

What's Growing On In Virginia?

AGRICULTURE IN THE CLASSROOM

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H O N E Y B E E S :

The secret to many Virginia crops' success

What would the world be like without honeybees? There would be no tomatoes for BLT sandwiches. We wouldn't have strawberries with our shortcake or jack-o-lanterns for Halloween. Without honeybees to pollinate our crops, we would have no cucumber slices to dip in ranch dressing or Burt's Bees® balm for our chapped lips.

Honeybees are crucial to the success of many crops—especially fruits and vegetables.

One-third of our country's food owes its existence to honeybees and other pollinators—either directly or indirectly.

Strawberries, cucumbers, squash, pumpkins, watermelons, muskmelons, beans, blueberries, peas and peppers all require bee pollination.

Without honeybees, our diet would be rich in wind-pollinated grains such as corn and wheat. And while grains are an important part of a healthy diet, fruits and vegetables are just as important.

Honeybees are not the only pollinators, but they are the most efficient.

While collecting nectar from a flower with its long, hollow tongue called a proboscis, a honeybee gets covered with pollen. When it rubs against the next flower, some of the pollen falls into it, fertilizing the flower.

Pollination is the transfer of pollen from the male part of the flower, the anther, to the female part, the stigma. Pollination is required to fertilize the ovules within the flowers in order for the seeds and fruit to grow.

Many Virginia orchardists place beehives on their farms to pollinate their fruit trees. Across the state, as many as 15,000 colonies are used each year to pollinate crops.



As a honeybee collects nectar from a flower it gets covered with pollen. When it rubs against the next flower some of the pollen falls off the bee and fertilizes the flower.

Hive is home for honeybees and their products

Honeybees were colonists long before John Smith and his crew arrived in Jamestown.

Honeybees' ancestors lived about 80 million years ago in highly structured groups called colonies. They were brought from Europe to America in the 1600s. Today, as many as 50,000 or more bees can live and work together in a single colony.

According to the Virginia Agricultural Statistics Service, Virginia had 6,000 producing



commercial honeybee colonies in 2007, which made 276,000 pounds of honey worth \$649,000. Those honeybees ranked Virginia 38th among honey-producing states that year.

Honeybee colonies can form naturally in dark, enclosed places like a hole in the trunk of a tree, or they can be established in man-made wooden hives.

Wherever they live, honeybees are busy. Inside the hives, they eat, raise young bees and store extra food.

Three types of bees live in a hive: the queen bee, worker bees and drones. The queen bee is the leader and is the only female who can lay eggs. Drones are male bees that mate with the queen.

But most bees in a colony are worker bees, which are females who are unable to lay eggs. Young worker bees are house bees,

and older ones are forager bees.

Honeybees build combs made of wax inside the hives. Each comb is made of thousands of small storage spaces called cells.

The bees store honey and pollen in the cells, and the queen bee lays eggs in the combs as well. Bees make the honey to feed themselves, but fortunately for beekeepers, they make a lot more than they need.

The honey is made from nectar, which is collected by forager bees. These bees leave the hive in the morning and spend the day sucking nectar out of flowers and storing it in what's called a honey stomach.

When the forager bee's stomach is full, she flies back to the hive and passes the nectar to a house bee. The house bee swallows it, and enzymes in its stomach are added to the nectar, which turns into a drop of honey. The house bee then puts that into a comb cell.

Once a cell is full of honey, worker bees use a cap of wax secreted by one of their glands to close it up.

While forager bees are out gathering food for the colony, house bees store pollen in cells, make honey, and feed and clean the other bees.

The forager bees always return to their hive each day.

Honeybees dance out directions

When forager bees return to the hive, they have a special way of telling the other forager bees where to find nectar and pollen. They do what's called the dance of the honeybees.

In the Circle Dance, forager bees circle in one direction, turn around and circle back the other way. This dance tells other forager bees to look for new flowers anywhere within 300 feet of their hive.

The Wag-Tail Dance tells the other forager bees that the flowers are farther than 300 feet away. The direction the forager dances while wagging her tail tells where the flowers are in relation to the sun. The number of wags per 15 seconds tells how far away the flowers are.

One forager bee can visit as many as 10,000 flowers a day, but all the nectar she collects in her entire life makes about one teaspoon of honey. One pound of honey requires nectar from more than 1 million flowers.



