Foreword

Virginia's Agriculture in the Classroom program connects children to agriculture. Through innovative programming and classroom resources that support core curriculum standards, students of all ages learn about the important role that agriculture plays in their lives. Included in this curriculum book are engaging, cross-curricular lessons that use Virginia agriculture and natural resources to teach the standards.

Lessons in this curriculum book are aligned with the most recent Virginia Standards of Learning revisions at the time of print for each subject areas.

For further resources, check us out at **Virginia.Agclassroom.org**. In addition to our comprehensive lesson plan library, you will find information about our school grant program. Educators may apply for grants of up to $500 for agriculturally related activities in their classrooms and schools.

Additionally, be sure to follow Virginia Agriculture in the Classroom on Facebook for the latest news and resource offerings such as how you can request a free resource kit to be shipped directly to your classroom.

Table of Contents

Barnyard Bag Books

Background Knowledge

The world is made up of a multitude of living things, and in this lesson, students will explore the natural world around them and become more aware of the many plants and animals that inhabit the farm. You will be bringing the farm to the classroom by filling a large plastic tub with various items that might be found on the farm. See the "Materials" section for suggestions.

Pre-punch your paper bags by folding each bag in half and punching two holes by the fold. Then have students assemble their books by threading either yarn or pipe cleaners through the holes to create the binding for the books.

Procedure

1. Have your large plastic tub filled with soil and pre-loaded with various items for your farm ecosystem.
2. Have students take turns in small groups coming up to the discovery tub. Give them a chance to sift through it and see what is hidden before returning to their desks with 2-4 items each.
3. In groups have them determine ways to classify their items. Suggestions include: living versus non; color; plant versus animal. Share and discuss as a class.
4. Use the books to write about their items. This may be a creative writing or a listing and description. Alternatively, younger students may draw picture of the item on each page.

Standards of Learning

Science: 1.1, 2.1, 3.1, 4.1
English: 1.11, 2.9, 2.10, 3.8, 4.7

Objective

Students will:

- Investigate an ecosystem
- Write utilizing descriptive vocabulary

Materials

- Large plastic container
- Soil or peat moss
- Small shovels/trowels (you may also use plastic spoons)
- Farm ecosystem items
  - Ex: leaves, artificial worms/ insects/animals, sticks, pebbles, pine needles, seeds, tractor toys, plastic farm animals
- Paper lunch bags
- Hole punch
- Yarn or pipe cleaners

"What's on the Farm?" Classification

Background Knowledge

Use the farm and its surrounding environment to help students practice sorting and classifying objects. Possible pictures and classifications are:

PK/Kindergarten: living vs. nonliving; plant vs. animal

First Grade: body coverings, animal movement; wild vs. domesticated

Second Grade: natural, human, and capital resources

Third Grade: producers, consumers, and decomposers; predator vs. prey; herbivores, carnivores, and omnivores

Procedure

1. Place the farm scene shower curtain on the floor and invite students to populate it will all of the different pictures. Discuss why they choose to place items in certain spots but reinforce that there may be multiple "correct" spots.
2. Next, sort and classify the pictures on the shower curtain. You may choose to have the class brainstorm their own classifications or give them predefined ones.
3. Draw columns and headings on the board for the classification groups. Next, students take turns taping their pictures into the correct column.

Extension

In addition to sorting pictures, you may also use them to create a food/energy web.

Standards of Learning

Various adaptations of the lesson available for the following standards-

Science: K.6, 1.5, 3.5

English: 2.13

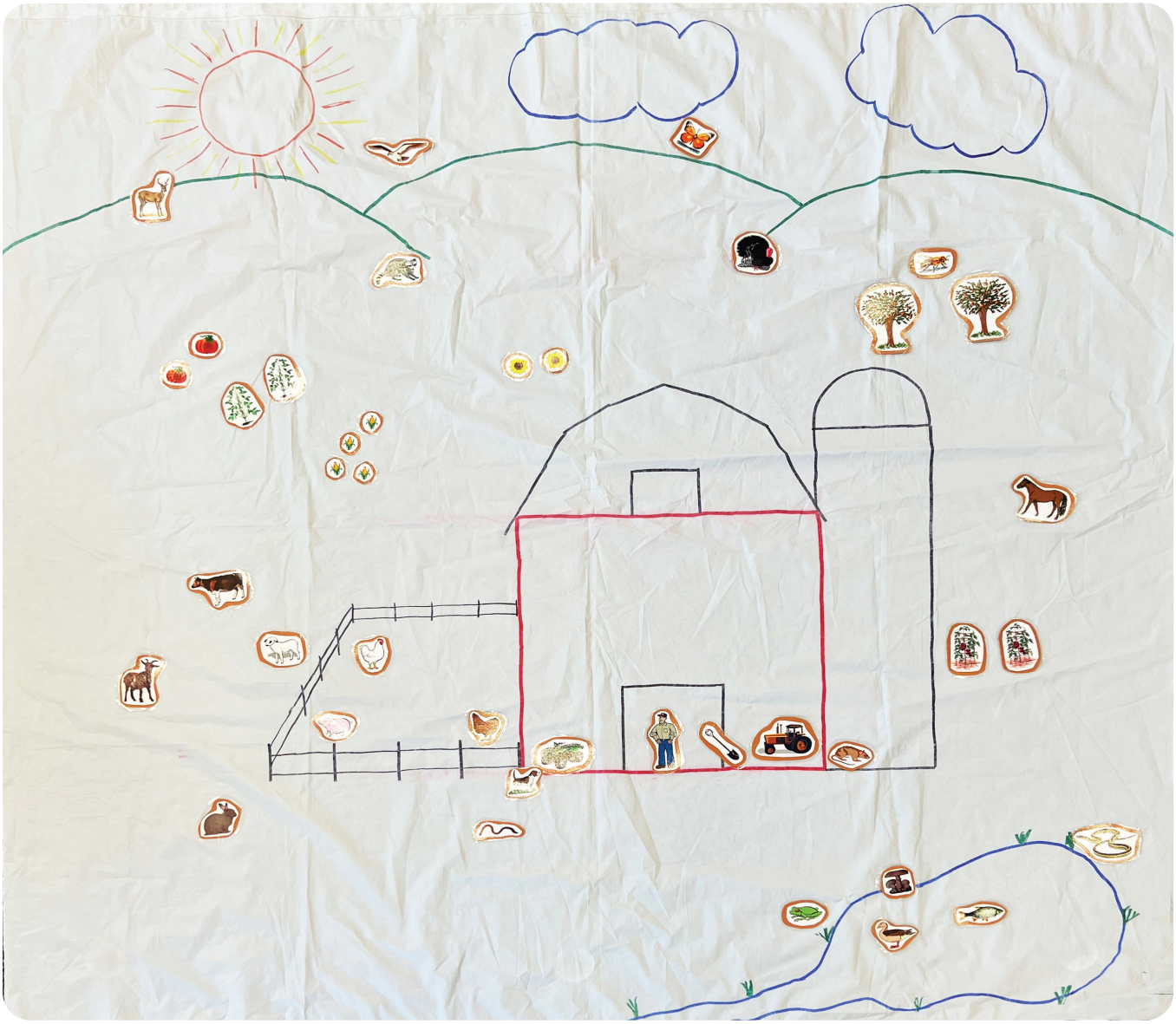
Objective

Students will:

- Sort and classify plants, animals, tools and people found on the farm

Materials

- Shower curtain with farm scene drawn on it
- Pictures of plants and animals found on a farm, see Appendix for images



In addition to plants and animals, there are a lot of jobs to be found on the farm. Learn more with these videos featuring a beef cattle farmer and a large animal veterinarian.

Meet Morgan, a beef cattle farmer in the Shenandoah Valley.

Learn about a day in the life of a large animal veterinarian with Dr. Bom Harris.

Habitat Hula Hoops

Background Knowledge

An ecosystem is a biological community of living organisms interacting with the nonliving parts of their environment. There are two main components of an ecosystem. The biotic factor is made up of living organisms like plants, animals, fungi, and bacteria. The abiotic factor is made up of nonliving components like soil, weather, water, and rocks.

An agricultural ecosystem is a managed ecosystem with the purpose of producing crops and/or animal products. Agricultural ecosystems comprise about 37% of the total land area of the Earth, with approximately 11% being arable land used to cultivate crops and the rest used to raise livestock. Natural ecosystems consist of many species of plants and animals while managed ecosystems have fewer species that are selected by humans and are limited in diversity. Natural ecosystems are self-sustaining as opposed to managed ecosystems that require the assistance of humans. Humans control many of the interactions in an agricultural ecosystem, including soil condition, soil erosion, water quality, and animal habitats. While sunlight is the energy source for both natural and managed ecosystems, managed systems may supply additional fertilizer and nutrients to the soil. Food chains in a natural system are more complex than in a managed system.

In this lesson, simple playground hoops will be used to define the parameters of a natural ecosystem for students to explore.

Standards of Learning

Science: 1.1, 2.1, 3.1, 4.1
English: 1.11, 2.9, 2.10, 3.8, 4.7

Objective

Students will:

- Investigate an ecosystem
- Classify their findings
- Record their discoveries

Materials

- Recreational hoops
- Magnifying glasses
- Collection containers (zip top bags, paper lunch bags, egg cartons and disposable cups work well)
- Colored pencils
- Science journals
- Digital camera (optional)
- Microscope (optional)

Procedure

1. Divide class into pairs or small groups.

2. Give each group a recreational hoop, magnifying glasses, and collection containers.

3. Instruct groups to find an area in the school garden/landscape to investigate.

4. Place the hoop on the ground (or vertically against taller plants).

5. Assemble around the hoop with magnifying glasses to see what can be found in this relatively small space.

6. Look to see what is living there...plants, insects, worms, etc.

7. Make notes in journals about what is found in the small ecosystem.

8. If cameras are available, take photos. Zoom in if you can!

9. Gather items that are not rooted/ growing in the space to take back to the classroom for further investigation. Some items that maybe collected are fallen leaves, flower petals, cones, small stones, etc. Don't bring any live animals back to the classroom!

10. In the classroom, groups should place their found items on their desks/ tables. Observe the items with magnifying glasses and microscopes (if available). What anything discovered that wasn't seen outside?

11. Classify the items that were found and include in their journals. Some ways to classify include living/non-living, plants/animals, edible/ non-edible, shape/size/color, etc.

Biodegradable Plastic

Background Knowledge

Corn is a versatile crop. It is the major grain grown for livestock feed by farmers in the United States, leading all other feed crops in value and volume of production. Corn is a major component in foods like cereals, peanut butter, and snack foods, and it is also processed into a wide range of industrial products, including ethanol. The kernel is used as oil, bran, starch, glutamates, animal feed, and solvents. The silk is combined with other parts of the corn plant to be used as part of animal feed, silage, and fuels. Husks are made into dolls and used as filling materials. The stalk is used to make paper, wallboard, silage, syrup, and rayon (artificial silk).

Corn can also be used to make a type of plastic known as bioplastic. Commonly, plastic is made from petroleum, a fossil fuel that is a nonrenewable resource. In contrast, bioplastic is made from biological materials—plant starches, cellulose, oils, or proteins. Unlike petroleum-based plastics, bioplastics are made from renewable resources such as corn, potatoes, tapioca, and casein (milk protein). One example of a bioplastic application is packing peanuts—the loose fill that goes all over when you open a package. Some packing peanuts are made of polystyrene (Styrofoam), which is a petroleum-based plastic. Corn-based packing peanuts are made of over 99% cornstarch and a very small percentage of food-grade oil. These packing peanuts are non-toxic, biodegradable, and compostable.

Standards of Learning

Science: 2.3, 5.7, 6.1, 6.5, 6.9
English: 1.11, 2.9, 2.10, 3.8, 4.7

Objective

Students will:

- Provide examples of the states of matter
- Explain that corn may be used as a renewable resource.

Materials

- Cornstarch
- Water
- Corn Oil
- Zip-lock baggies (sandwich size)
- Measuring spoons
- Dropper
- Food coloring

Learn more about bioplastic and the engineers investigating new uses for it.

Plant based plastics in a car? Learn how scientists are doing just that.

Procedure

1. Place one tablespoon of cornstarch in a plastic zip-lock bag.
2. Add 2 drops of corn oil to cornstarch.
3. Add 1 tablespoon of water to the mixture.
4. Mix cornstarch, corn oil, and water in plastic bag by rubbing the outside with your fingers. It should have the consistency of pancake batter.
5. Add 2 drops of food coloring and mix again.
6. Place the bag in a microwave oven on high for 20-25 seconds. You may microwave more than one at a time.
7. Use caution when removing the bags, as they will be hot immediately from the microwave.

Extension

Have students place their homemade plastic in water. How long does it take to disintegrate? Do the same thing by burying it outside in soil.

Butter Lab

Background Knowledge

Milk fresh from the cow has both cream and milk mixed together. The cream is less dense than the milk, so the cream rises to the top where it can be skimmed off. The milk left behind after the cream is skimmed off is called skim or fat-free milk. Whole milk that you might buy in the grocery store is homogenized to keep the milk and cream mixed together.

Butter is a dairy product made when cream is churned to separate the buttermilk from the butterfat. Churning the cream forces the fat globules to slam into one another. If they hit each other with enough force, they will stick together, the fat collection becoming bigger and bigger with each extra globule. After enough churning, the fat globules form a chunk of butter. What remains is a watery liquid with small butter grains floating in it. This is called "buttermilk" and is drained off and saved for other purposes. The butter is pressed and kneaded into a solid mass to remove any remaining pockets of buttermilk or water. Butter remains a solid when refrigerated, but softens to a spreadable consistency at room temperature, and melts to a thin liquid consistency at 32–35 °C.

Extension

Have students compare and contrast how butter was made before modern technology to how butter is made today.

Standards of Learning

Science: K.1, 1.1, 2.1, 3.1, 3.3, 4.1, 5.1

Objective

Students will:

- Conduct an experiment to observe the changes in state of matter as cream is turned into butter.

Materials

- Heavy whipping cream (room temperature)
- Measuring cup or teaspoon
- Marbles
- Small (2oz) jar with lid
- Timer
- Science notebook or recording sheet

Procedure

1. Organize students into groups. Provide each group with 2 small jars, one marble, a scale, measuring cup and timer.
2. Each group will begin by measuring 1 ounce (one fluid ounce equals 6 teaspoons) of cream into their jar.
3. After checking to see that the jars are sealed tightly, the groups will start their timers and begin shaking their jars. Group members may take turns shaking and you may want to play music to encourage their movement. While they are shaking remind students to be observing the properties of the contents of their jar. What does it sound and look like at the beginning, middle, and end?
4. The jar's contents will go through 3 stages – beginning as a liquid, then becoming a solid (resembling a whipped butter) as the fat and milk solids stick together, lastly the solution will separate into a liquid and a solid, with the butter forming as a solid chunk and the liquid buttermilk surrounding it.
5. They should stop their timers and record the time when they have solid butter at the bottom of the jar and buttermilk on top.
6. Next tell them you will be adding a marble to the next trial as an agitator. Have them form hypotheses on whether this will affect the time it takes for the cream to become butter. Repeat the steps above and record their observations and findings.
7. You may choose to provide crackers to taste their freshly made butter.

Take a field trip to a Virginia dairy farm utilizing the latest in milking robotics.

Strawberry DNA Extraction

Background Knowledge

In this activity, students will model a process that scientists use to extract DNA strands. Deoxyribonucleic acid (DNA) is a long molecule that contains the genetic instructions used in the development and functioning of all known living organisms and some viruses. Yes, DNA is in all your food! The main role of DNA molecules is the long-term storage of information. DNA is often compared to a set of blueprints, a recipe, or a code because it contains the instructions needed to construct other components of cells, such as proteins and RNA molecules.

In this lab, students will extract strands of DNA from the nuclei of strawberry cells. Mashing the strawberries will break the cells' walls, exposing the inner membranes. The DNA extracting solution will disrupt the cell and nuclear membranes. Filtering the mixture gets rid of all the strawberry cell parts that are bigger than DNA. Finally, the alcohol causes the DNA to precipitate and come out of the solution. Participating in the extraction of DNA will help familiarize students with one aspect of the work biotechnologists do.

In terms of careers, a plant scientist or genetic engineer may use biotechnology as a tool; these scientists may also employ biotechnologists. Biotechnologists have diverse and interesting careers. Biotechnologists can be hired to help develop new medicines and medical treatment options, assist in waste treatment or environmental remediation, or develop new characteristics in livestock and plants for agricultural use. Biotechnologists work in many different sectors, including hospitals and research facilities, private food or animal production companies, pharmaceutical companies, government agencies, and food processing plants. They come from backgrounds in science and engineering or a combination of several educational groups including chemistry, biochemistry, microbiology, life sciences, and pharmacy sciences.

Standards of Learning

Science: 5.1, 6.1, LS.1, LS.2, LS.10, BIO.5

Objective

Students will:

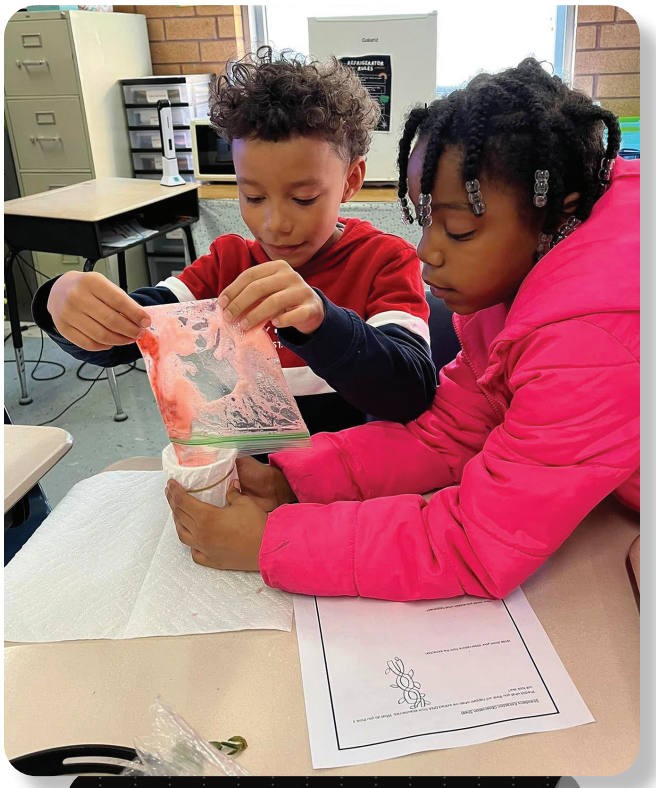
- Follow a process and extract DNA from living tissue.

