Healthy Gardens, Healthy Youth
Educational Toolkit Framework

The Educational Toolkit was developed to provide 19-20 lessons over an 18-month period for interventions schools in Healthy Gardens, Healthy Youth, the People’s Garden School Garden Pilot Project Research Grant (USDA CN-CGP-11-0047). The lessons began in the early spring 2012, and extended through the next school year, ending in Spring 2013.

A team of extension specialists in nutrition, horticulture and youth development reviewed 17 (see references) curricula, numerous garden implementation resources and other materials to select appropriate resources for this project. Criteria used to select curricula for consideration included 1) experiential learning 2) age-appropriate nutrition, food, and gardening content and skills 3) research-based content and standards alignment, 4) Science, Technology, Engineering and Math (STEM) area focus, 5) support for the school garden.

Lessons were selected from ten curricula (detailed below) to meet the necessary topic areas for the two years. Permission from the original authors was sought for reproduction in the Educational Toolkit. Additional activities directly related to the garden were developed to enhance the lesson. Since each state has slightly different educational standards, a compendium of content standards and benchmarks compiled by Mid-continent Research for Education and Learning, a private nonprofit corporation was used as standards. During this grant period, the Common Core Standards were introduced and the USDA introduced MyPlate to replace MyPyramid. Some lessons may contain references to MyPyramid.

The Toolkit provided 10-11 lessons to be taught in 2012 between February and the end of the school year in weekly sessions, and nine lessons to be taught through the month from September 2012 – May/June 2013. Because classes in the Arkansas and Washington could begin gardening earlier in the year than Iowa and New York, it was suggested that they start in 2012 with the garden planning and planting lessons, and then cover the first few lessons later in the spring.

The Toolkit included information and safety guidelines to create, maintain and harvest gardens; store, use and sample garden produce; take the garden through the summer; build community capacity; and sustain and grow the program. In addition it provided tasting and snack suggestions and information on the use of produce in the school cafeterias.

All Toolkit resources were available on a password-protected website. Lessons were introduced through webinars posted to the secure website and videos on our YouTube channel https://www.youtube.com/user/ExtSchoolGarden. Other supplementary materials, such as donated books, were delivered to the schools by the local Extension Educator.
Lesson Sequence

Spring 2012, February – May/June (depended on school end dates)

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Grade 2</th>
<th>Grade 4/5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plant Parts Become Me</td>
<td>My Lunch Came from Soil</td>
</tr>
<tr>
<td>2</td>
<td>Rock to Ice Cream: Keep Soil Alive</td>
<td>Get the Scoop on Soil &amp; Composting</td>
</tr>
<tr>
<td>3</td>
<td>Our Food Garden Plan</td>
<td>Our Healthy Garden Plan</td>
</tr>
<tr>
<td>4</td>
<td>Seasons through the Year</td>
<td>Our Healthy Garden Plan (continued)</td>
</tr>
<tr>
<td>5</td>
<td>Germination</td>
<td>Banking on Seeds</td>
</tr>
<tr>
<td>6</td>
<td>Planting the Garden &amp; Nutrition Super Hero</td>
<td>Planting our Healthy Garden</td>
</tr>
<tr>
<td>7</td>
<td>Seeds and Sprouts</td>
<td>Photosynthesis</td>
</tr>
<tr>
<td>8</td>
<td>Salad Gardens</td>
<td>Watering in the Garden</td>
</tr>
<tr>
<td>9</td>
<td>Life in the Garden</td>
<td>A Butterfly’s Life</td>
</tr>
<tr>
<td>10</td>
<td>Garden Patrol</td>
<td>WANTED: Out of My Garden</td>
</tr>
<tr>
<td>11</td>
<td>Salad Party</td>
<td>Eating from the Garden</td>
</tr>
</tbody>
</table>

Fall 2012 – Spring 2013

For Grade 2 students who went into Grade 3 | For Grade 4/5 students who went into Grade 5/6

