene silencing technique was used to prevent the apples from producing polyphenoloxidase and thus make them resistant to browning.

# LEARNING PROCEDURES

Interst Approach:

1. Show students a red apple and a red onion. Ask, “Which one would you like to eat in a pie? How can you tell the difference between the apple and the onion?”
2. As a class, list the physical characteristics of the apple and onion. Point out that many of these characteristics are heritable traits that can be used to tell apples from onions.
3. *Optional:* Show other types of fruits and vegetables that have both similar and different characteristics. Have students observe, record, and discuss the similarities and differences.

### Procedures

Activity 1: Apple Exploration

1. Divide the students into small groups. Provide each group with a Gala, Granny Smith, and McIntosh apple (or other similar varieties); one measuring tape; one scale; and an *Apple Data Sheet* for each student. 
2. Have students record the color and smell of each apple variety on their data sheets.
3. Have students predict each apple’s weight in grams and circumference in centimeters.
4. Teaching Tip: When students make predictions, encourage them to use a known variable for comparison. For example, if you are using gram weights, have a student place 100 grams in one hand and an apple in the other. This way, the student has a known quantity against which to compare the apple’s weight and a basis for making his/her prediction. As soon as one apple’s mass is known, the apple can then become the next known quantity.
5. Have students measure the actual weight and circumference of each apple.
6. Have students make a prediction about how many seeds are in each apple.
7. Cut each apple open for the groups, designating one slice for observing how long it takes the apple to turn brown. Ask students to observe the inner characteristics of the apple and record on their data sheets the color of the inside flesh and the actual number of seeds inside each apple.
8. Cut each apple into small sections and allow students to taste the differences among the apples. As they are tasting, remind them to pay attention to the texture (crunchy, juicy, etc.) of the apple as well as the flavor. Be sure to follow proper health and safety regulations for step 7, or ask the cafeteria workers to slice the apples for tasting. Have students record their observations on the data sheet.
9. Using the background information, explain to students why apples turn brown after they are cut. If any of their apples have started to turn brown, have them record on their data sheets that these varieties are fast to brown. Ask them to continue observing their cut apples to compare their rate of browning as you do the next activity.
10. Discuss the variation that students observed between different apple varieties. Explain to students that these variations are examples of traits that can be passed from parent to offspring.

Activity 2: Apples in the Orchard

1. Show students the [*How Does it Grow? Apples*](https://www.youtube.com/watch?v=UWLmEh1HIBw) video.
2. Use the following discussion questions to explore the video:
   * Why don’t farmers grow apples from seed? *(Each seed is genetically unique, meaning that when it grows into a mature tree, the apples it produces will be different from those produced by its parent trees.)*
   * What is grafting? *(The process of joining a cut stem—or bud—with the trunk of another tree so that the two grow together.)*
   * Why do apple farmers graft their trees? *(Grafting allows farmers to “clone” the apple trees that produce the fruit they want. A grafted branch has the same genetic makeup as the tree it was taken from.)*
   * Do all apple varieties ripen at the same time? *(No, some varieties ripen earlier than others, so planting different varieties allows farmers to extend their length of harvest.)*
3. Explain to students that apples have been selectively bred for thousands of years to produce the varieties that we know today. Apple breeders, unlike farmers, plant apple trees from seed in order to find and develop new traits. Under human cultivation, the traits that give apple trees a survival advantage are the traits that are most useful and desirable to people. Ask students to brainstorm all the different traits they can think of that might be desirable in an apple tree (e.g., pest resistant, grows fast, has strong branches, produces big apples, juicy apples, sweet apples, crisp apples), and write them on the board.
4. Circle all the traits that are directly related to the fruit of the apple tree (e.g., produces big apples, juicy apples, sweet apples, crisp apples). Point out that these are like the characteristics that students observed and recorded on their *Apple Data Sheets*.
5. Based on the information from their data sheets, ask students to vote on which apple variety was their favorite. Imagine that an apple breeder crossed the two favorite class varieties. What characteristics might the resulting apple have?

**Concept Elaboration and Evaluation**

After conducting these activities, review and summarize the following key concepts:

* Inherited traits are passed from parents to offspring.
* The characteristics of different apple varieties are examples of inherited traits.
* Knowledge of inherited traits is important to apple production; apples grown from seed may have different characteristics from their parents while an apple produced through grafting will be genetically identical to its parent.
* Under human cultivation, the traits that give apple trees a survival advantage are the traits that are most useful and desirable to people.

# Additional Learning Procedures

To help students review and elaborate more about horticulture try using the [“Think Pair Share”](https://drive.google.com/file/d/1dfnsZjluib-A7DYWDyeKjI8vm67DsK1i/view?usp=drive_link) method to allow students to think deeper and make new connections.

Additional texts to include:

[Uncle John’s City Garden](https://www.agfoundation.org/recommended-pubs/uncle-johns-city-garden)

[Jaden’s Impossible Garden](https://www.agfoundation.org/recommended-pubs/jadens-impossible-garden)

[Plants Feed Me](https://www.agfoundation.org/recommended-pubs/plants-feed-me)



Source: <https://www.agclassroom.org/teacher/matrix/>

*For more information and additional lessons visit*

*https://msfb.org/ag-in-the-classroom/lesson-plans/.*