Materials

- Strawberries
- Water
- Salt
- Blender
- Coffee filter
- Detergent
- Test Tube
- Rubbing Alcohol
- Wooden Stick

Procedures

1. Place the following ingredients into a blender:
   - **i.** 100 ml or ½ cup of strawberries
   - **ii.** 200 ml or 1 cup of water
   - **iii.** 1 gram or 1/8 tsp salt
2. Blend on high for 15 seconds
3. Strain the mixture through a sieve to remove the unblended material
4. Add 20 ml or 2 TBSP of detergent. Swirl to mix. Let sit for 5-10 minutes
5. Fill a test tube about 1/3 full with the mixture.
6. Add a pinch of enzymes (Meat tenderizer) to each test tube and stir carefully.
7. Tilt the test tube and slowly pour an equal amount of alcohol down the side of the tube so that it lies on top of the mixture.
8. Stringy DNA should appear at the boundary between the mixture and the alcohol.
9. Use a wooden stick or a hook to gently move the mixture up into the alcohol so that more DNA will precipitate out; you can also let the tube sit for 30 minutes or more.
10. You can keep the DNA indefinitely in a sealed container with alcohol or dry it on paper.



Resource Round-up

Background Knowledge

Agricultural by-products are essential in the lives of modern Americans. However, many people overlook the link between by-products and their commodity of origin. This growing lack of knowledge leaves consumers unaware that much of what they use beyond food and fiber has an agricultural origin. For more background knowledge, see Commodity Facts and Product Matches below.

Note: you may choose to use as many or as few of the suggested items and matches as you would like.

Standards of Learning

Science: 3.8, 4.8

Social Science: VS.13

Objective

Students will:

- Identify and match Virginia raised plants and animals with their products and by-products.

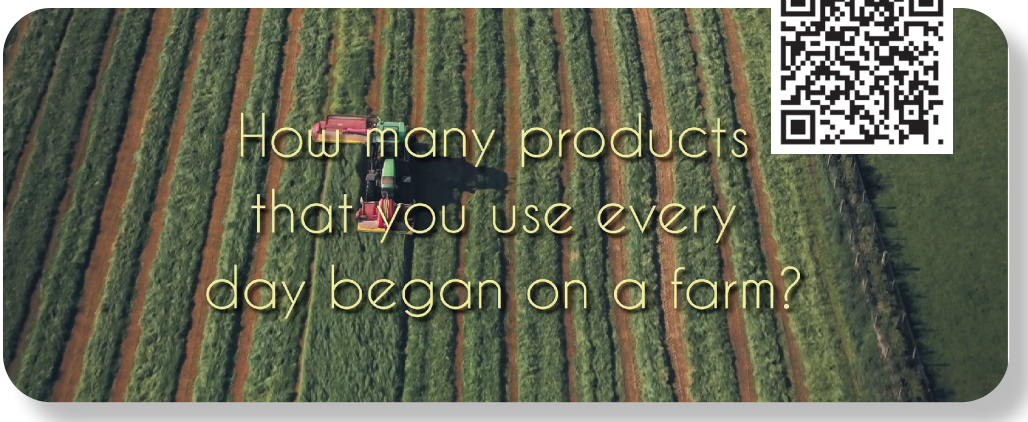
Materials

- **Pictures (please see Appendix) of crops and animals that are among the top 20 in Virginia:**
  - peanut, tomato, soybean, cotton, forestry (trees), dairy cow, chicken, sheep, corn, beef cattle, grape vines, apple trees, wheat, potato, pig
- Raw/Base Product Suggested **Items:**
  - Peanut
  - Tomato
  - Soybean
  - Cotton boll
  - Tree bark
  - Milk container
  - Egg
  - Wheat seeds
  - Grapes
  - Wool
  - Potato
  - Corn
  - Beef jerky
  - Apple
  - Bacon package
- **By Product Suggested Items:**
  - Grape jelly
  - Small piece of wood
  - Peanut butter (or wrapper)
  - Package of cheese
  - Ketchup
  - Container of chicken nuggets
  - Soy crayon or candle
  - Cotton fabric
  - Dollar bill
  - Rayon yarn
  - Yogurt container
  - Mayonnaise
  - Lotion
  - Lipstick
  - Box mashed potatoes
  - Corn cereal
  - Marshmallow or gelatin (Jello)
  - Apple juice box
  - Bread or box of pasta
  - Snickers bar (or wrapper)
  - Empty container of medicine/gelcaps

Procedure

1. Display pictures of plants and animals raised in Virginia.
2. Provide a bag of products which we use from the plants and animals.
   Ask students to match each crop with the appropriate plant picture. Next students should match the animal with the base product it is known for such as milk matches with the dairy cow. This is known as the raw commodity for both plants and animals.
3. Check for accuracy.
4. Discuss how sometimes consumers utilize resources in their original state – for instance, eating an apple from an apple tree. However, sometimes these natural resources are turned into products using capital and human resources.
   So, in the apple example, the apple has been picked and then sent to a processing facility where it is turned into apple sauce.
   With the remaining items challenge students to use reasoning and eduction to correctly link the raw commodities and their by-products.

See how agriculture affects you every day with Ag 24/7.



Resource Round-up (cont.)

Commodity Facts and Product Matches
(note: some by-products may be correctly matched with more than one raw product)

Peanut Plant – Peanut – Peanut Butter, Snickers Bar: Virginia grows a special variety of nut called Virginia-Carolinas. These peanuts have the largest kernels and account for most of the peanuts roasted and processed in-the-shell. When shelled, the larger kernels are sold as snack peanuts, they are also used in Snickers bars. Virginias are grown mainly in southeastern Virginia and northeastern North Carolina. A peanut is actually an underground pea, or legume, rather than a true nut.

Tomato Plant – Tomato - Ketchup: Virginia ranks 3rd nationally in fresh market tomato production (tomatoes grown to be enjoyed whole, rather than those grown to be processed into other products). This salad staple is grown predominantly on the eastern half of the state as well as in greenhouses and hydroponically (without soil). Tomatoes are planted after the last frost and will produce fruit in 65 to 75 days. Tomatoes come in many sizes, shapes and colors.

Soybean Plant – Soybeans – Soy Crayons, Soy Candle, Mayonnaise: Soybeans are an incredibly versatile plant which can be used in a wide variety of application – from human consumption, such as in tofu, mayonnaise and chocolate to animal feed, as well as non-food uses such as inks, dyes, insecticides, car seat foam, candles and even crayons. Prang Fun Pro makes a crayon that is 85% soybean oil. It took a team of chemists and product developers two years to bring this unique crayon to consumers. One acre of soybeans can make 82,368 crayons. Soybeans are farmed throughout Virginia and are the state's top crop.

Cotton Plant – Cotton Boll – Fabric, Dollar Bill: Cotton is planted in rows during the spring; about two months later, flowers develop from the buds. When the flowers die and fall off, they leave behind pods called bolls. After the bolls ripen and break open, the cotton fibers emerge. After the cotton is picked, it is sent to the gin for the seeds to be removed (there are 5 cotton gins in Virginia) and goes through a long process of cleaning and sewing before it can be used to make blue jeans and other clothing items. In addition to fabric, cotton fibers are also used in paper money. Cotton's seeds and hulls are useful as well, cotton seeds may be used in cooking oil while the hulls are ground up and used in animal feed.

Tree – Bark – Wood, Rayon Yarn: More than 5,000 products are made from trees. One is rayon, a silk-like fabric that was the first manufactured fiber. It's made from cellulose acetate, which comes from wood pulp. The cellulose is dissolved by chemicals, forced through tiny holes in a metal spinneret, and then twisted into silky yarn.

Dairy Cow (Holstein) – Milk – Yogurt, Cheese: The most widely recognized dairy cow is the Holstein, which has black and white spots. The spots are similar to people's fingerprints in that no two cows have the same pattern of spots. Dairy cows tend to look more "boney" because all of their energy is going to make milk, whereas beef cattle tend to be bulkier. Dairy farmers milk their cows at least twice a day, every day. Most dairies used automated milking machines, some even use robotics to maximize efficiency and cow comfort. One cow produces 90 glasses of milk a day, and 200,000 in her lifetime. In fact, a cow's udder can hold 25-50 pounds of milk! Diary is Virginia's third largest agricultural commodity.

Chicken – Egg – Mayonnaise, Chicken Leg/ Nuggets: There are several types of chickens grown in Virginia. Layers are grown to produce eggs. Broilers are raised to produce poultry products. It takes a chicken about 24 hours to produce one egg. It is very likely that the egg will be laid between 7 and 11 a.m. during the day. One chicken will lay approximately 250 eggs per year.

The color of a chicken egg is determined by the breeding and genetics of the hen and does not affect the quality of nutritional value of the egg.

Very generally speaking, a brown hen will lay a brown egg while a white hen will lay a white egg. The nutritional value of an egg is determined by the diet of the bird not the color of the egg. The diet of the bird also determines how yellow the yolk will be. If you crack open your egg to discover a dark yellow yolk, the hen was probably fed green vegetables. A medium-yellow yolk would indicate a diet of corn and alfalfa while a light-yellow yolk could be the result of eating wheat and barley.

Labels on eggs-
Cage-free — These hens are free from the confines of a cage, but this does not necessarily mean they are raised outside. More often, they are free to roam a barn or warehouse, but their living conditions can vary widely.
Natural — Anyone can use the term "natural" to describe their eggs, so this does not denote anything specific.
Free-range — This means hens are free to roam the outdoors at some point, but there is no regulation specifying how long is necessary.
Certified Organic — Hens have some access to the outdoors and are fed an organic vegetarian diet that excludes any pesticides, animal by-products, or genetically modified foods.

Sheep – Wool – Lotion, Lipstick/Chapstick: Wool from sheep contains lanolin, which helps the wool repel water. During processing, the lanolin is removed from the wool for use as a moisturizer in many soaps, facial creams and lotions.

Corn Plant – Dent Corn – Biodegradable Packing Peanuts, Corn Mug, Corn Cereal: According to the National corn Growers Association, there is a use for every part of the cornstalk-husks, kernels, an even the water that kernels are processed in. The vast majority of corn grown in Virginia is field corn, which is grown for animal feed. This is different from the sweet corn variety that people enjoy. Corn is a very starchy plant; the starch can be used in biodegradable plastics like a coffee mug, diapers, and packing peanuts.

Beef Cow (picture is of a black angus) – Raw Beef – Beef Jerky, Marshmallow/Gelatin: Beef cattle are raised across Virginia. Beef products are used for a variety of purposes; in fact, 99% of each steer is able to be used in products for consumers. In addition to the obvious items such as steak and ground beef, beef byproducts are also found in food items such as Jello, marshmallows, gum, and even gummy bears. Leather comes from cattle as well which are key in the manufacturing of footballs, basketballs and baseball gloves.

Grape Vine – Grapes - Jelly: Virginia's grape production has grown significantly over the past decade. The state ranks 5th nationally in grape production. Virginia grapes are predominately used in the production of wine, however jelly is more child appropriate.

Apple Blossom (note the pollinator) – Apple – Apple Juice: Virginia growers produce an average of 8 to 10 million bushels of apples per year. Apple varieties grown in Virginia include Red Delicious, Fuji, and Granny Smith. The majority of apples in Virginia are grown in the Shenandoah Valley area.

Wheat Plant – Wheat Seeds – Bread, Pasta: Wheat is a versatile small grain. It can be grown in the fall or spring and is used for animal food or sold for human use in breads and cereals.

Pig – Bacon Package – Medicine Package: Pork is the most widely consumed meat in the world. In addition to bacon, sausage, and pork chops, there are many different byproducts that come from pigs. Gelcaps, insulin and even heart valves are a couple of the medical byproducts from pigs. Similar to cows, pig byproducts may also be used in gelatin and leather.

Potato Plant – Potato – Box of Mashed Potatoes/Hash Browns: Farmers in Virginia typically produce between 3,000 and 4,000 acres of potatoes. Growers in the state produce high-quality red, white, yellow and russet potatoes. A large number of Virginia potatoes are grown on the Eastern Shore.

Mapping and Graphing Virginia Agriculture

Background Knowledge

Virginia is a unique state agriculturally, in that it produces a wide variety of crops and products. One of the reasons for this agricultural diversity is that Virginia's geography – including its topography, climate and soil, vary greatly from east to west. The eastern most region, the Coastal Plain, has a sandy soil favored by cotton and peanuts and a longer growing season than the western regions. Furthermore, the western regions of the state, including the Blue Ridge Mountains, Valley and Ridge, and Appalachian Plateau, have mountains and hills and less flat land than the Coastal Plain and Piedmont regions. Thus, one will find more row crops such as corn, soy, and wheat in the East and less in the West.

This lesson may be adapted and modified for multiple grade levels.

Standards of Learning

This lesson may be adapted for multiple grade levels covering various standards.

Social Science: VS.1, VS.13

Appropriate map skills for grades K-5

Objective

Students will:

- Provide examples of the states of matter
- Explain that corn may be used as a renewable resource.

Materials

- Outline map of Virginia's five regions, projected onto a screen, to then be drawn on a white shower curtain.
- Gridlines, projected onto a screen, to be drawn on top of state outline
- Various items representing things grown and raised in Virginia, see the Map of Virginia Agriculture for a comprehensive list. You may also choose to copy and cut out the items rather than using 3-D objects.
- Map of Virginia Agriculture (see Appendix or **virginia.agclassroom.org**)

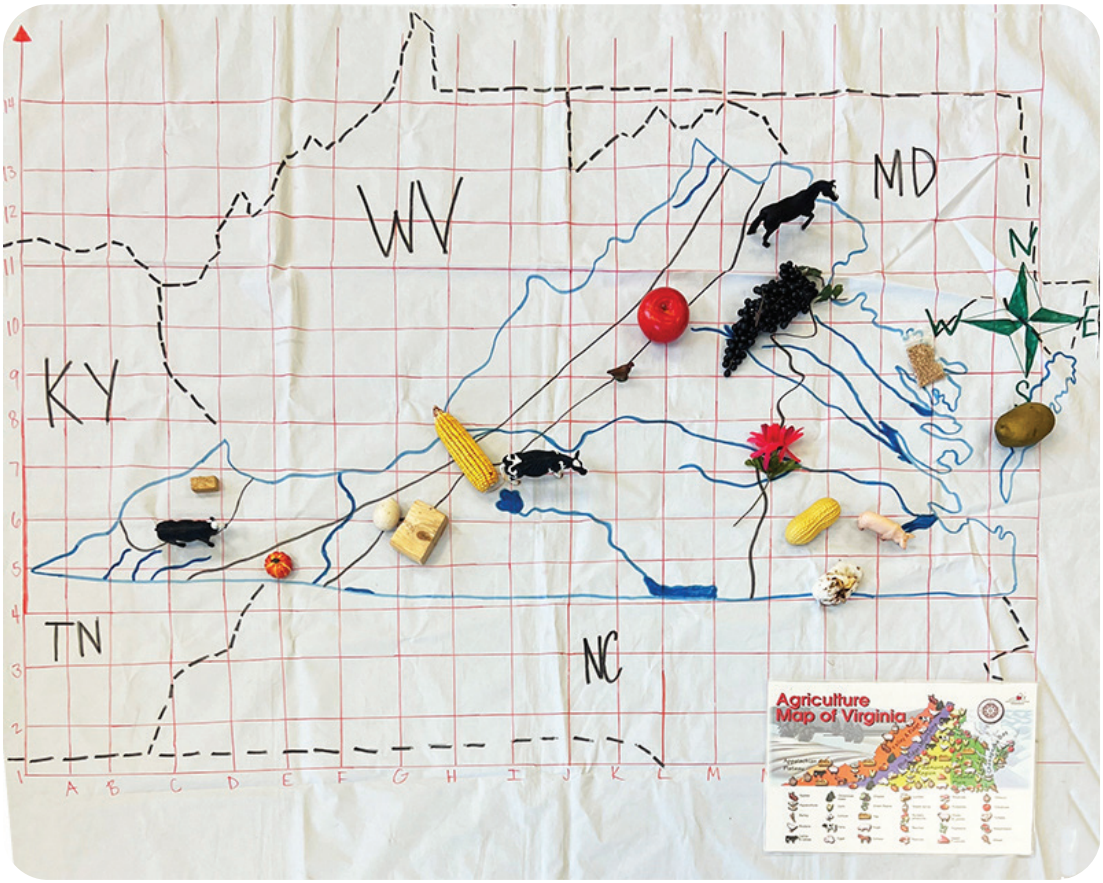
Check out AITC's interactive Virginia regions map. Click on each region for a brief overview of geography, climate and products.

Procedure

1. Enlarge the outline map of Virginia's five regions using an overhead projector and trace it onto the shower curtain. You may also choose to draw in major rivers as well as add stars marking where you live as well as the capital of Richmond.

2. Using a ruler, create a coordinator graph on top of the map. Label your X and Y axis.

3. Map lesson suggestions:
   - Leave the map empty and have students place commodity items on the map using specific coordinate pairs (such as an "Ag Battleship").
   - Place all of the symbols on the map and have students provide you with the coordinate pairs for each symbol.
   - Locate the Fall Line.
   - Label neighboring states.
   - Ask one student to stand on the map and practice giving cardinal directions telling them where to move.
   - Compare and contrast products seen in the eastern part of the state with the west. Discuss why these difference exist.



Ag Tag

Background Knowledge

Agriculture is Virginia's largest industry by far. Advances in agricultural productivity have led to abundant and affordable food and fiber throughout most of the developed world. The diversity of Virginia agriculture affords you many different potential pictures to use with this lesson.

In this activity, students wear "Ag Tags" on their back with pictures of agricultural products. Other students write adjectives describing the pictures, and students must guess the identity of their "mystery product." This activity is a wonderful opportunity for students to expand their use of adjectives while learning more about Virginia agriculture.

Standards of Learning

English: 1.12, 2.10, 3.8, 4.7, 5.7

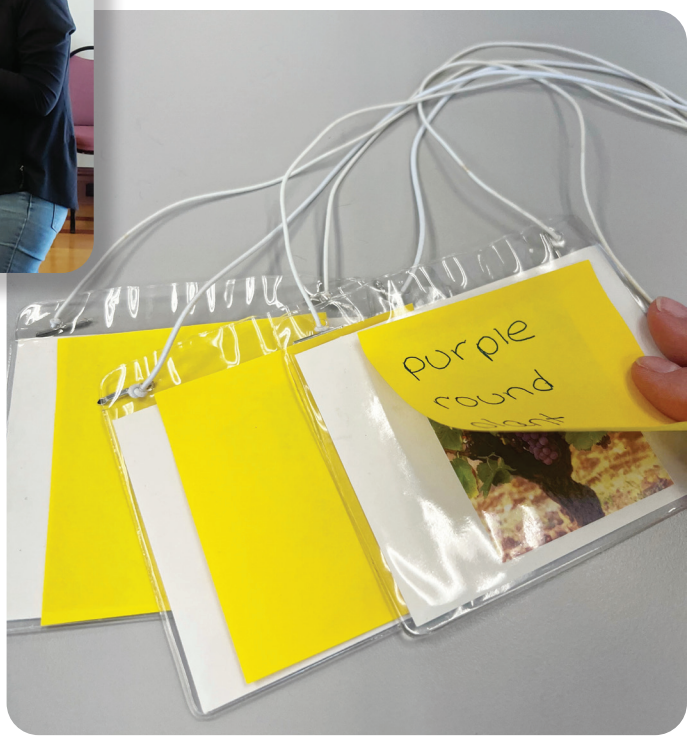
Objective

Students will:

- Expand listening, speaking, and written vocabulary
- Use descriptive words and adjectives
- Build prewriting skills to generate ideas

Materials

- Name badge holders
- Pictures
- Post-It notes



Procedure

1. Construct nametags prior to doing the activity with students.
   - Insert an agriculture related picture into each hanging name badge
   - On the outside, cover the picture with a large post-it note.