What is made from *beeswax*?



Types of honey

COMB – honeycomb sold in pieces that have been cut apart

LIQUID – gold-colored, clear and runny; sold in jars and bottles

CREAMED – light yellow or white and very thick; sold in jars and bottles

LESSON PLAN >> ELEMENTARY SCHOOL

Busy bees

SOL:
Science 4.4

Objective:
to be able to identify the steps in pollination and identify the importance of bees to agriculture.

Materials:

- paper plates
- circle template (about 6.5 inches in diameter), split into quadrants
- green construction paper
- crayons/colored pencils/markers
- brads
- tape

Background Knowledge

Pollination is the transfer of pollen from the male flower part to the female flower part. The male part is called the anther and contains pollen grains. The female part is called the pistil and contains the sticky stigma, which collects the pollen grains. Pollination must occur in order for flowering plants to reproduce. Pollen grains can be transferred by wind, water, bees, butterflies, other insects, birds and bats. Bees are attracted to the nectar and pollen in fragrant flowers. The bee stops at a flower to suck the nectar, and the pollen grains get stuck to the bee's body. Then, when the bee moves to another flower, the pollen grains are transferred from the first flower to the second, which is how pollination occurs.

Insects are needed to pollinate a variety of fruits, vegetables and legumes such as tomatoes, onions, blueberries, cherries, pears, sunflowers, pumpkins, broccoli, carrots, squash, cucumbers, lettuce, potatoes, oranges, lemons, limes, mustard seed, vanilla, sugar, almonds, watermelon and apples. In fact, about one-third of the human diet is derived directly or indirectly from insect-pollinated plants. About 80 of Virginia's most popular crops, valued at about \$80 million, rely on pollinators.

Procedure

1. Write the following journal prompt on the board: "Do you think bees are helpful or harmful? Describe." Have students brainstorm and write their answers down, and then ask for some to share.
2. Write the term "pollination" on the board. Using the background knowledge above, discuss that this is a way that bees help people. Have students brainstorm a list of the foods they eat that are pollinated by bees.
3. Pass out circle templates (circle divided into 4 quadrants) and art supplies. Have students cut out the circle and then illustrate and narrate the pollination cycle on the four sections.
 - a. The bee is looking for food.
 - b. The bee lands on a flower and is sipping nectar. Pollen gets stuck on its body.
 - c. The bee flies off looking for more food.
 - d. It lands on a new flower with pollen from the last flower. The pollen rubs off on the new one.
4. Pass out paper plates (you may choose to buy various colored plates or have students color them). Using a brad, attach the circle to the middle of the plate.
5. Use green construction paper to make a flower's stem and leaves. Attach to the plate with tape.
6. Have students get with a partner and tell the pollination story to each other using their completed cycles.
7. In conclusion, revisit the opening journal prompt. Ask students if they would like to add to or change their answers. Why?

Extension

Discuss how bees often face a negative reputation. Challenge students to change this public perception by creating posters or performing skits that advertise the positive role bees play in pollination (thus allowing fruits and vegetables to grow).

Additional lessons, activities and worksheets can be downloaded from the National Honey Board's Web site at honey.com/consumers/kids/honeyfiles.asp.



