

HARVEST *of the* MONTH in the CLASSROOM



APPLES

HISTORY

Fossil evidence shows that apples existed in Europe and Asia as early as 11 million years ago! But the apples we eat today probably are closely related to a seed dated to 1000 BCE, found in modern day Kazakhstan. Apple trees originated in central Asia and were brought to North America by European settlers in the 1600s. In fact, the only apple native to North America is the crab apple. But by the 1800s, the United States grew more varieties of apples anywhere in the world.

FUN FACTS

Apples are 25% air. This means they are less dense than water, perfect for apple bobbing!

It takes about 36 apples to produce one gallon of apple cider.

The world's largest apple peel was created by Kathy Madison in 1976, in Rochester, NY. It was 172 feet, 4 inches long.

Over 7500 types of apples are known. 120 varieties are grown in Massachusetts.

FARMER BIO



Breezeland Orchards in Warren grows apples, peaches, and raspberries on 100 acres and has been in operation since 1896! Farmer Mark Tuttle's favorite apple variety is Pink Lady, which makes pink applesauce. Breezeland Orchard's apples are sold at their farm stand, other farm markets and to local schools for lunches.

Apples and the Science of Genetic Selection



OBJECTIVES

In this lesson, students will distinguish between natural and artificial selection. They will use a student-centered learning activity to see how science and genetics have been used to artificially select apples for specific traits like color, texture, taste, and crispness.

MA STATE FRAMEWORK(S)

- LS3.A Inheritance of traits
- LS3.B Variation of traits
- LS4.B Natural selection
- Speaking and Listening Standards [SL] 112

ESSENTIAL QUESTIONS

- What is the difference between natural selection and artificial selection?
- Are apples different today because of something humans have done or because of something that occurred naturally?

MATERIALS NEEDED

- [Apples and the Science of Selection](https://bit.ly/AppleSelection) handout, <https://bit.ly/AppleSelection>
- 1 copy per student
- Paper plates, utensils, and napkins as needed for taste testing
- See Station Set Up Info below

STATION SET UP

Station # 1

1. [Station 1 Card](http://bit.ly/3jTlfGy) (<http://bit.ly/3jTlfGy>)
2. [Story of John Chapman](https://bit.ly/AppleseedHandout) (aka Johnny Appleseed) <https://bit.ly/AppleseedHandout>
3. Crabapples, apple cider, or crabapple jelly to taste.

Station #2

1. [Station 2 card](http://bit.ly/3X517zq) (<http://bit.ly/3X517zq>)
2. Device to view [How Does it Grow?](https://youtu.be/UWLMeh1HIBw) <https://youtu.be/UWLMeh1HIBw>
3. Device to use for research.

Station #3

1. [Station 3 card](http://bit.ly/3WQWTvs) (<http://bit.ly/3WQWTvs>)
2. [Apple Varieties Handout](https://bit.ly/MA-AppleVarieties) <https://bit.ly/MA-AppleVarieties>
3. Applesauce recipe ingredients to make homemade applesauce. Choose the recipe and method that meets your classroom needs:
 - [Microwave](https://bit.ly/3Qir7Fe) (<https://bit.ly/3Qir7Fe>)
 - [Slow Cooker](https://bit.ly/3ZcrfKt) (<https://bit.ly/3ZcrfKt>)
 - [Pressure Cooker](https://bit.ly/3WHiR45) (<https://bit.ly/3WHiR45>)

Station #4

1. [Station 4 Card](http://bit.ly/3WNAjnG) (<http://bit.ly/3WNAjnG>)
2. Device to view [Have We Engineered the Perfect Apple?](https://youtu.be/2rLigq0jhGY) <https://youtu.be/2rLigq0jhGY>
3. Samples of Honeycrisp and Red Delicious apples to taste.

Station #5

1. [Station 5 card](https://bit.ly/3vJVVWa) (<https://bit.ly/3vJVVWa>)
2. Device to view videos:
 - [What is Genetic Engineering?](https://youtu.be/3IsQg2KiBwM) <https://youtu.be/3IsQg2KiBwM>
 - [How are GMOs Created?](https://youtu.be/2G-yUuiqIZo) <https://youtu.be/2G-yUuiqIZo>
 - [Arctic Apples Explained](https://youtu.be/SVv8G4GUGoA) <https://youtu.be/SVv8G4GUGoA>
 - [Arctic Apples Time Lapse](https://youtu.be/g2-BqBZmVd0) <https://youtu.be/g2-BqBZmVd0>

You can modify the taste tests to include varieties of apples grown in your region. Check local farmers markets or grocery stores to discover varieties unique to your area.

INTRODUCTION

Ask students to raise their hand if they have recently eaten a Red Delicious apple. Ask a student to describe what it looked and tasted like.

Ask students to raise their hand if they have recently eaten a Honeycrisp apple. Ask a student to describe what it looked and tasted like.

Continue a class discussion comparing varieties of apples. What qualities make a good apple? What qualities make a poor apple? How many varieties of apples are there? How are different varieties of apples developed? What will apples be like in the future? Can science explain why different varieties of apples taste different? Conclude your discussion with the final question, "Are apples different today because of something humans have done or because of something that occurred naturally (without human intervention)?" Leave the question open-ended and inform students that you will return to it after the activity.

Vocabulary:

artificial selection: the intentional breeding of plants and animals to produce specific, desirable traits

asexual reproduction: a form of reproduction involving a single parent and producing offspring that are exact genetic duplicates

clone: an organism or cell produced asexually from one ancestor or stock to which they are genetically identical

crossbreeding: selectively breeding two plants or animals of different breeds or cultivars to produce a superior offspring sometimes called a hybrid

evolution: the process by which different kinds of living organisms are thought to have developed and diversified from earlier forms during the history of the earth

natural selection: the process whereby organisms better adapted to their environment tend to survive and produce more offspring; a theory first introduced by Charles Darwin

PROCEDURE

Prior to class, set up the five stations around the classroom as described above.

1. Give each student one copy of the **Apples and the Science of Selection** handout.
2. Divide the class into 5 equal groups and assign each group a specific station for their first rotation.
3. Give a brief introduction to students by explaining that they will be rotating through 5 stations. They will have approximately 10-15 minutes at each station to read the station card and complete the three tasks listed on the back.
4. Once students have come back together, re-ask the question, "Are apples different today because of something humans have done or because of something that occurred naturally (without human intervention)?" (They are a result of what humans have done, also known as artificial selection.)
5. Show the video, [Natural Selection vs Artificial Selection](https://youtu.be/ghzWbTpxME8) (https://youtu.be/ghzWbTpxME8). Create a Venn diagram together on the similarities and differences between natural and artificial selection.

EXTENSIONS & VARIATIONS

- Listen to the NPR Planet Money podcast [The Miracle Apple](https://bit.ly/3X7WXXt) (https://bit.ly/3X7WXXt) to hear the story of the development of new varieties of apples.
- Tour a [local apple orchard](https://bit.ly/2LOEMG3) (https://bit.ly/2LOEMG3) to view apple production first hand or invite an apple farmer in to speak with your class.