2. Hand out the nametags and instruct students not to look at the picture below their post-it. Have them place the nametag around their neck so the picture is on their back.

3. Students should walk around the room and have others look at their picture and write a descriptive phrase or word on the post-it that gives a clue as to what is pictured.

4. After time is called, tell the participants to take off and read the post-it and try to guess their picture.

5. After guessing, tell the participants to look at their nametag to see if they guessed correctly.

Suggested Pictures

- Wildlife (snakes, groundhogs, squirrels, birds, etc.)
- Farm animals (cows, chickens, pigs, horses, etc.)
- Crops (corn, peanuts, pumpkins, apples, soybeans, tobacco, etc.)
- Forestry (soil, trees, etc.)
- Farming/gardening equipment (tractors, shovels, calculators, etc.)
- Products (milk, eggs, cheese, etc.)

Extension

- This game can be adapted to fit any unit of study. Simply change out the pictures to match the topic being studied.
- Have students take the adjectives / adverbs given to them during the game and write a descriptive paragraph about the item in the picture, incorporating the adjectives / adverbs on their tag.
- This lesson can be modified for younger students by using clear page protectors and construction paper, rather than name badges and post-its, as this will give a larger area to draw pictures instead of writing words.

Apple Earth

Background Knowledge

How much of the Earth's land is available to feed, clothe, and fuel the world's population? Explore this question as well as the importance of soil as a natural resource in "Apple Earth."

Farmers are keenly aware of the importance of soil and its value as a natural resource. Thus, they may adopt one or several ways to protect the soil. Examples include conservation tillage, wind breaks, contour farming, and crop rotation. As the population increases, vital cropland is being covered and lost from production. Thus, today's farmers must find ways to be more efficient and produce more food on less land, especially as it is projected that the world's population will reach 9 billion by 2050. In the 1960s, one farmer supplied food for 25.8 persons in the U.S. and abroad. Today, even as the population increases but the number of farms decreases, one farmer supplies food for 166 people in the U.S. and abroad. Modern technology that creates farming efficiency is crucial to generating a food supply to sustain the growing world. In order to feed 9 billion by 2050, the world's farmers will have to grow about 70% more food that what is currently produced.

Standards of Learning

Science: 1.8, 3.6, 3.8, 4.8

Objective

Students will:

- Understand that natural resources are limited
- Discuss the importance of managing natural resources
- Identify the effects of humans and weather on land

Materials

- Apple
- Knife

Procedure

1. Cut the apple into four equal parts and do the following:
   - Remove three parts –

   These three parts represent the portion of the earth covered by water.
   Locate the Earth's oceans on a map.
   - The part that is left, one-fourth of the earth, represents land.

2. Cut the remaining portion (quarter) in half lengthwise and do the following:
   - Remove one part –

   This half represents areas of Earth where plants we eat can't grow because the climate is too hot or cold.

   What places are too hot? (identify major deserts)

   What places are too cold? (identify the poles and places where the ground is frozen)

3. Cut the remaining portion crosswise into four equal parts and do the following:
   - Remove three parts –

   These three parts represent land that is too rocky or steep, too marshy, or where something has already been built.
   The fourth part – only 1/32 of the earth – represents the land that can be used for growing crops to sustain more than seven billion people and all of the billions of animals in their care.

4. Ask students if we can grow plants all the way into the core of the earth. Once they have identified that this is not a possibility, discuss what part of the earth we do use for planting and growing crops (topsoil on the crust of the earth).

5. Peel the skin off of the remaining section and do the following:
   - Show the skin –

   This tiny piece of the apple represents the topsoil – the part of the earth where plants grow. This small amount of soil is important for growing all of the food needed to feed all of the people and animals on our planet

6. Discuss the importance of soil conservation and ways that erosion can be prevented.

Water Cycle in a Bag

Background Knowledge

Water is vital for all living things, including farmers. There are several things that farmers can do to conserve it and keep it clean. For example, they might utilize watering systems that put water directly at the plants' roots - this allows more water to get straight to the plant instead of evaporating. They may also employ vegetative or conservation

Correctly identify and label buffers, which are trees or grasses that are planted in between fields the steps of the water and waterways. These act as a barrier, helping keep pollutants out of cycle the water. Additionally, cover crops are a way that farmers take care of the land and water. Cover crops, such as rye grass or clover, protect the soil from wind and water erosion. Further, cover crops help keep nutrients in the soil and out of the waterways.

Standards of Learning

Science: 3.7

Objective

Students will be able to:

- Correctly identify and label the steps of the water cycle

Materials

- Sandwich size plastic bags
- Various colored permanent markers
- Small aquarium rocks (optional)
- Water
- Water cycle image (attached)

Procedure

1. Hand out the picture of the water cycle to your students as well as permanent markers and a plastic bag.

2. Tell them to place the picture of the water cycle inside the bag and close the bag. Using the permanent markers, have your students trace over the picture including the numbers.

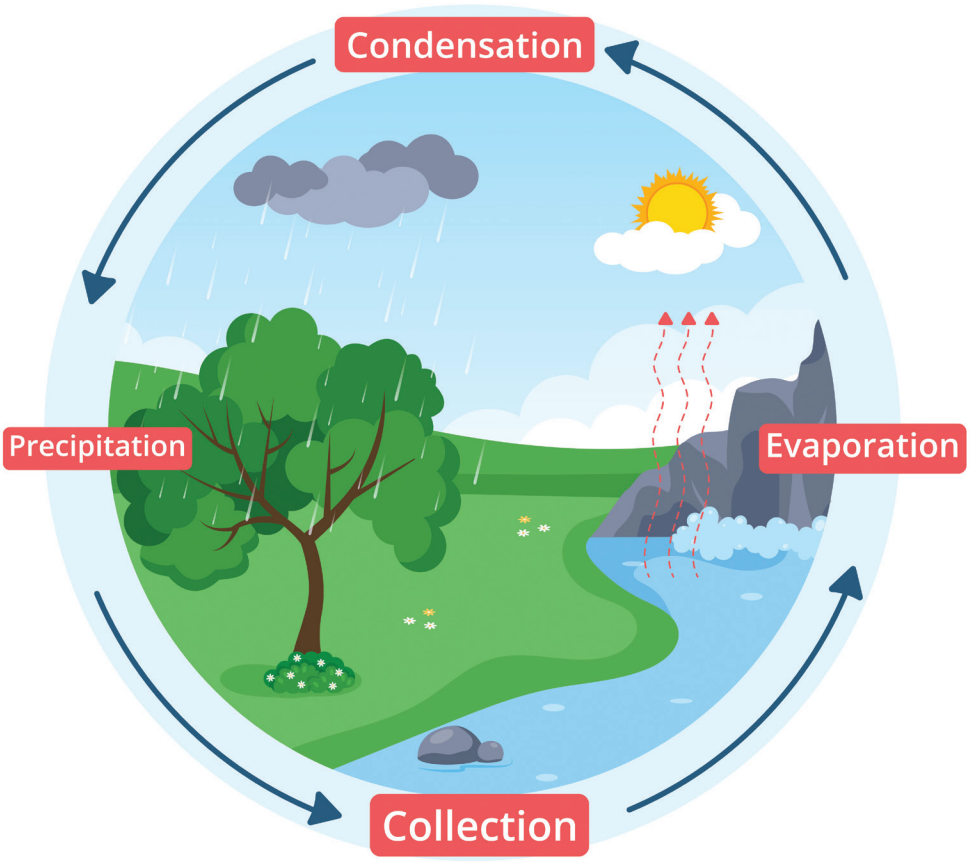
3. After they trace everything, they remove the picture from the bag.

4. Next have students number 1-5 on a sheet of paper. Have them correctly identify the numbers from the water cycle picture with the steps of the water cycle. Make sure to remind them that the water cycle steps need to be in order.

5. Instruct your students to add 2 tablespoons of aquarium rocks to the bottom of their bag. Next they need to add ¼ cup of water to their bag.

6. Lastly, using wide, clear packing tape, affix the bag to a window in direct sunlight.

7. Explain to your students how they will be able to watch the water cycle work as the sunlight heats up the water in the bag.



Soil Your Undies

Background Knowledge

The soil under our feet is much more than just dirt. In fact, it is an eco-system full of life. In this lesson students will observe decomposition as organic matter (100% cotton underwear or t-shirt) is broken down by organisms living in soil. One teaspoon of healthy soil contains more microbes than there are people on the planet. These microbes break down organic matter like cotton, while also helping soil retain nutrients and moisture. Healthy soil is vital to farmers as well as all plants, animals and humans. Farmers implement healthy soil practices such as reduced or no-till, planting cover crops and nutrient management. Such practices benefit both the crops as well as the soil and water.

A day in the life of a soil scientist

Standards of Learning

Science: 3.5, 3.6, 3.8

Objective

Students will be able to:

- Understand the impact of soil organisms on soil health and the environment.
- Define decomposition.

Materials

- White 100% cotton underwear or t-shirt
- Shovel
- Landscape flag or label

Procedure

1. Select a location on the school grounds to bury your 100% cotton underwear or t-shirt. Take a picture of the item before burial
2. Dig a hole and plant the underwear at least 4 inches in the ground. Place a landscape flag or label to mark the site. Record observations about the site, such as—What color is the soil? Can you see any organisms in the soil?
3. Wait 60 days. Have students make hypotheses about what they think the underwear will look like. Carefully, dig them up and compare them to both the "before" picture as well as students' hypotheses.
4. Discuss the results. Remember, the more decayed the underwear the more active and healthy the soil.

Extension

Bury two pairs in different spots and compare the results.

Milk Jug Composting

Background Knowledge

Soil is a vital natural resource as the majority of our food depends on it for growth and production. Natural soil is something that comes from rotting plants and other materials. Rotting plant materials make the soil rich in nutrients. This is a natural cycle called decomposition. Composting speeds up and intensifies decomposition.

Worms are very beneficial to healthy soil, in fact, they are often called the gardener's best friend. They act as nature's recyclers because they eat both living and dead plant material. When they digest this material it is passed back into the soil as nutrient rich "castings." Castings contain much nitrogen, potassium, and phosphorus that are nutrients that are essential to plant growth. Each day an earthworm produces its weight in castings. Further, as worms burrow into the soil, they aerate the soil which loosens it and allows plant roots to deepen in the soil.

Standards of Learning

Science: 3.1, 3.6, 3.8, 4.1, 4.8

Objective

Students will:

- Explore how organic material decomposes and becomes part of the soil.
- Create a compost jug in order to investigate decomposition.
- Understand how worms play an important role in nutrient rich soil.

Materials

- Clear, plastic gallon jug
- 2 plastic plates, 1 with holes
- Gravel
- Bedding mixture: shreded paper, peat moss, grass clippings, leaves, dryer lint, etc.
- Water
- Red worms (can be purchased via Amazon)
- Chopped fruit and vegetable scraps

Procedure

1. Cut the top from a clean, clear plastic milk jug. Poke holes in the bottom of the jug for drainage. Poke small holes on the sides for air flow. Place a plastic plate or dish underneath to collect excess drainage.
2. Add 1 inch of gravel to the bottom of the jug. Poke holes in a plastic plate and place over the gravel. Create a simple bedding mixture with shredded, moist newspaper and lay on top.
3. Add 3-4 worms. Red worms will eat the garbage.
4. Sprinkle some fruit and vegetable scraps on top of the worms. You may choose to put the scraps in a food processor or blender first to make them easier for the worms to eat. Cover with more bedding materials. Spritz with water from a spray bottle, being careful not to soak the contents.
5. Place a plastic garbage bag on the top so to control the moisture level and provide darkness. You may remove it daily to gently stir and record observations. Add water and food as needed.

Compost Lab Extension

Learning Focus

Investigate the importance of moisture in composting.

Directions

1. Start with 2 short soda bottles (4 inches) that have their tops already cut off. Fill each of them with a mixture of grass clippings, leaves, vegetable scraps, and shredded newspapers. Fill until it is 1 inch from the top.
Spray one bottle with water until it's very damp. Leave the other bottle dry.

2. Take a tall soda bottle (9 inches) and turn it upside down over the damp bottle. Slip the tapered end of the taller bottle inside the shorter one and push them together, making sure the seal is snug. Repeat the same thing to the dry bottle. Make sure both soda bottle cylinders fit tightly. If the compost bottle with the holes
(see below) begins to dry out, take it apart and spray more water on it.

3. On the WET composting bottle, use a thumbtack to gently punch 15 small holes into the top cylinder of the bottle. Do NOT punch any holes in the other compost bottle. Use tape to seal the connection between the 2
bottles.

Recording:

1. What are the environmental differences between your two compost bottles? Is that going to impact what will happen in the compost bottles? Explain. _____
_____
_____
_____
_____

2. Predict what you will see in each bottle over time. _____
_____
_____
_____
_____

3. Predict what you will see in each bottle over time.3. Over the next 7 days, you will record your observations on the chart. At the end of 7 days, which compost bottle promoted faster decomposition? Explain. _____
_____
_____
_____

Growing the Three Sisters

Background Knowledge

Native Americans adapted to their environment and used a variety of agricultural techniques to grow food. Three principal crops of the Eastern Woodlands Native Americans were corn, beans, and squash. These "Three Sisters" were planted together because of the ways in which they benefit each other. The corn stalk serves as the pole for the beans. In turn, the beans help add nitrogen back to the soil; this is very helpful to corn, which requires a lot of nitrogen. The squash provide ground cover that helps the soil retain moisture and prevent weed growth. Thus, the Native Americans, who recognized the relationship between the plants, used the natural harmony between them to feed their communities. It is not surprising that many legends and Native American folktales reference the Three Sisters.

Modern agriculture still utilizes these same principles. A typical crop rotation in Virginia is corn, soybeans, and wheat Crop rotation allows farmers to maintain and improve soil fertility. It can also help with pest/weed management.

Standards of Learning

Social Science: 2.5, VS.2

Science: 1.4, 2.4, 4.2

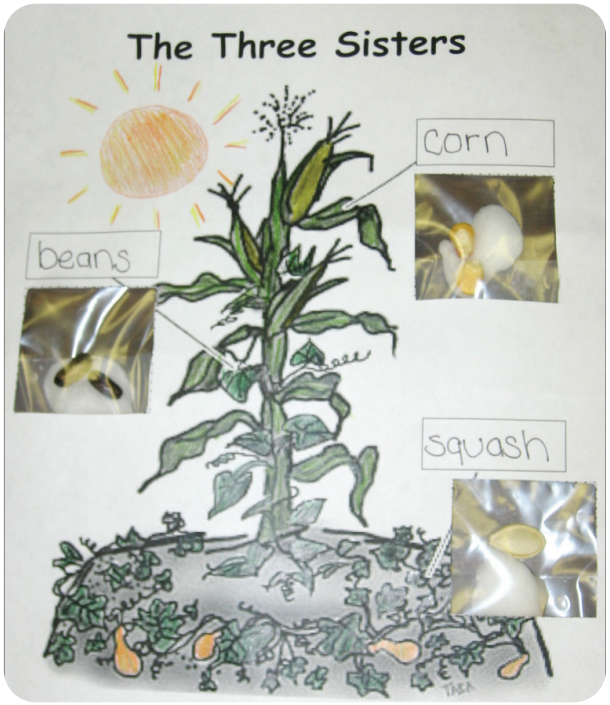
Objective

Students will be able to:

- Identify the "Three Sisters" and describe their role in Native American life
- Investigate seed germination

Materials

- Three Sisters handout, attached
- Crayons/coloring pencils
- Scissors
- Jewelry bags
- Corn, bean, and squash seeds
- Cotton balls
- Tape



Learn more with this virtual field trip to Henricus Historical Park.

Procedure

1. Begin the lesson by asking students to imagine what life would be like with no grocery stores, malls, etc. Where would they get food and clothing? Remind them that this is what life was like long ago. The Native Americans had to rely on and adapt to their environment to supply them with food, clothing, and shelter. Tell them that the three staple crops of the Eastern Woodlands Indians were corn, beans, and squash. These were harvested in the summer. The Native Americans recognized that when grown together these crops helped and assisted each other.

2. Pass out the Three Sisters handout. Have students label the rectangles with the correct "sister"). Point out that the beans are using the corn as a trellis, while the squash is spread out over the ground giving it shade and preventing erosion.

3. Have students cut out the squares with the dashed lines, to make "windows."

4. Give each student 3 jewelry bags, 3 cotton balls, and one of each type of seed.

5. Place small cups with water around the room so that students can share.

6. Review the conditions necessary for seed germination: water, oxygen, and warmth.

7. Instruct students to dip their cotton balls in the water then place one in each bag.

8. Next, place a seed in each bag and close them.

9. Match the seeds with the correct labels and tape them behind the "windows."

10. Lastly, students may color the picture.

11. You may choose to hang the sheets in the window so that seeds receive the warmth of the sun. Have students observe the seed germination over the next few days.

Extension

Students observe and record data related to the seed germination. Which seed germinated first? How long did each seed take to germinate? Measure the growth of each plant after one week. Graph the results.

All Three Sisters information below is from **www.birdclan.org/threesisters.htm**

The Three Sisters

The three sisters are Corn, Beans, and Squash. They are seen as the three beautiful sisters because they grow in the same mound in the garden. The Corn provides a ladder for the Bean Vine. They together give shade to the Squash. The Cherokee till the mound three times.

The Native American story of the Three Sisters vary from tribe to tribe. This story below is taken from an oral account by Lois Thomas of Cornwall Island, compiled by students at Centennial College and found in "Indian Legends of Eastern Canada."

A long time ago there were three sisters who lived together in a field.

These sisters were quite different from one another in their size and way of dressing. The little sister was so young that she could only crawl at first, and she was dressed in green.

The second sister wore a bright yellow dress, and she had a way of running off by herself when the sun shone and the soft wind blew in her face.