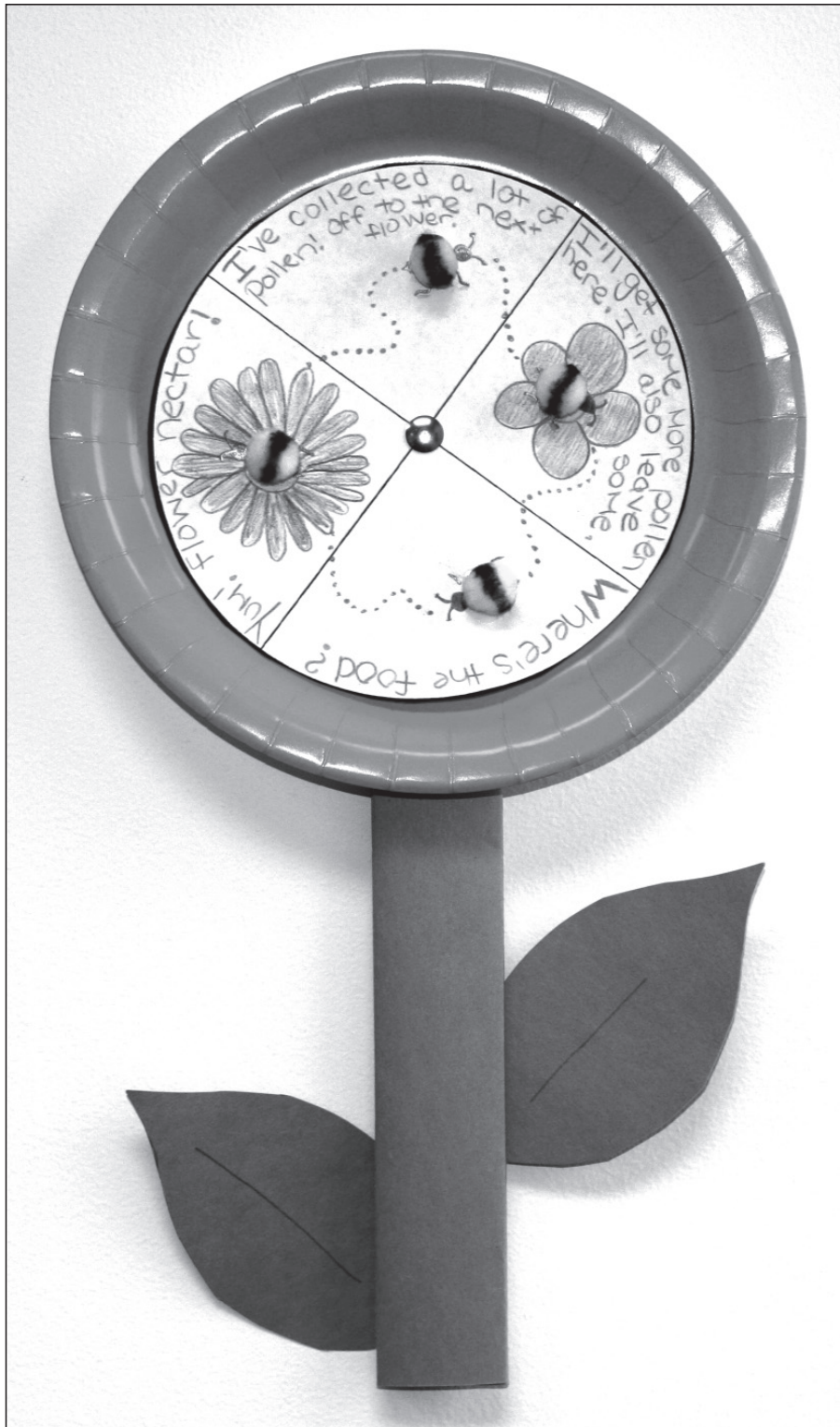
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References

- Kansas Foundation for Agriculture in the Classroom, ksagclassroom.org
- National Honey Board, honey.com/consumers/kids/honeyfiles.asp



LESSON PLAN >> MIDDLE SCHOOL

Hexagon hives

SOL:

Science LS.8, LS.12
Math 6.9, 7.9

Objective:

to be able to explain the advantage of the use of hexagon-celled hives by honeybees. Students will develop polygon models that demonstrate the strength and structural advantages of hexagon hive cells.

materials:

- tape
- paper clips
- 2" x 9" strips of construction paper
- ruler
- balloons

Background Knowledge

Consider a bee hive. What does one look like? How does the structure provide a safe environment for the colony? Why do bees use a hexagon shape for the cells of the hive? Each question encourages the development of a hypothesis and proving a theory.

Whether naturally occurring or in manmade frames, bees create cells within the honeycomb in a hexagon shape. The hexagon shape provides a sturdy structure by using an irregular interlocking pattern with no space between cells. These cells are used as a place for bee larvae to grow into adult members of the colony, as well as for food storage. One queen bee is in charge of the hive and lays up to 3,000 eggs per day. The worker bees are responsible for collecting food, caring for the queen, tending a nursery full of larvae, and keeping the hive clean.

Modern manmade beehives consist of wooden box-like sections stacked on top of each other. Each box (or super) holds eight to 10 wooden frames, each containing a thin sheet of wax foundation. The bees build their combs on these foundations provided by the beekeepers, and therefore save time and effort in honey-making. Honey is stored in the combs in the upper parts of the hive. When the bees have filled the combs in this upper section with honey and covered them with wax caps, the beekeeper takes them away to extract the honey and sell the wax for many products.