The third was the eldest sister, standing always very straight and tall above the other sisters and trying to protect them. She wore a pale green shawl, and she had long, yellow hair that tossed about her head in the breeze.

There was one way the sisters were all alike, though. They loved each other dearly, and they always stayed together. This made them very strong.

One day a stranger came to the field of the Three Sisters - a Mohawk boy. He talked to the birds and other animals - this caught the attention of the three sisters.

Late that summer, the youngest and smallest sister disappeared. Her sisters were sad.

Again the Mohawk boy came to the field to gather reeds at the water's edge. The two sisters who were left watched his moccasin trail, and that night the second sister - the one in the yellow dress - disappeared as well.

Now the Elder Sister was the only one left. She continued to stand tall in her field. When the Mohawk boy saw that she missed her sisters, he brought them all back together and they became stronger together, again.

Nitrogen Needs

Background Knowledge

George Washington Carver is known as the "Peanut Wizard" because of his extensive work with peanuts. In fact, he developed over 300 different uses for peanuts. He did this work as a way of encouraging southern farmers to grow peanuts as a rotation crop. At this time in the south, cotton was "king." However, cotton uses a lot of nitrogen from the soil in order to grow. When planted in the same field year after year, the soil will become depleted making the soil unproductive and the crop poor. Crop rotation is now commonly used by farmers to keep soil healthy. A typical crop rotation in Virginia will see corn, followed by soybeans and then either wheat or other grass cover crop.

Peanuts, like soybeans, are a legume and help replenish the nitrogen in soil when planted. Nitrogen is in all living cells – plant, animal, and human. It is an essential nutrient for plant growth. Like phosphorus and potassium, nitrogen is a primary macronutrient because plants absorb large amounts of them in order to grow. Plants need nitrogen because it makes proteins, fruits, seeds, and chlorophyll to carry out photosynthesis. If a plant is lacking nitrogen you might observe it lacking flowers and root growth. Furthermore, a plant that has adequate nitrogen will be better able to utilize water from rainfall and soil moisture. Farmers take soil samples that are studied at a laboratory to determine the amount of usable nitrogen already in the soil. This helps the farmer determine whether or not he needs to apply additional nitrogen, in the form of fertilizer, to the soil.

Standards of Learning

Science: 1.1,1.4, 2.1, 2.4, 4.1, 4.2, LS.1, LS.5

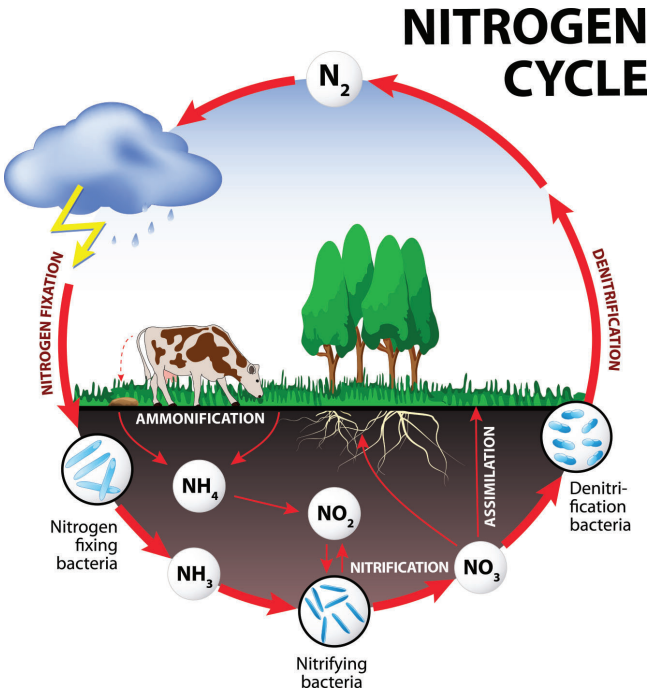
Objective

Students will:

- Identify the conditions necessary for seeds to germinate
- Investigate the importance of nitrogen to plan growth

Materials

- Clear plastic cups
- Bean seeds
- Soil
- Paper napkins (bright colors other than white allow you to better observe seed growth)
- water



Procedure

1. Review with students the conditions necessary for plant growth and germination.
2. Discuss how George Washington Carver encouraged farmers to rotate their cotton crops with crops such as peanuts, soybeans, or sweet potatoes that would replenish the nitrogen in the soil, thus keeping the soil healthy.
3. In partners or groups students will plant 6 bean seeds two different ways. The first way they will plant their seeds is to fill a clear plastic cup with soil. Then place three bean seeds about an inch down in the soil and up against the side of the cup (the seed should be visible when looking at the side of the cup).
4. Next take another clear plastic cup and open up a paper napkin. Push the paper napkin down into the cup so that it covers the bottom and comes up the sides. Use a spray bottle to wet the napkin at the bottom of the cup (the water will wick up the sides).
5. Place the remaining 3 seeds in between the napkin and cup so that the seeds are visible when looking at the side of the cup.
6. Have students record observations about the different growing environments as well as make predictions about seed germination and plant growth.
7. Over the next 2-4 weeks (until the plants have developed leaves) have students record the amount of water that they give each cup and continue to observe and record plant growth and appearance.
8. Point out that the leaves on the plants grown in soil are darker green than the leaves on the plant grown without soil because they received nitrogen.

Seed Buddy

Background Knowledge

A seed is the start of a new plant. Seeds are covered in a seed coat that keeps the tiny leaves and roots inside safe from harm. A seed contains food for the new plant to use until it grows big enough to reach sunlight and the plant can make its own food. A seed's germination is dependent upon moisture, temperature, and light. Many of the foods we eat come from plants, and most of these plants start out as seeds. Farmers plant seeds to grow everything from the tomatoes that are made into spaghetti sauce to the wheat that is made into bread to the watermelon that you eat at a picnic. A seed can be both the start of a new plant and the start of a new meal!

In order for a seed to germinate, or sprout, it needs warmth, moisture, and air. Seeds remain dormant and will not germinate until the proper conditions are present. Seeds vary greatly in germination rate, amount of time needed for plant maturity, and growing conditions. Some seeds, like radishes, only need 4-6 weeks to grow to maturity, while corn and soybeans require several months. The purpose of this activity is to provide students with an opportunity to observe the germination process.

Standards of Learning

Science: K.7, 1.4, 2.4

Objective

Students will:

- Investigate the germination of seeds
- Investigate plant needs

Materials

- Seeds, any type will work
- Small baggie (jewelry size – one per student)
- Cotton balls (one per student)
- Pipe cleaners
- Hole punch
- Water

Procedure

1. Define the term germination and discuss what a seed needs in order to germinate.

2. Provide each student with a small jewelry-sized plastic baggie with a hole punched at the top, above the zipper. Instruct students to blow a puff of air into the baggie as seeds need air.

3. Wet a cotton ball to give the seed moisture.

4. Place the cotton ball inside the small baggie.

5. Place two seeds on top of the dampened cotton ball.

6. Zip the baggie shut and place a pipe cleaner through the punched hole so that students may wear their seed buddies in order to keep them safe and warm. Alternatively, you can use the pipe cleaners to hang the seed buddies in a window.

7. The seed should soon swell up from moisture and germinate in about 3-5 days.

8. Over the next 3-5 days make observations and record in a science journal.

Take a virtual field trip to Battlefield Farms, Inc. greenhouse operation and see how marigolds are germinated, grown, and sent to consumers.

Extension

Use old seed packets as germination journals.

1. Provide each student with a packet of seeds. This activity works best when seed packets are paper rather than see through plastic.
2. Cut open the top of packet. Remove seeds.
3. Cut open the bottom and right side of packet. The open packet will form a book cover.
4. Provide each student with a 8 ½ by 11 piece of paper.
5. Fold paper in half horizontally. Fold in half vertically. Open the paper and cut on the folds.
6. Stack the four pieces of paper and fold in half to form a book.
7. Insert book pages into seed packet book cover. Staple in the center.
8. Use the book to record the steps of the germination process.

Water Bottle Hydroponics

Background Knowledge

All plants need water, light, nutrients, oxygen, and space to grow to full maturity. Typically plants get the nutrients they need from the soil. The three most important nutrients for plant growth are nitrogen, potassium and phosphorous. It is possible, however, and sometimes even advantageous to grow plants without soil; this is called hydroponics.

Hydroponics is particularly useful in places where there might not be enough quality soil or space. In addition to allowing growers to plant and harvest their crops in a smaller area, hydroponics actually uses less water than traditional growing methods, and because plants are grown inside they can be grown and harvested year round. When a plant is grown using hydroponics its roots are submerged in a nutrient-enhanced water. The addition of the nutrients is important because plants would normally get these from the soil.

Procedure

1. Cut the top off of your water bottle just underneath where it begins to curve upwards.
2. Mix your liquid fertilizer with water according to package directions and then fill the bottom of your water bottle.
3. Invert the top of the water bottle (with cap off) into the bottom. Place a large cotton ball or other growing medium into the whole and stretch so that it is touching the water solution.
4. Place 1-2 seeds on the top of the growing medium and observe growth over the next 1-2 weeks.

Extension

Conduct an experiment in which one system utilizes fertilizer and the other does not. Use the attached "Learn More about Plant Nutrients" handout to guide your observations.

Standards of Learning

Science: 1.4, 2.4

Objective

Students will:

- Understand what plants need to grow. Investigate the germination of seeds.
- Define hydroponics and define how it is different from traditional growing methods.

Materisla

- Scissors
- Plastic water bottles (this is a great way to use items from a class recycling bin)
- Seeds
- Water
- Cotton balls (larger size recommended) or other growing medium such as rock wool
- Fertilizer, such as Floragro

Learn More about Plant Nutrients

Nutrients are essential to plant growth. Nitrogen (N), phosphorous (P), and potassium (K) are primary macro-nutrients. The positive effects of the presence of these nutrients at optimum levels and the negative effects of deficient or excess levels can be visually observed in plants.

Nitrogen (N):

- **Optimum:** Plants are rich green and the protein content increases.
- **Deficient:** Plants are stunted and light green in color, the lower leaves are yellow, and the stem is slender.
- **Excessive:** Plants have a very lush foliage with sappy, soft stems and flowering is delayed.

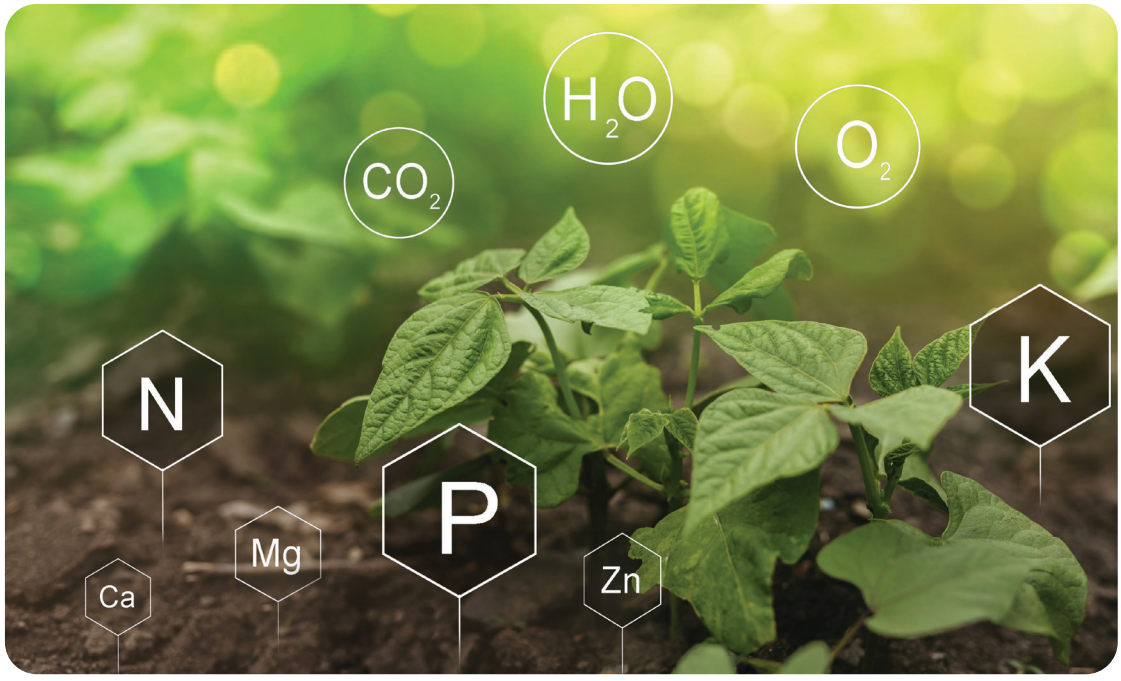
Phosphorous (P):

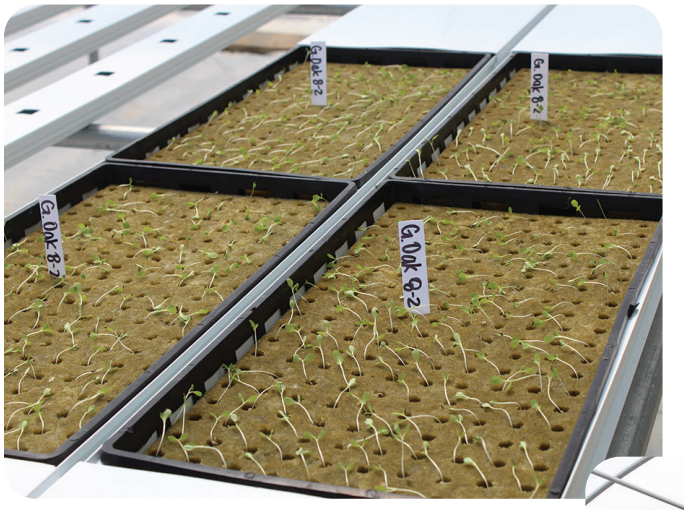
- **Optimum:** Phosphorous stimulates root formation and growth, giving the plants a vigorous start. Phosphorous also stimulates flowering and aids in seed formation.
- **Deficient:** Plants have slower growth and delayed flower and pod development, the leaves are dark green and dull, the root system is poor with little branching, and the stem is slender.
- **Excessive:** Plants have very lush foliage with sappy, soft stems and flowering is delayed.

Potassium (K):

- **Optimum:** Potassium imparts increased vigor and disease resistance.
- **Deficient:** Leaves can be mottled or chlorotic, small necrotic spots may appear between veins or near leaf tips and margins, the flowers do not achieve vibrant yellow color, and the stem is slender.
- **Excessive:** Plants have dark foliage, stiff stems, and leaf branches.

Information sourced from Investigating Plant Physiology with Wisconsin Fast Plants™ found at https://fastplants.org/wp-content/ uploads/2017/02/WFPphysiology-06web.pdf.





Visit Shore Breeze Hydroponics on Virginia's Eastern Shore and learn how they grow lettuce hydroponically.

Discover an Acre

Background Knowledge

A seed is the start of a new plant. Seeds are The purpose of this activity is to provide students with a concrete and visual example of area and perimeter. Further, it will give examples of real-world applications for these math concepts in the context of designing and laying out a garden. In this lesson students will use one foot square pieces of construction paper to "plant" their garden. This is similar to a popular school garden layout – the Square Foot Garden. Square Foot Gardens are popular among classes and schools because each class or student can be assigned their own square within which to plant and harvest. It is also an optimal size for a child to use.

As mentioned in the Extension portion of this lesson, different plants can be planted within each square foot. Some will be planted one plant per foot, while others can be planted as 4, 9, or 16 per foot. The number of plants per square foot is dependent upon how large the plant gets. Because plants need sunlight, soil, water, and space to grow, planting too many in a square would cause them to not have adequate access to these growing requirements.

Standards of Learning

Math: 3.8, 4.7, 5.8

Objective

Students will:

- Investigate perimeter and area using 12 inch squares to model a garden
- Measure the perimeter and area of a given space

Materials

- 12" x 12" construction paper (at least one square per student)

  Note: scrapbooking paper is typically already cut to 12 inch squares and is an excellent option for this activity

- Optional for Extension Activity: plant images with planting guidelines (included in Appendix), small pom-poms

Procedure

1. Tell the children that today they are going to be planting a garden using colored sheets of paper.

2. Give each student several 12" x 12" pieces of construction paper. Explain each piece of paper is a square foot. It measures 1 foot x 1 foot. The area of one piece of paper is one square foot.

3. Clear a space in the classroom or go to a room such as the cafeteria where students will be able to lay all of the squares on the floor and view them.

4. Ask the students to place each square on the floor one at a time to create their garden. The field can be any shape but each square must touch at least one side of another square.

5. When all the squares are laid down, tell students that you now want to construct a fence around your garden. What do you need to know about the garden to know how many fencing supplies to purchase?

    a. To answer this question students need to determine the perimeter of their garden by counting the outside edges. Bring in circulars from stores that sell landscaping materials, ask them how much the fencing supplies would cost. Is this the most cost effective shape for the garden? Point out that you will save money by having the smallest possible perimeter.

    b. Next, find the area by counting the squares.

6. Collect the squares and have the students create a new garden (different shape). Again calculate the area and perimeter of the garden. Point out that while the perimeter may change, area does not change simply because the shape changes.

Extension

- Bring in ad circulars from home improvement stores that carry fencing supplies. Ask students to determine fencing costs using the circulars.

- Utilize the seed packet images and planting guidelines located in the Appendix. Glue onto the construction paper squares.

    - Use colored pom-poms as seeds and have students "plant" according to the planting recommendations. Discuss why different plants have different planting recommendations.

    - Discuss different ways the garden can be sorted using the plant pictures.

- Take students outside with the 12" x 12" pieces of construction paper to find square footage and/or perimeter of common objects such as a sidewalk, door, window, a picnic tabletop, a seesaw, or a parking space.

Become a Landscape Designer

Background Knowledge

Landscape designers combine a knowledge of horticulture and plants with design principles to create outdoor spaces for their clients. Landscape designers receive formal training to receive an associate or bachelor's degree at a community college, or four-year college/university. Areas of study include horticulture or plant science, math, science, and design. Many landscape designers develop areas of specialty during their career. Some specialty areas are home landscapes, corporate landscapes, native plant gardens, children's gardens, etc.

In this lesson students will become landscape designers who are tasked with designing a school garden according to set parameters. The lesson is written using a scale of 1 inch equaling 4 feet, for younger students you may modify they requirements to not require them to convert to scale.

Standards of Learning

Math: 3.8, 4.7, 5.8

Objective

Students will:

- Utilize area and perimeter to design a school garden.

Materials

- 11 x 17 white or graph paper
- Pencils
- Rulers
- Scissors
- Card Stock or construction paper of various colors
- Glue
- Clear Tape

Task Overview

All gardens have requirements that vary depending on the type of garden that is being designed. Vegetables and fruits require well-drained soil, at least six hours of sunlight each day, and a water source. For this exercise, you will be designing a vegetable and fruit garden for a school taking into account the requirements below. Use the scale 1" = 4'.

1 inch = 4 feet

Requirements

Fence

The designated area for the school garden measures 40 feet x 60 feet. The area needs to be enclosed by a fence to prevent wildlife (deer, rabbits, and groundhogs) from enjoying the produce. Choose an appropriate fence and enclose the garden with as much space as possible for growing.

Raised Beds

Raised bed sizes: height: 12 – 18 inches, width: 2 – 3 feet, length: up to 12 feet. Number of beds required: Build at least two raised beds for each grade level at the school (K – 5). Space between the beds should be 4 feet.

Water

All gardens require water. Rain is the best water source, but sometimes supplemental water is needed from an outdoor spigot or rain barrel. With one of these sources of water, the garden may be watered with an overhead sprinkler, soaker hoses, hand-held garden hoses, or watering cans. Show a water source in the garden.

Compost

Recycling is important in the garden! Compost is a mixture of decomposed organic materials that may be used as plant fertilizer and to improve soil's physical, chemical, and biological properties. It is commonly prepared by decomposing plants, food waste, recycling organic materials, and manure. Designate an area for a composter or compost pile that measures 6 feet by 6 feet.

Vegetables

These are great vegetables to grow in a school garden because they mature in a short amount of time and can be grown in the fall or spring. Avoid vegetables that have a longer growing season unless students and teachers are in school during the summer. Choose the vegetables you want for your garden beds.

Optional fruit plants:

- **Blueberries:** Blueberry bushes can be planted as close as 3 feet apart to form a solid hedge, or space them up to 6 feet apart so they grow individually. If you plant in rows, allow 8 to 10 feet between the rows. Mature bushes range in size from 1 – 8 feet tall and 2 – 10 feet wide depending on the variety.

- **Thornless Blackberries:** Thornless Blackberries can be planted as close as 3 feet apart to form a solid hedge, or spaced up to 6 feet apart so they can grow individually. Bushes mature at 3 – 6 feet tall by 3 – 6 feet wide depending on the variety.

- **Strawberries:** Strawberries can be planted as close as 1 foot apart, but keep in mind that they send out runners and can mature as much as 2 feet wide or more. Their mature height varies from 4 inches to 1 foot depending on the variety.

Vegetables	# plants per sq. ft. grown tomaturity	Days to maturity	Comments
Beets	16	50-70	Harvest small outer leaves for salads
Brocolli	1	50-65	Side shoots may be harvested after main head is removed.
Brussle Sprouts	16	50-70	Harvest lower tiny heads when they are 1 – 2" in diameter. Plant will continue to grow.
Lettuce, Leaf	4	45-60	May have more plants/square foot if harvested as baby lettuce.
Peas	6	55-85	Harvest when seeds are plump in the pods.
Radishes	16	25-45	Harvest before they become too large.
Spinach	9	45-60	May have more plants/square foot if harvested as baby spinach. Eat raw or cooked.
Turnips	4	45-70	Greens/foliage may also be cooked and eaten.

Apple Tree Engineering

Background Knowledge

There are over 7500 types of apples in the world, with 2500 of them grown in the United States. With so many apple choices, its not surprising that Americans eat more apples than any other type of fruit.

Apple trees are not typically grown from seed because it takes about 15 years for an apple tree grown from seed to produce an apple. Instead, most apple trees are grown by budding or grafting onto rootstocks—sections of tree roots still attached to a part of the tree trunk. Budding involves taking one bud from an existing tree branch and attaching it under the bark of a rootstock with special grafting tape or glue. Grafting is similar, but rather than a single bud, a section of a stem with multiple leaf buds is attached to the rootstock with grafting glue and tape. Grafted or budded trees usually grow in a nursery for about one year before being planted in an orchard.

Standards of Learning

Science: K.1, K.7, 1.1, 1.4

Objective

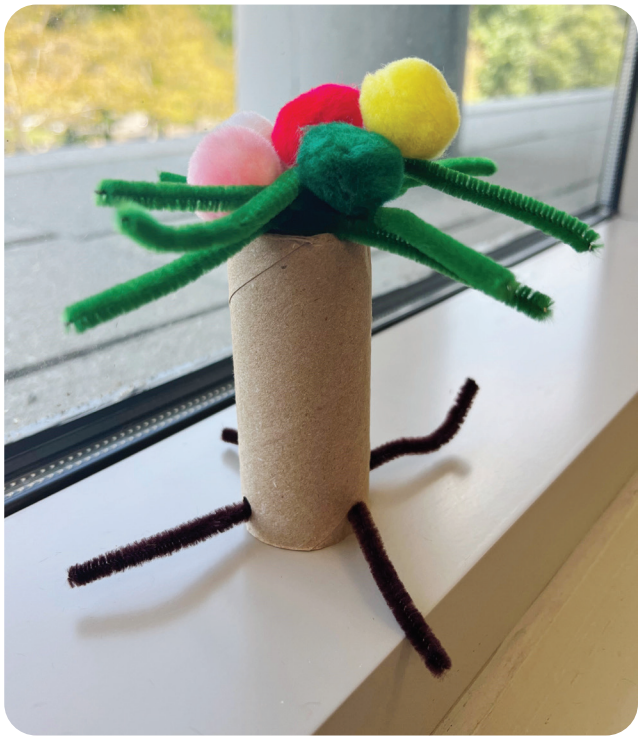
Students will:

- Identify the parts of an apple tree while using engineering principles to solve a task.

Materials

- Paper towel rolls, cut into halves or thirds
- Hole punch
- Brown and green pipe cleaners
- Green, white, yellow, & red

Modify and extend this lesson for older students by challenging them to consider how would you package your fruit for transportation and sale? Find out by becoming a Food Packaging Specialist in this lesson.



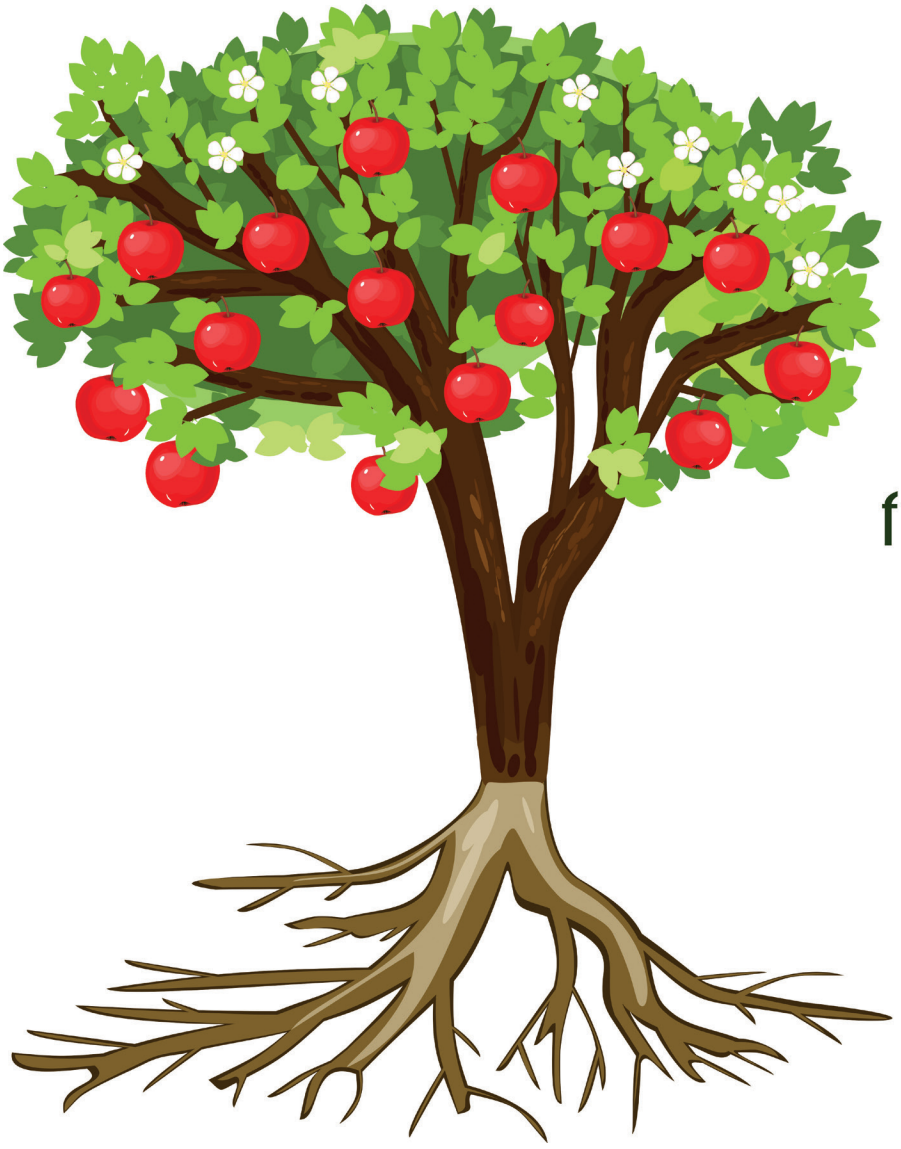
Procedure

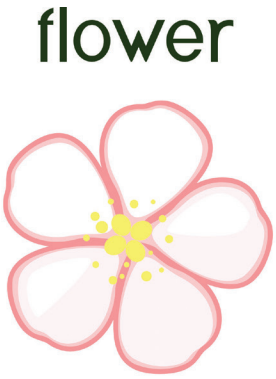
1. Organize students into pairs or groups and give each group a piece of paper towel roll, a hold punch, pipe cleaners and pom-poms.

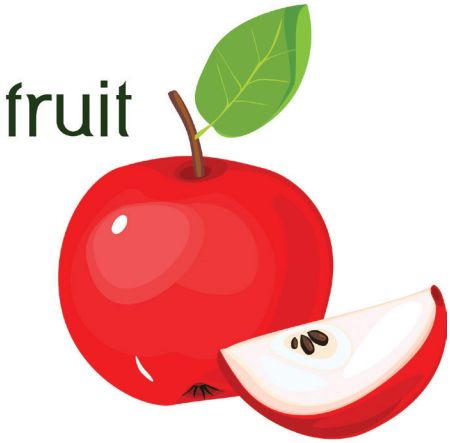
2. Begin by identifying the parts of the tree, the paper towel roll is the trunk, punch several holes in the bottom and thread brown pipe cleaners through the holes, these are the roots.

3. Point out that apples come in a variety of colors but first they each start as an apple blossom, this is what the white pom-poms will represent. After the blossom has been pollinated it will bear fruit. This fruit may be green, red, yellow or pink, this is what the remainder of pom-poms represent.

4. Task students with building an apple tree using the cardboard trunks and the green pipe cleaners as branches. Challenge them to see which group's tree can hold the most "apples and blossoms."







seed

Become an Ag Engineer

Background Knowledge

An engineer is someone who uses math and science to solve a problem. An agricultural engineer applies these concepts to the farm. They might design farm machines (such as a new tractor or tool) or facilities (such as chicken house or milking parlor) to maximize the efficiency of the farm.

Task

You will apply what you have learned about measurement and perimeter to design a farm for your assigned livestock. Each animal will have a different set of needs and requirements in order to be kept most comfortable. There may be more than one correct way to create the requirements.

You will work in a group to design your blueprint first on a piece of construction paper by measuring and then drawing the lines for your fences, enclosures, and other features.
Next you will use construction paper to create your own 3-D farm model. Each group will complete one model.

Farms will be inspected by the Farm Safety Inspector to be sure that you have followed the appropriate specifications.

Standards of Learning

Mathematics: 3.8, 4.7. 5.8

Objective

The student will be able to problem solve using measurement skills:

Materials

- 11x17 white paper
- Construction paper
- Rulers
- Pencils
- Scissors
- Glue

Group One: Dairy Cows

Farm Requirements

Dairy cows spend a lot of time in the field grazing. In fact, they spend about 6 hours a day eating both the grass in the pasture and the feed provided by the farmer. In order to keep both the dairy herd and the nearby streams and waterways healthy, you need to construct a fence to keep the cows out of the waterways. **The fence must have a perimeter of 130 centimeters.**

Because you have fenced the cows out of the stream you need to provide them with a watering trough where they can have access to plenty of fresh water throughout the day. Dairy cows drink 25-50 gallons of water each day! **The watering trough must have a perimeter of 20 centimeters.**

Dairy cows are milked at least twice a day, every day. The building where they are milked is called the milking parlor. Most milking parlors are automated, some are even robotic! You will need to construct a milking parlor so that the cows can be milked.
The perimeter of the milking parlor must be 60 centimeters.

Learn about Temple Grandin and how she used her experience as a person with autism to engineer better solutions for moving cattle.

Group Two: Equine (Horses)

Farm Requirements

Horses love to eat short, juicy grass. They also eat hay (which is dried grass), especially in the winter or in their stable. Some horse owners might also supplement their horse's diet with barley, oats, or other types of feed. In a field, horses might spend most of their day grazing. To keep them from wandering off you need to build a fence around pasture.

The perimeter of the fence must be 100 centimeters

Horses typically have a stable where their grooming equipment might be kept. Horses should be groomed frequently with a comb, brush and hoof pick (which removes dirt, stones, and other objects from the feet). The horse owner might also keep the horse's saddle and blankets in the stable.

The perimeter of the stable must be 60 centimeters.

In addition to being used for storage, most stables have stalls for each horse. A horse might sleep in his stall (although horses generally sleep standing up!) or go there to be protected from bad weather. There are 3 horses on your farm and each needs their own stall in the stable.

Each stall must have a perimeter of 24 centimeters.

Group Three: Chickens

Farm Requirements

The majority of chickens raised in Virginia and the nation are raised in climate-controlled barns, called houses, designed to maximize the chicken's health and welfare by providing a balanced diet, clean water, comfortable bedding, and fresh air. On many farms a computer monitors the temperature and air in the chicken house and automatically adjusts to keep the birds comfortable. This information can also be delivered straight to the farmer's phone. Your farm will have two chicken houses on it.

The perimeter of each chicken house must be 80 centimeters.

Chicken houses have automated feeders and water dispensers located throughout them. This provides the chickens with access to nutritionally balanced food and fresh water. Place a feeder as well as a water dispenser in each chicken house.

The perimeter of each feeder must be 12 centimeters and the perimeter of each water dispenser must be 8 centimeters.

Group Four: Beef Cattle

Farm Requirements

Beef cattle spend much of their day grazing in pastures. Many beef farmers utilize rotational grazing where cattle are cycled to different pastures, sometimes called paddocks, over time. This practice helps ensure the quality of both the grass and the soil.
Divide your farm into 3 equivalent paddocks.

The total outside perimeter of your farm must equal 110 centimeters.

You will need to provide a source of clean drinking water for your cattle. In addition to being sure that the water level remains stable, you will also need to ensure that it does not freeze in the winter.Place a water trough in one of your paddocks.

The trough must have a perimeter of 20 centimeters.

Your beef cattle will need a barn or shelter. This will give the cows shelter from the weather as well as a place for routine health procedures.

The perimeter of the shelter should be 46 centimeters.

Teacher's Notes

Virginia Standards of Learning

Mathematics: 3.8, 4.7, 5.8

Extensions/Adaptations

- Take students on a virtual field trip to the farm by visiting AITC's Farm Life 360 on YouTube. These 360 degree videos allow viewers to explore various farms including a chicken house, beef cattle pasture, and milking parlor.
- Read The Girl Who Thought in Pictures by Julia Finley. The true story Temple Grandin shares how she used her unique mind to connect with animals and bring innovation to the agricultural world.
- You may bring in toy farm animals or toy fencing for students to include in their models.
- Directions can be modified to include other math concepts such as radius/ circumference. For example, the cows' water trough could be directed to made with a radius of 5 centimeters.
- You may choose to convert the measurements to standard (rather than the metric that was used).
- This project can be done individually, in pairs or groups. There is generally more than one way to design each en- closure which makes it interesting when the different groups demonstrate various ways of designing their farms.
- Younger students may omit perimeter measurements and instead focus on simply creating a farm to meet their animals' needs. You may also substitute shape requirements for measurements (for example: Farms must include 2 rectangles, 3 squares, and 1 circle).
- Challenge students to use toothpicks and pipe cleaners to build a nest for a hen. Use hard candies as the "eggs" and see whose nest can hold the most eggs. Note that this type of nest is most common in a small poultry operation. Chickens in larger scale breeding operations will have man-made "nests" where they lay their eggs. These have a slanted bottom with flap that allow the egg to be deposited straight to the incubator.

Extension: Engineering for Eggs

Provide students with any or all of the following materials:

- Paper bags
- Paper plates
- Pipe cleaners
- Construction paper
- Scissors
- Tape

Challenge students to use the materials listed above to build a nest for a hen. Use hard candies as the "eggs" and see whose nest can hold the most eggs. Note that this type of nest is most common in a small poultry operation.

Chickens in larger scale breeding operations will have man-made "nests" where they lay their eggs. These have a slanted bottom with flap that allow the egg to be deposited straight to a conveyor belt that leads to the incubator. You may choose to have older students design this type of nest. Tell them that they must remember to consider how the egg will drop without breaking.

Become an Agricultural Engineer: Primary Version

Background Knowledge

An engineer is someone who uses math and science to solve a problem. An agricultural engineer applies these concepts to the farm. They might design farm machines (such as a new tractor or tool) or facilities (such as chicken house or milking parlor).

Task

An engineer is someone who uses math and Farmers must provide for their animals' basic needs of food, water, space, and shelter. Each animal will have a different set of needs and requirements in order to be kept most comfortable. There may be more than one correct way to create the requirements.

You will use construction paper to create your own 3-D farm model. Each group will complete one model.

Farms will be inspected by the Farm Safety Inspector to be sure that you have followed the appropriate specifications.

Group One: Dairy Cows

Farm Requirements

Dairy cows spend a lot of time in the field grazing. In fact, they spend about 6 hours a day eating both the grass in the pasture and the feed provided by the farmer.

Include 3 circle bales of hay on your farm. Have a small, medium, and large bale.

Dairy cows drink 25-50 gallons of water each day! **Make sure your cows have plenty of fresh water by including a rectangle water trough.**

Dairy cows are milked at least twice a day, every day. The building where they are milked is called the milking parlor. Most milking parlors are automated, some are even robotic! You will need to construct a milking parlor so that the cows can be milked.
Your milking parlor should have 4 corners.

Standards of Learning

Mathematics: 1.MG.2, 2.MG.4

Objective

The student will be able to use knowledge of geometric shapes to problem solve.