Bee facts:

Weight of average worker bee: 80 milligrams

Amount of nectar the honey sac can hold: 70 milligrams

Amount of pollen a worker can carry in the pollen baskets: 20 milligrams

Maximum number of eggs laid daily by the queen: 3,000

Average number of trips a worker bee makes outside the hive each day: 10

Average speed of a worker bee in flight: 15 mph

Average distance from hive a worker bee travels in one trip: 1½ miles

Average life of a worker bee in the summer: 45 days

Procedure:

1. Ask students to define a polygon.
2. Provide examples of polygons, including the number of sides for each.
3. For this example the length of all sides will total 9 inches.
4. Give each student at least 5 strips of construction paper and a ruler.
5. Instruct the student to properly measure the dimensions listed on the chalkboard for each type of polygon and to fold each strip on the measurement lines in order to form the polygon. Students can use tape to connect the ends of the strip to complete the polygon.
6. Have the students construct their triangles as you demonstrate the measuring, folding and taping of a triangle.
7. Have the students construct the four remaining polygons on their own. Have plenty of extra paper strips on hand for mistakes.
8. Once everyone has completed all the polygons, put students in groups of four or five to build structures of like polygons.



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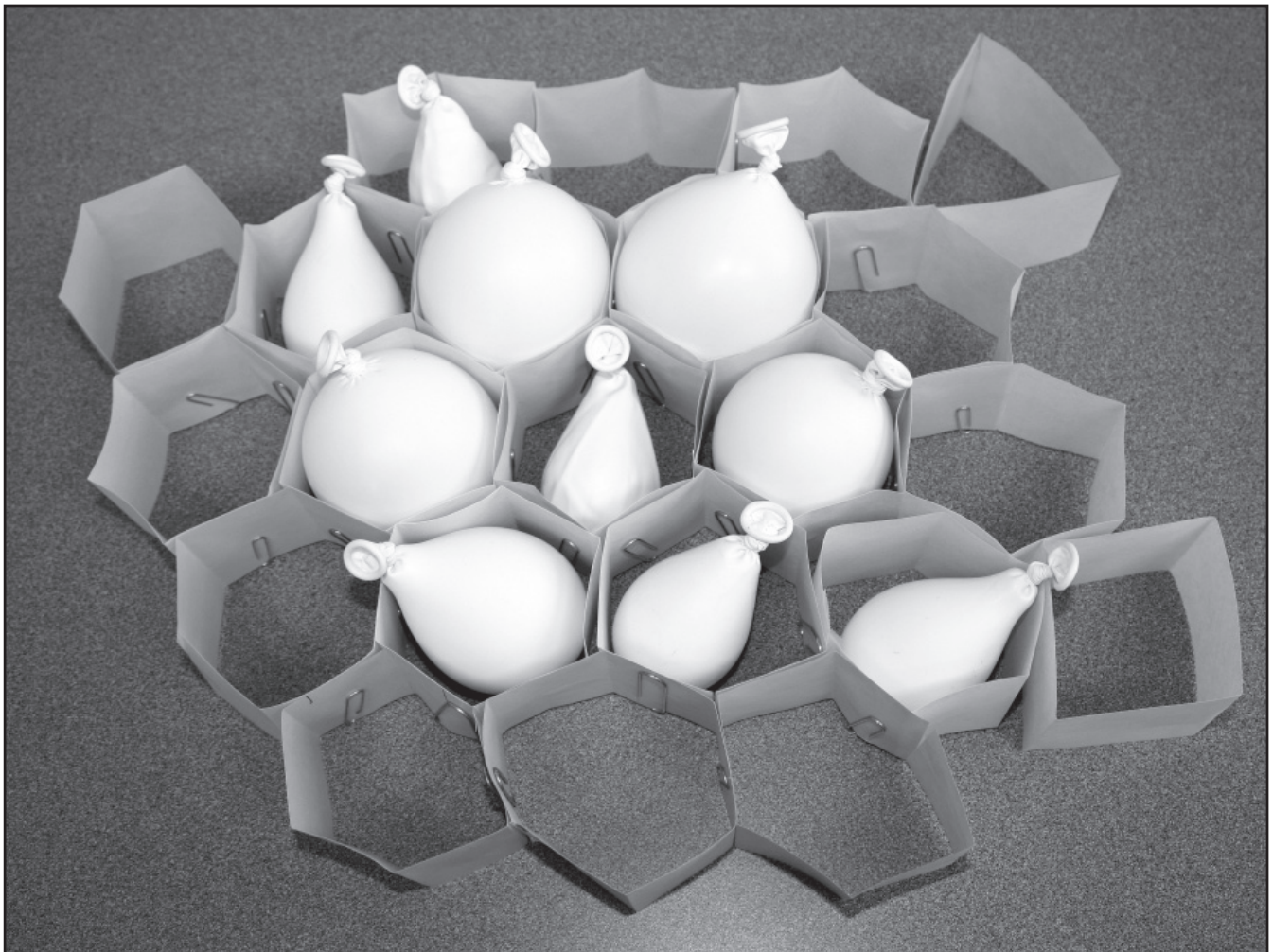
9. Give each group a few balloons to blow up to diameters of approximately 1 inch, 1½ inches and 2 inches to represent developing bees. Students should then see how balloons fit inside each polygon.
10. Have groups discuss the benefits or drawbacks of each structure in terms of how they fit together, strength of structure, whether there is any wasted space between the polygons, or whether there is any wasted space within the polygon when the balloon is inserted.
11. Discuss the group findings as a class.