Materials

- 11x17 white paper
- Construction paper
- Crayons
- Pencils
- Scissors
- Glue

Learn more about what an agricultural engineer does.

Group Two: Equine (Horses)

Farm Requirements

Horses love to eat short, juicy grass. They also eat hay (which is dried grass), especially in the winter or in their stable. Some horse owners might also supplement their horse's diet with barley, oats, or other types of feed. In a field, horses might spend most of their day grazing. To keep them from wandering off you need to build a fence around pasture.

The fence should have 2 short sides and 2 long sides.

Horses typically have a stable where their grooming equipment might be kept. Horses should be groomed frequently with a comb, brush and hoof pick (which removes dirt, stones, and other objects from the feet). The horse owner might also keep the horse's saddle and blankets in the stable.

The stable should have 4 equal sides.

In addition to being used for storage, most stables have stalls for each horse. A horse might sleep in his stall (although horses generally sleep standing up!) or go there to be protected from bad weather. There are 3 horses on your farm and each needs their own stall in the stable.

Place 3 rectangle stalls in your stable. Include a small, medium, and large stall.

Group Three: Chickens

Farm Requirements

The majority of chickens raised in Virginia and the nation are raised in climate-controlled barns, called houses, designed to maximize the chicken's health and welfare by providing a balanced diet, clean water, comfortable bedding, and fresh air.

Build 3 rectangle chicken houses of equal size.

Chicken houses have automated feeders and water dispensers located throughout them. This provides the chickens with access to nutritionally balanced food and fresh water.

Place a circle feeder as well as a circle water dispenser in each chicken house. The feeder should be larger than the water dispenser.

Chicken a la Coin Flip

Background Knowledge

This lesson is designed to provide students with the knowledge of and experience with genetics and to teach students how to use the tools used by breeders such as the Punnett Square. By the end of this lesson, students will be able to correctly identify the parentage of a pullet or cockerel as demonstrated by the completion of at least two Punnett Squares which predict the observed traits.

As you learn more about and compare breeds of chickens, you will notice many different characteristics which are a result of genetic variation within the domestic chicken species. Skin color, feather color, feather patterns and textures, body size, and egg shell color are all characteristics you can see. These are known as phenotypes. Some genetic characteristics you cannot see by simply looking at a chicken, but you can measure these traits by keeping good records. Examples include rate of growth and egg production. These characteristics are particularly important to poultry farmers. Farmers research the genetic characteristics of chicken breeds and choose the best breed or breeds for their farm.

Standards of Learning

Life Science: LS.10

Objective

Students will:

- Be able to determine the phenotype of a trait based on the genotype in a monogenetic simple cross

Materials

- "Chicken a la Coin Flip" Student Sheet
- "Chicken a la Coin Flip" Trait Key, coins
- "Punnett Practice Problems" Student Sheet

Procedure

1. Hand out one penny and one copy of "Chicken a la Coin Flip Student Sheet" to each student group.

2. Hand out one copy of "Chicken a la Coin Flip Trait Key" to each group. This sheet will need to be printed in color.

3. Have students complete the "Chicken a la Coin Flip" activity. This activity features a list of single allele dominant/recessive traits in chickens. Students each flip a coin to signify one set of alleles. Heads represents the dominant allele, tails represents the recessive allele. By combining their flips with another student, students will have a list of genotypes. Students are then to illustrate the phenotype of their cross on the "Blank Chicken Coloring Sheet." Students can then compare their cross with other crosses in the class and notice the variety of offspring which can originate from one set of parents.

4. Once a student is done drawing and coloring their "chicken," have them hang it on a board or wall which has been designated the "chicken coop."

5. Hang two copies of the "Chicken a la Coin Flip Parents" above the "Chicken Coop." Have students reflect and discuss the diversity of the offspring coming from the same two parents. I.e. "Do any two chickens (who aren't from the same partnership) have the exact same set of traits?"

6. Have students complete the "Punnett Practice Problems" sheet. This sheet requires students to complete various parts of Punnett Squares. These squares are based on crosses from Reginald Punnett's work.

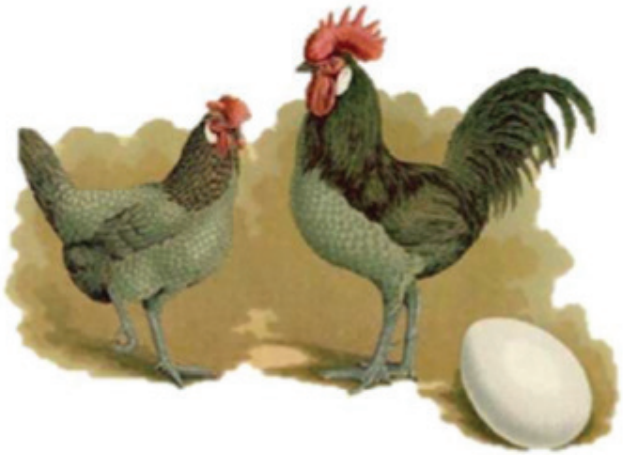
Credit

Chris Kniesly, Virginia Agriculture in the Classroom 2019 Teacher of the Year

Name: _____ Period: _____

Chicken a la Coin Flip

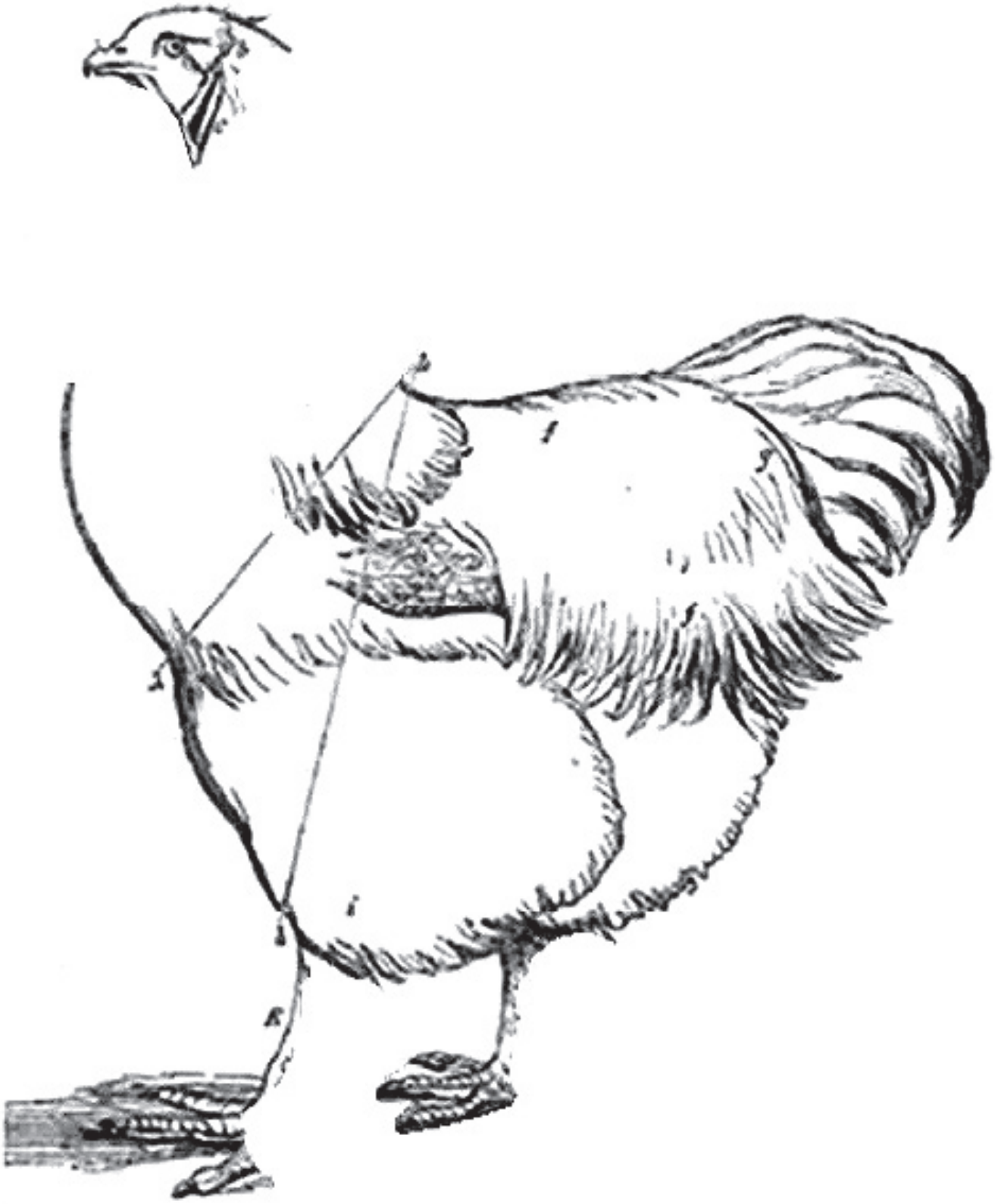
Background: In Mendelian genetics, a hybrid cross is a cross where both parents have identical phenotypes as a result of identical genotypes which are heterozygous for each trait. Hybrid crosses were used by George Mendel, and later Batesono and Saunders, to demonstrate that some traits were dominant over others. The number of possible outcomes in a multi-trait hybrid cross is part of the reason for the diversity of living things.



Directions: For each of the listed traits, flip two coins, one coin for each parent. On the chart below, record the number of "heads" and the number of "tails." Then determine what traits your chicken would have if "heads" were the dominant genes and "tails" were recessive genes.

Trait	Coin 1 (Mother)	Coin 2 (Father)	Genotype of Offspring	Phenootype of Offspring
Crest				
Muffs & Bears				
Vulture Hocks				
Polydactyl				
Frizzled				
Neck Feathering				
Fibromelanosis				
Comb Type				
Feather Color				

Directions: On the opposite page, use the "Chicken Template" to illustrate and color your chicken.



Chicken a la Coin Flip Trait Key

Homozygous Dominant	Heterozygous	Homozygous Recessive
 Figure 10. Sultan's Head, Male (Ideal). 1-1, V-shaped Comb; 2, Crest; 3, 3, Muffs; 4, Beard.	 Figure 10. Sultan's Head, Male (Ideal). 1-1, V-shaped Comb; 2, Crest; 3, 3, Muffs; 4, Beard.	 Figure 8. Pea Comb, Profile (Ideal).
Crested (C_rC_r)	Crested (C_rc_r)	No Crest (c_rc_r)
 Figure 10. Sultan's Head, Male (Ideal). 1-1, V-shaped Comb; 2, Crest; 3, 3, Muffs; 4, Beard.	 Figure 10. Sultan's Head, Male (Ideal). 1-1, V-shaped Comb; 2, Crest; 3, 3, Muffs; 4, Beard.	 Figure 8. Pea Comb, Profile (Ideal).
Muffs and Beard (M_bM_b)	Muffs and Beard (M_bm_b)	Clean Faced (m_bm_b)
		
Clean Legged (VV)	Clean Legged (Vv)	Vulture Hocks (vv)
		
Polydactyl, 5 toes (P_oP_o)	Polydactyl, 5 toes (P_op_o)	Standard, 4 toes (p_op_o)

Homozygous Dominant	Heterozygous	Homozygous Recessive
		
Frizzled (FF)	Frizzled (Ff)	Standard Feathering (ff)
		
Naked Neck (N_aN_a)	Naked Neck (N_an_a)	Standard Feathering (n_an_a)
		
Fibromelanosis (F_MF_M)	Fibromelanosis (F_Mf_M)	Standard Pigmentation (f_Mf_M)
		
Rose Comb (RR)	Rose Comb (Rr)	Single Comb (rr)

Feather Color

There are many genes in chickens which affect feather color. To simplify this complex process, the effect of four monogenetic color traits are choesn below. Select ***one*** and use it to determine your "chicken's" feather color.

Homozygous Dominant	Heterozygous	Homozygous Recessive
		
White Feathers (II)	White Feathers (Ii)	Wild Type Feathers (ii)
		
Silver Feathers (SS)	Silver Feathers (Ss)	Gold Feathers (ss)
		
Black Feathers (P_gP_g)	Blue Feathers (P_gp_g)	Splash Feathers (p_gp_g)
		
Wild Type Feathers (LavLav)	Wild Type Feathers (Lavlav)	Buff Feathers (lavlav)

Name: _____ **Period:** _____

Punnett Poultry Problems

Backgrounds: William Bateson, Edith Rebecca Saunders, and Reginald C. Punnett were pioneers in the field of genetics and heredity. Their work helped popularize the earlier work of an Austrian botanist named Gregor Mendel, who developed principles of hybridizing garden peas. Bateson, Saunders, and Punnett worked with peas as well, however a vast majority of their work and discoveries dealt with the domestic chicken.

Directions: Use the Punnett squares to solve the problems below> Be sure to write the genotypic and phenotypic rations.

"By crossing two forms exhibiting antagonistic characters, crossbreds were produced... (The crossbred's) inability to transmit both of the antagonistic characters, is the central fact proved by Mendel's work. ... the zygote formed by the union of a pair of opposite allelomorphic gametes we shall call a heterozygote." - Bateson and Saunders, 1902

Repeat one of Mendel's crosses by crossing a purebred tall plant (TT) with a purebred short plant (tt) to create heterozygotes.

_____ **X** _____

_____ **TT:** _____ **Tt:** _____ **tt**

_____ **Tall:** _____ **Short**

Next cross two of the offspring from your last cross to create the "F_1" generation of Mendel's experiment.

_____ **X** _____

_____ **TT:** _____ **Tt:** _____ **tt**

_____ **Tall:** _____ **Short**

Graphing My Plate

Background Knowledge

My Plate is a nutritional guide published by the United States Department of Agriculture (USDA). It serves as a tool to encourage students to make healthy food choices. Eating a variety of foods including protein, grains dairy, fruits, and vegetables will ensure that your body has the nutrients it needs.

In this lesson students will be analyzing food labels that they have collected at home. These may include such things as the label off of a jar or bottle or a cut out ingredient list from a boxed or bagged product. Prior to the lesson challenge each student to bring in at least 5 labels representing foods that they may eat in a typical week. You may choose to allow them to make their own label for raw foods such as apples or carrots by drawing a picture and labeling the item on a piece of paper.

Standards of Learning

Health 1.1, 1.2, 2.2, 3.1, 4.1

Math: 3.8, 4.7, 5.8

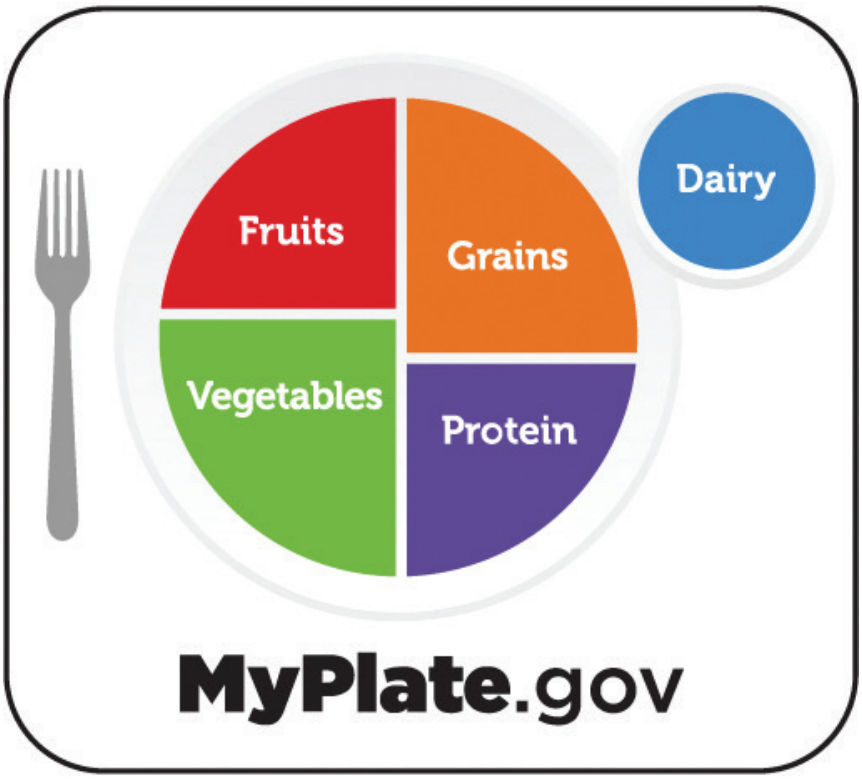
Objective

The student will:

- Understand the nutritional components of the My Plate food guide.
- Draw a bar graph and develop conclusions regarding it.

Materials

- My Plate poster(s)
- Food labels
- 1" square graph paper
- Crayons or markers



Procedure

1. Divide students into groups of 3 or 4 to represent a "family."

2. Give each group a set of labels in no particular order.

3. Have each group sort their labels into the 6 food groups using the main ingredient in each item. Point out that by reading the ingredient list you can determine the top ingredient in the product as it will be the one listed first. You may choose to have a 7th "food group" for miscellaneous items such as soft drinks and "junk food."

4. Using one inch square graph paper, have students create a bar graph, showing the foods eaten by their "family".
   One square inch will equal one label for each category. Color the squares to coordinate with the colors of My Plate.
   a. Orange = grain; green = vegetable; red = fruit; blue = dairy; purple = protein (meat/beans)

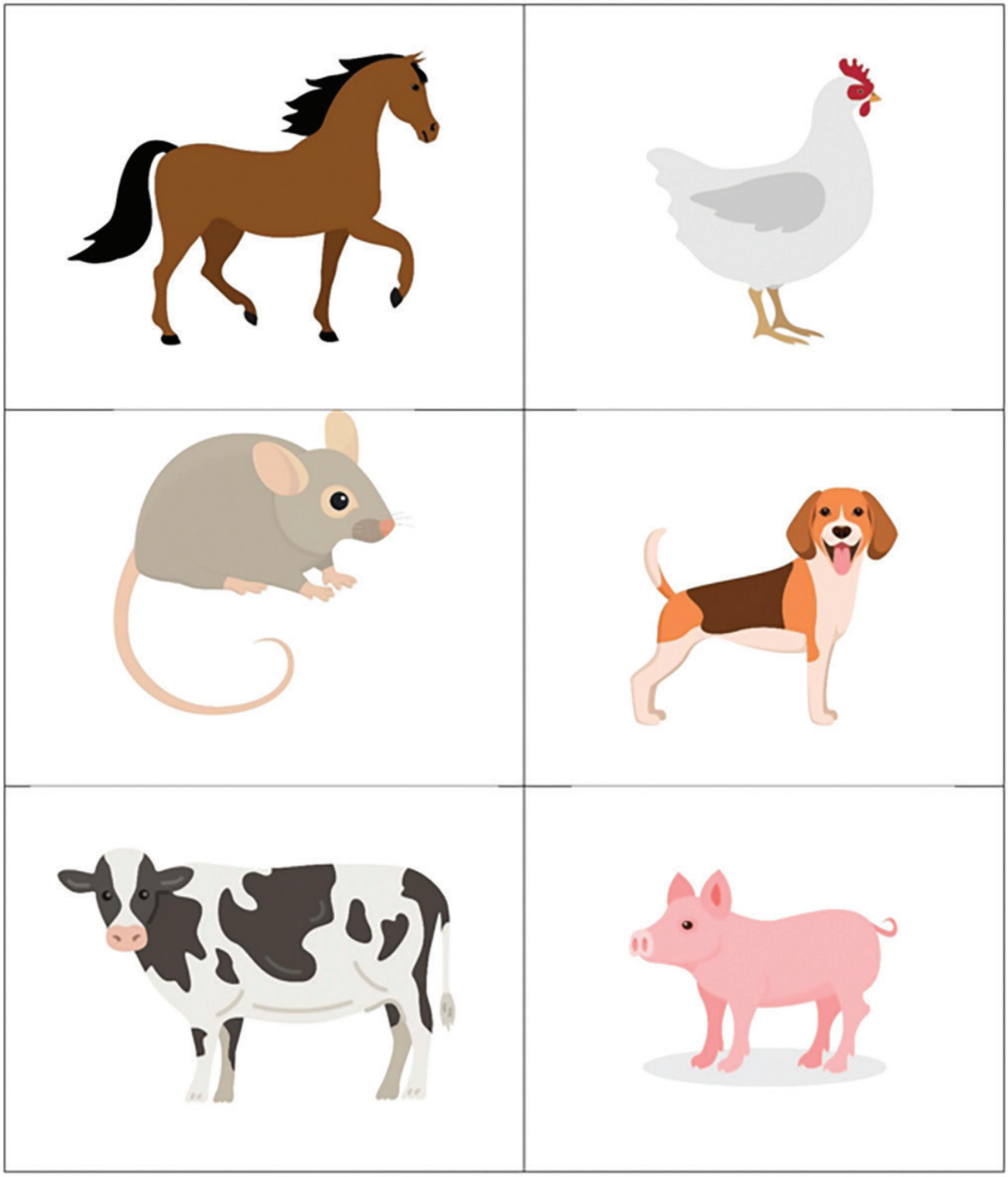
5. Students will write a summary about the graph and the food consumed by their family group.

6. Have students cut their graphs apart in strips according to the food group and glue them onto a larger bar graph on the board.

7. Have students write a summary of the class graph. Does the graph represent a balanced diet? Why or why not?

Appendix

"What's on the Farm?" Classification Pictures



Resource Round-Up Pictures

Loblolly Pine
Pinus taeda
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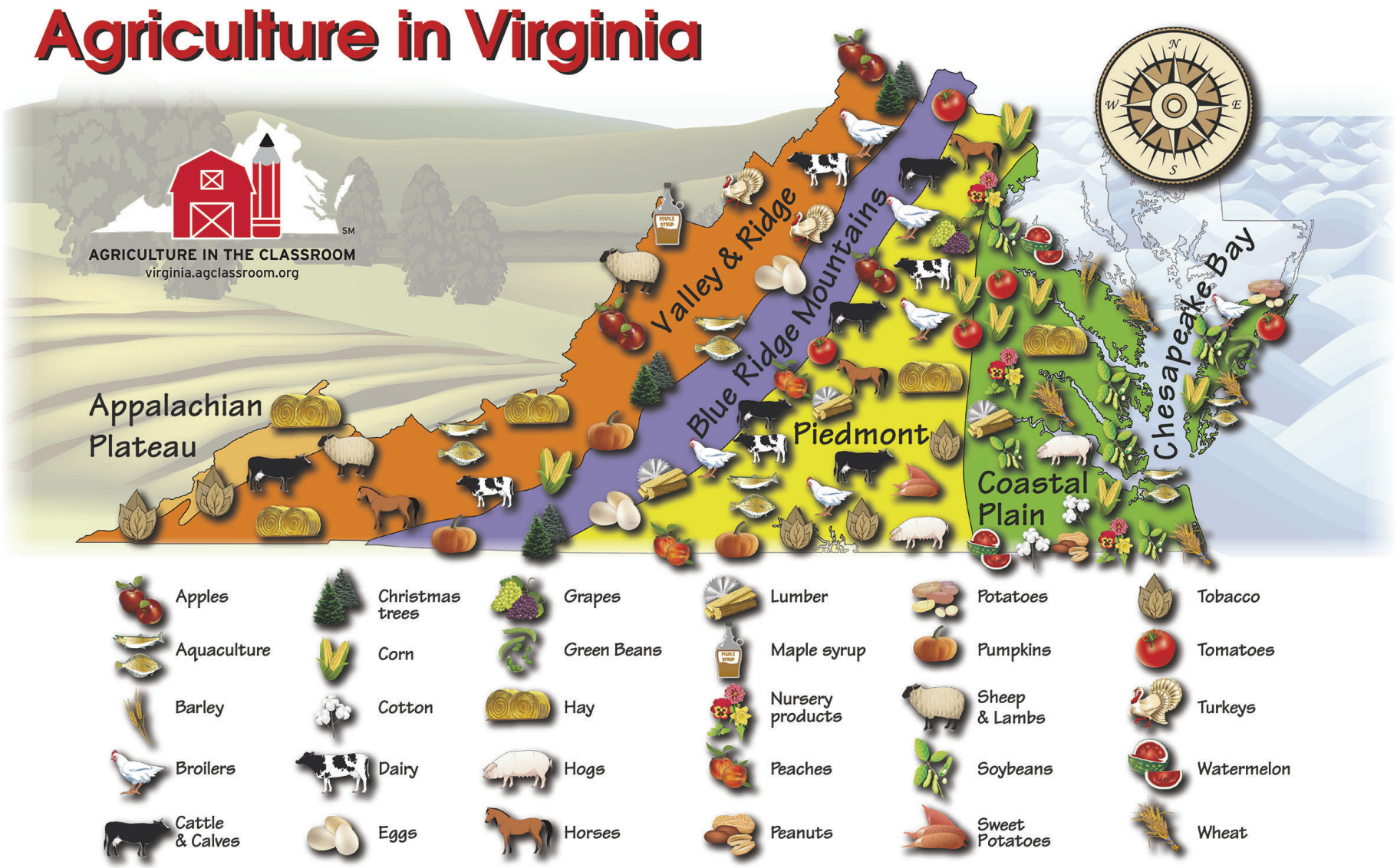
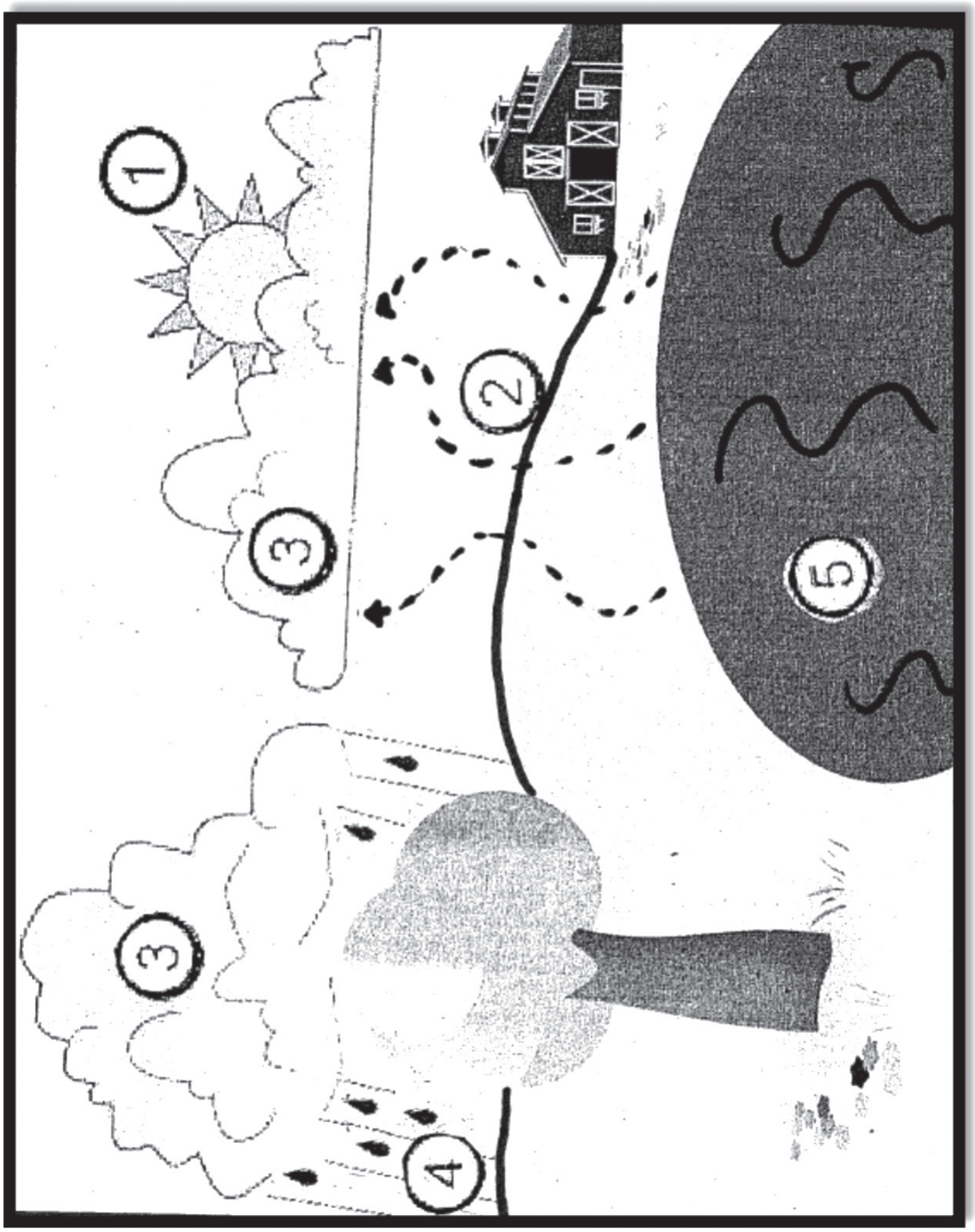
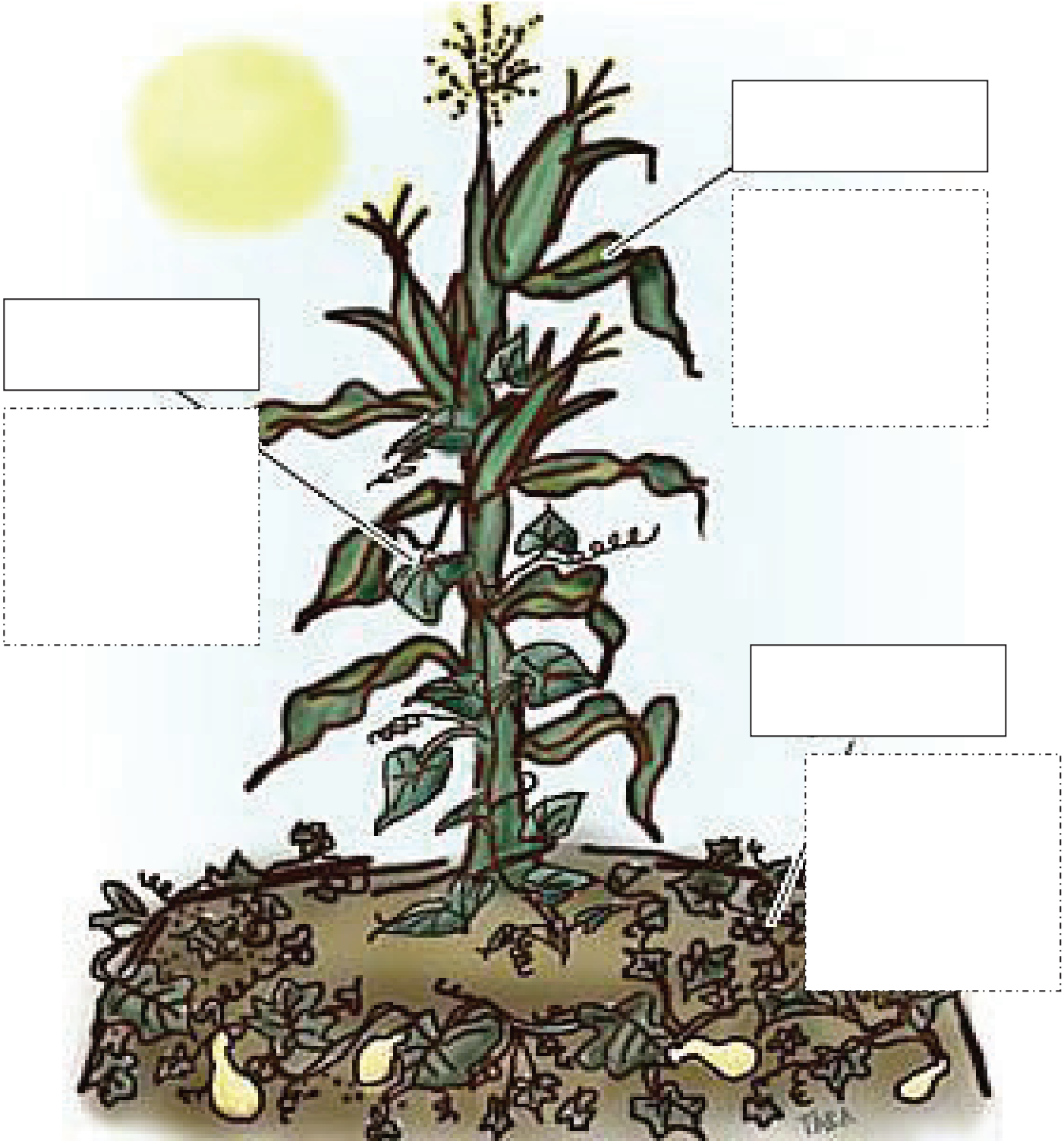
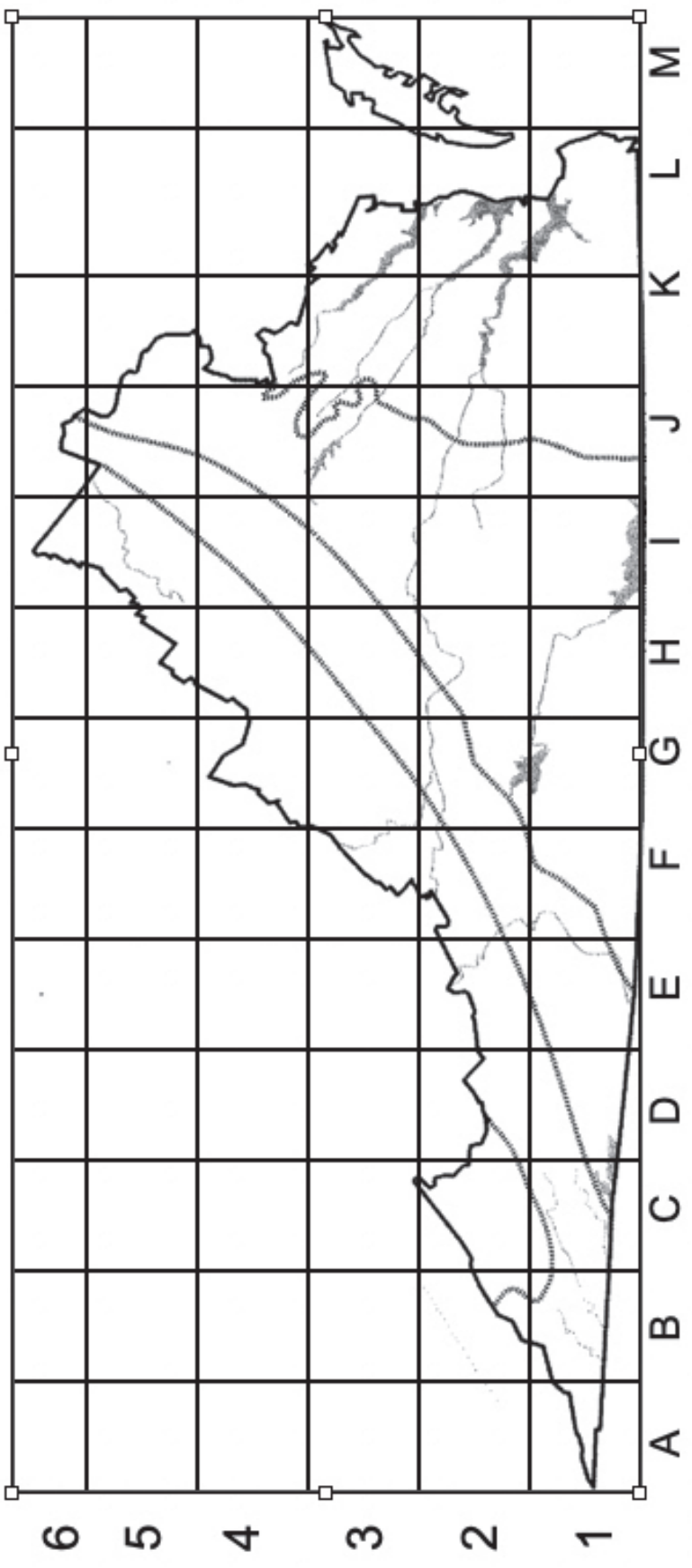
272


Agriculture in Virginia
AGRICULTURE IN THE CLASSROOM
virginia.agclassroom.org
Appalachian Plateau
Valley & Ridge
Blue Ridge Mountains
Piedmont
Coastal Plain
Chesapeake Bay
N
W
E
S
Apples
Aquaculture
Barley
Broilers
Cattle & Calves
Christmas trees
Corn
Cotton
Dairy
Eggs
Grapes
Green Beans
Hay
Hogs
Horses
Lumber
Maple syrup
Nursery products
Peaches
Peanuts
Potatoes
Pumpkins
Sheep & Lambs
Soybeans
Sweet Potatoes
Tobacco
Tomatoes
Turkeys
Watermelon
Wheat