Extension

Create a model of a manmade hive to include outer and inner covers, honey super, frame, brood chamber and bottom board.

References

- "The Honey Files: A Bee's Life" by Alyssa Boettcher on the National Honey Board Web site at honey.com/consumers/kids/honeyfiles.asp



LITERARY CORNER

Books tell about honeybees and their keepers

The Bee, Paul Starosta, Charlesbridge Publishing, ISBN-13: 978-1-57091-629-8

The Bumblebee Queen, April Pulley Sayre, Charlesbridge Publishing, ISBN-13: 978-1-57091-362-4

The Honey Makers, Gail Gibbons, William Morrow and Company, ISBN 0-688-11387-7

Hooray for Beekeeping!, Bobbie Kalman, Crabtree Publishing Company, ISBN 0-86505-668-4

Beekeepers, Linda Oatman High, Boyds Mills Press, ISBN- 1-56397-486-X



AITC Program Highlights

AITC comes to your computer screen

Can't make it to an AITC workshop?

You can now download and watch videos of AITC facilitators demonstrating some of their favorite hands-on lessons. Lessons include Strawberry DNA Extraction, Biodegradable Plastics, and a Lily Lab and Investigation.

Find these virtual lessons, as well as many other great ideas for your classroom, on the AITC Web site, AgInTheClass.org, in the teachers' section.

Ag Week with AITC resources

Celebrate National Ag Week, March 15-21, in your classroom by exploring the many and varied agriculture careers available with the Ag Careers WebQuest, found in the teachers' section of AgInTheClass.org.

Or read Virginia Agriculture in the Classroom's Book of the Year, "The Tree Farmer" by Church Leavell and Nicholas Cravotta, to your class. This beautifully written and illustrated book teaches responsibility for the land and is sure to become a favorite in your classroom library.

Summer workshop series

Teacher workshops provide hands-on activities, grade appropriate SOL-aligned lessons and other resources. Each teacher who attends one of the AITC summer training workshops will receive a free teacher resource kit. Register today by e-mailing aitc@vafb.com or calling 804-290-1141.

July 9 9-2 Virginia Beach Rural Heritage Center (Virginia Beach)
AITC Elementary Workshop

July 14 9-3 Lewis Ginter Botanical Gardens (Richmond) AITC Garden Workshop

July 20 9-2 Loudoun Farm Museum (Loudoun) AITC Elementary Workshop

July 28 9-3 Lewis Ginter Botanical Gardens (Richmond) AITC Garden Workshop

July 29 9-2 Lewis Ginter Botanical Gardens (Richmond)
AITC Middle School Workshop

July 31 9-3 Hahn Horticulture Garden (Blacksburg) AITC Garden Workshop

August 3 9-3 Norfolk Botanical Garden (Norfolk) AITC Garden Workshop



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For additional information and activities, visit our Web site at
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