1
2
3
5
3
4

The Three Sisters




A
B
C
D
E
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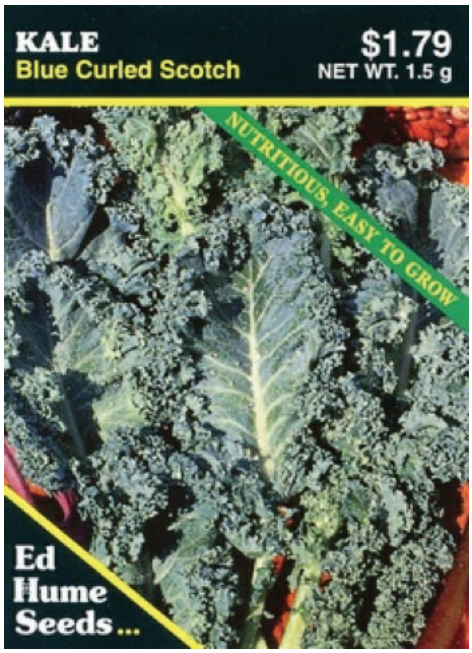
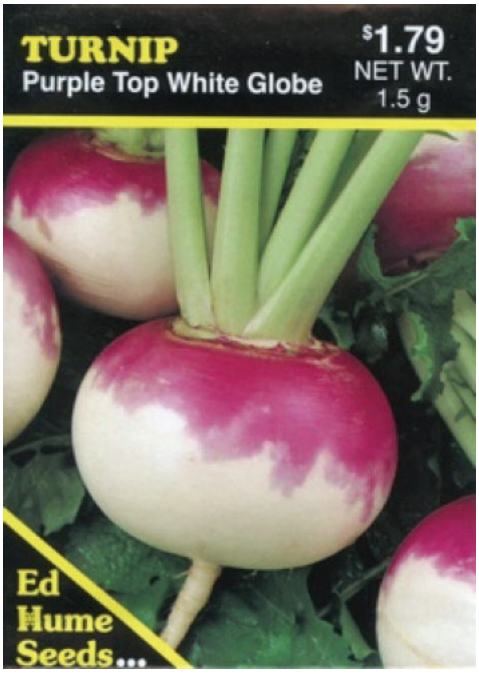
G
H
I
J
K
L
M
6
5
4
3
2
1

Kale



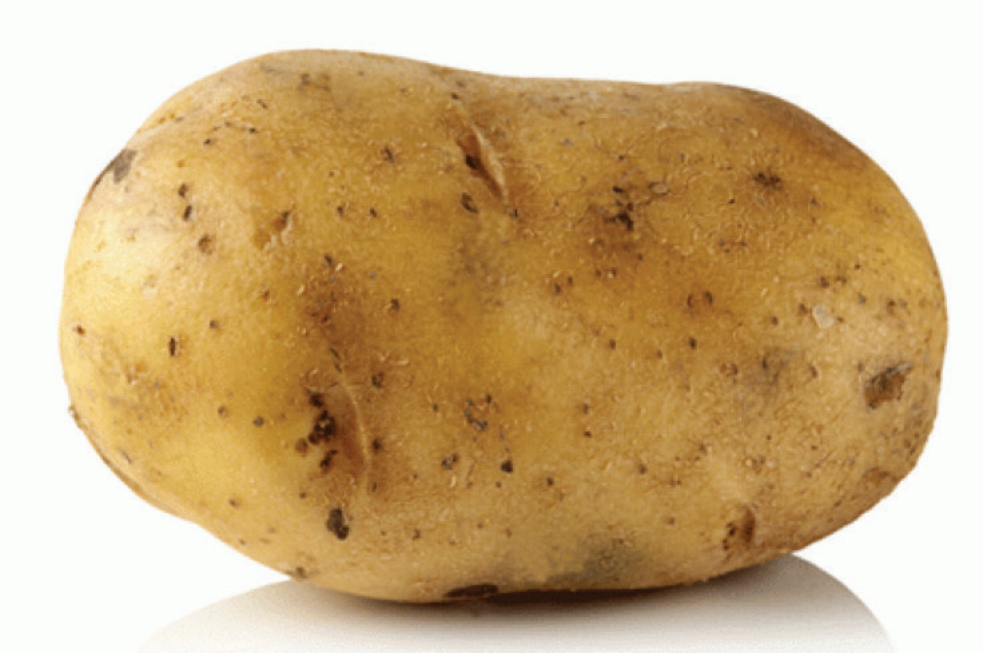
1 plant per square foot

Turnip



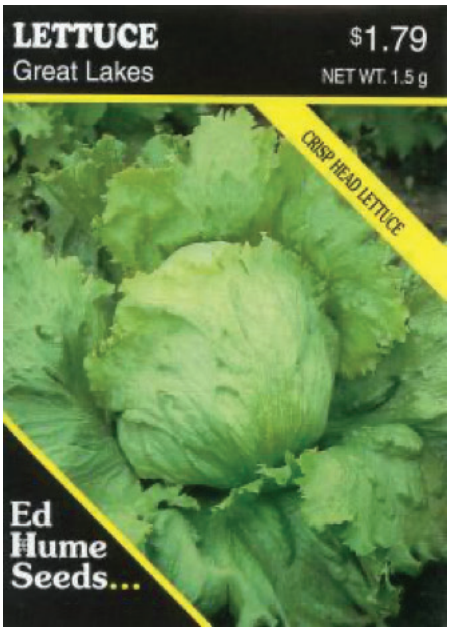
4 plants per square foot

Potato



1 plant per square foot

Head Lettuce

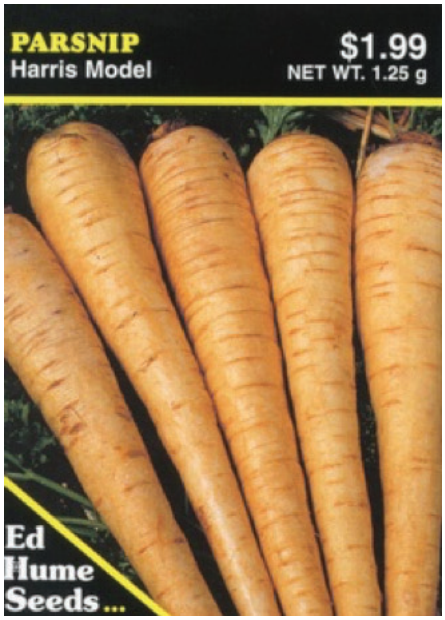


1 plant per square foot

Large Sunflower

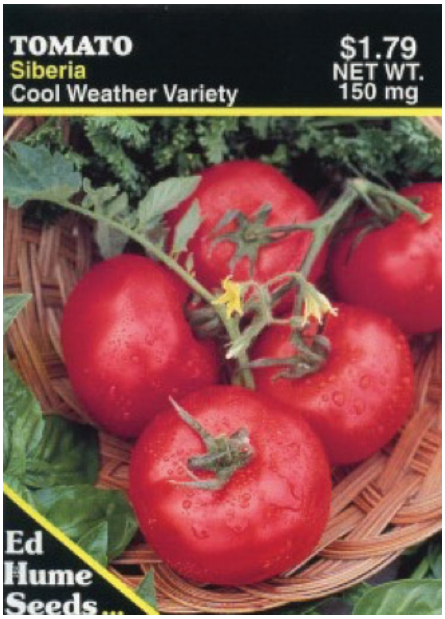
1 plant per square foot

Parsnip



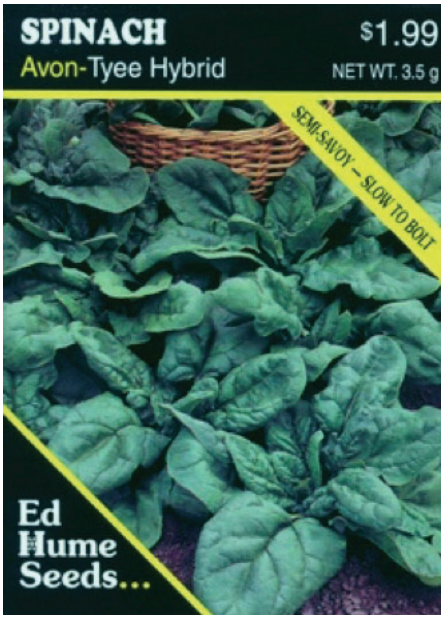
4 plants per square foot

Tomato



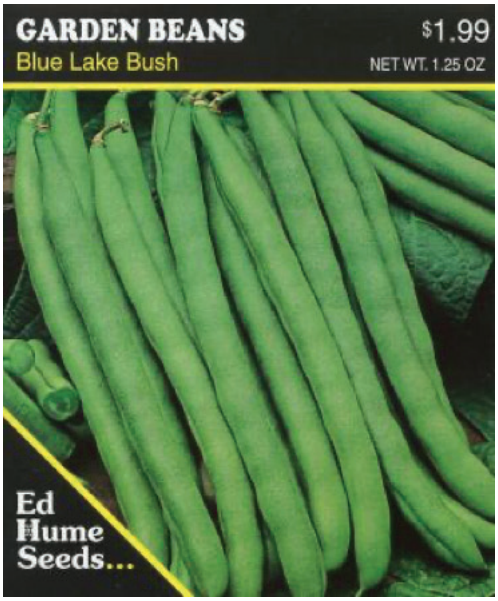
1 plant per square foot

Spinach



9 plants per square foot

Bush Beans



4 plants per square foot

Eggplant

1 plant per square foot

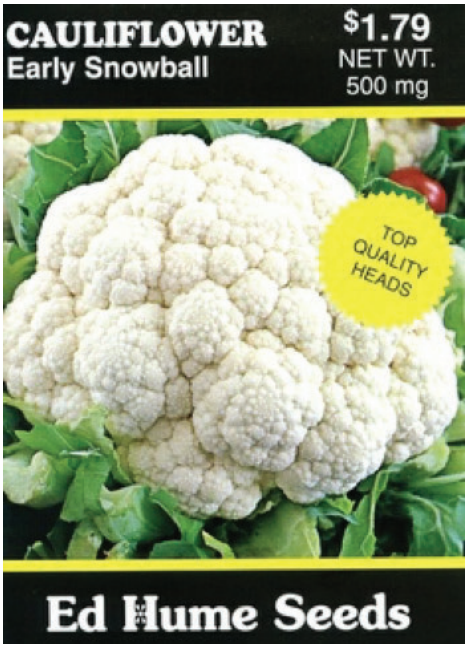
Dwarf Sunflower

4 plants per square foot

Dill

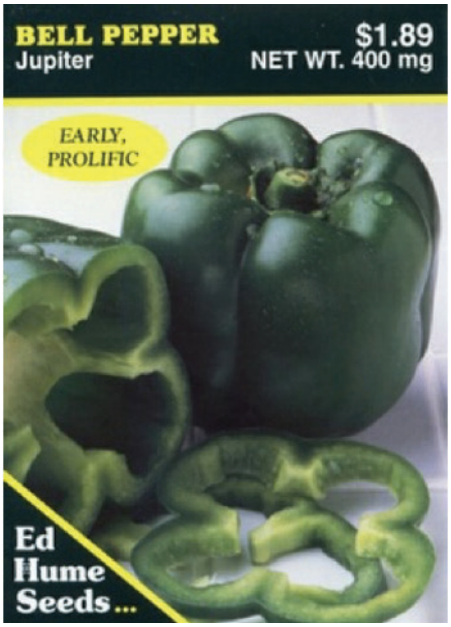
4 plants per square foot

Cauliflower



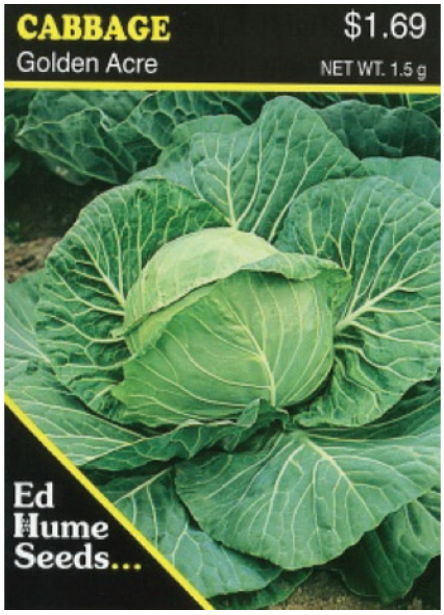
1 plant per 2 square feet

Peppers



1 plant per square foot

Cabbage

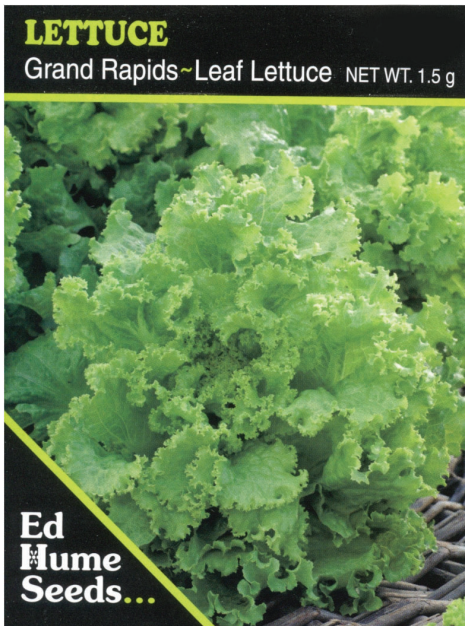


1 plant per square foot

Carrots

16 plants per square foot

Leaf Lettuce



4 plants per square foot

Swiss Chard

4 plants per square foot

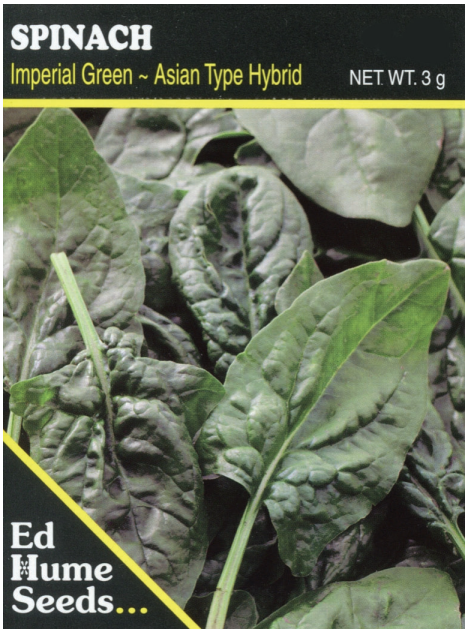
Basil

4 plants per square foot

Coriander (Cilantro)

4 plants per square foot

Spinach

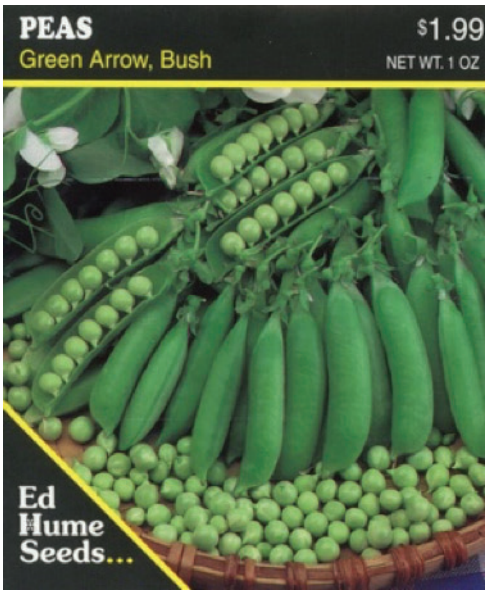


9 plants per square foot

Corn

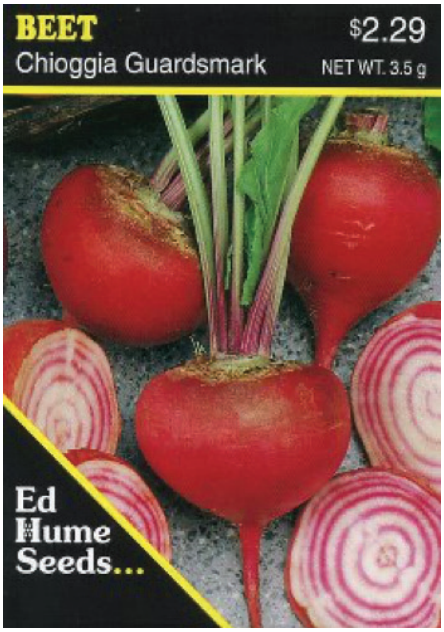
2 plants per 3 square feet

Peas



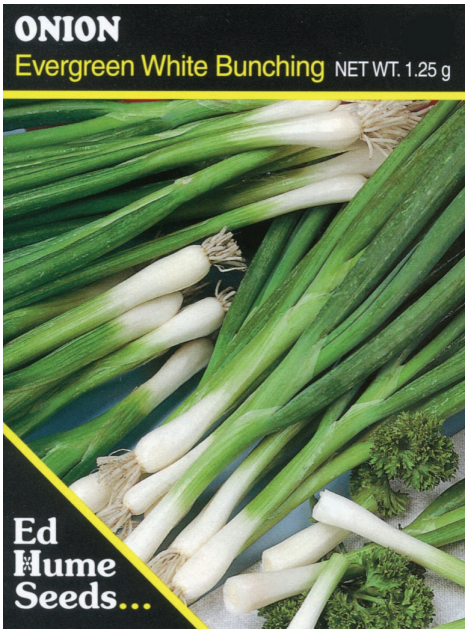
3 plants per square foot

Beets



4 plants per square foot

Spring Onions



4 plants per square foot

Sweet Corn

2 plants per 3 square feet

HAVE YOU EVER?

Directions: How connected to agriculture are you? Mingle with your neighbors to see who has done the most in relation to agriculture. Simply ask your neighbor "Have you ever ____?" If they have, get their signature in the box. **One person may only sign twice!** Once you have your boxes filled—or when time runs out—read over the list and place a star beside the things you've done. Total up your stars. Have fun!

Milked a cow or goat	Collected eggs from a hen house	Dug potatoes	Planted a vegetable garden
Visited a Virginia vineyard	Driven a tractor	Lived or worked on a farm	Saved and planted seed from the garden
Visited a farm	Ridden a horse	Sheared a sheep	Made butter
Visited a produce stand/farmers' market	Visited a fish farm	Made pickles	Made a compost pile
Worked in the agriculture industry	Been fishing and caught a fish	Visited a Christmas tree farm	Stomped grapes
Collected honey from a hive	Made ice cream	Made salsa	Eaten a soybean
Cut grass	Petted a pig	Planted flowers	Planted a tree
Made jam or jelly	Used a rototiller	Touched a cotton boll	Picked apples
Picked and shucked corn from the garden	Visited a greenhouse	Been on a hayride	Picked pumpkins
Picked strawberries	Cooked in your classroom	Taught about agriculture in your classroom	Seen an alpaca

Notes

ADDITIONAL RESOURCES

In addition to lessons found on the Virginia Agriculture in the Classroom website, Virginia.Agclassroom.org, be sure to check out National Agriculture in the Classroom at **Agclassroom.org**. You'll find a large searchable curriculum matrix and much more.

National Agriculture in the Classroom
agclassroom.org

Secondary teachers, visit **Journey2050.com** for a comprehensive program in which students investigate food sustainability through a virtual farm simulation game.

Journey 2050