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Grade 3</th>
<th>Grade 5/6</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>Harvest</td>
<td>Harvest</td>
</tr>
<tr>
<td>October</td>
<td>Post-Harvest, Garden Clean-up</td>
<td>Post-Harvest, Garden Clean-up</td>
</tr>
<tr>
<td>November</td>
<td>Apples and Squash</td>
<td>Root Vegetables and Pears</td>
</tr>
<tr>
<td>December</td>
<td>MyPlate</td>
<td>Making Healthy Food Choices</td>
</tr>
<tr>
<td>January</td>
<td>My Food Garden Plan</td>
<td>My Food Garden Plan</td>
</tr>
<tr>
<td>February</td>
<td>Winter Vegetables and Mulch</td>
<td>Winter Vegetables and Mulch</td>
</tr>
<tr>
<td>March</td>
<td>Planting Our Garden</td>
<td>Planting Our Garden</td>
</tr>
<tr>
<td>April</td>
<td>Food for Plants and People</td>
<td>Food for Plants and People</td>
</tr>
<tr>
<td>May/June</td>
<td>Celebrate the Harvest</td>
<td>Celebrate the Harvest, Jeopardy</td>
</tr>
<tr>
<td>Optional</td>
<td>Harvest Party</td>
<td>Harvest Party</td>
</tr>
<tr>
<td>Grade 4-5</td>
<td>Objectives</td>
<td>Activities</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Lesson 1: How does food relate to plants? Source: “My Lunch Came From Soil” from <em>Growing In The Garden, Local Foods and Healthy Living</em>, Iowa State University Extension and Outreach; “Carrot Tops” from <em>Science Projects of the Week</em> (S.P.O.W.), Nimitz Middle School, LA</td>
<td>Describe how most foods start in the soil and then go through several steps before we eat it. Understand the implications of how little soil is left to grow food for a growing population. Identify ways to have access to healthy foods. Understand characteristics of carrots and conduct an experiment.</td>
<td>Students conduct experiments and prepare a healthy recipe with carrots.</td>
</tr>
<tr>
<td>Lesson 2: How does healthy soil relate to food? Source: “Get the Scoop on Soil” from <em>Growing in The Garden</em>, Iowa State University Extension and Outreach “Composting” from <em>Garden Mosaics</em>, Cornell University Cooperative Extension</td>
<td>Describe sand, silt and clay. Explain why loam is a good mixture of soil to grow plants. Define composting and describe what compost organisms need to grow and multiply. Explain how to build and care for a compost pile.</td>
<td>Examine local soil, conduct soil testing, learn how to compost and make the soil healthier. Taste melon salad or perfect parfait. Read <em>Dirt</em> by Steve Tomecek and <em>Diary of a Worm</em> by Doreen Cronin</td>
</tr>
<tr>
<td>Lesson 3 AND 4: How do we make a garden plan and a garden calendar? “Our Healthy Garden Plan” from <em>Growing in The Garden: Local Foods and Healthy Living</em>, Iowa State University Extension and Outreach</td>
<td>Identify and select locally grown fruits and vegetables to plant, grow, harvest and eat. Use a variety of mathematical and science concepts and skills to create local garden plans and calendars.</td>
<td>Make seed catchers, develop garden plan and calendar, make garden labels. Lettuce Wraps and Salsa tasting Books: <em>The Vegetables We Eat</em> by Gail Gibbons, <em>Too Many Pumpkins</em> by Linda White</td>
</tr>
<tr>
<td>Grade 4-5</td>
<td>Objectives</td>
<td>Activities</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Lesson 5: Where do garden seeds come from? “Banking on Seeds” from <em>Food, Land &amp; People: Resources for Learning</em>, Food, Land &amp; People</td>
<td>Give examples and compare the use of seeds by people in the past, today, and in the future. Gather, store and plant seeds. Create a seed bank and explain its importance. Label the basic parts of a seed.</td>
<td>Examine squash and seeds, seed experiment, draw observations of seed growth.</td>
</tr>
<tr>
<td>Lesson 6: How do you plant a garden? “Planting Our Healthy Garden” from <em>Growing in The Garden: Local Foods and Healthy Living</em>, Iowa State University Extension and Outreach</td>
<td>Identify and implement efficient and productive methods to prepare the soil for gardening. Mark a garden. Plant seeds, sets, or transplants. Water the garden for the first time.</td>
<td>Garden rules, garden tool checklist, garden matching game, planting and watering the garden</td>
</tr>
<tr>
<td>Lesson 7: What do plants need to grow? Source: “Photosynthesis” from <em>Growing in The Garden</em>, Iowa State University Extension and Outreach</td>
<td>Define photosynthesis. Identify the basic ingredients in photosynthesis and describe the process. Give reasons why photosynthesis is important to plants and animals.</td>
<td>Photosynthesis experiment, diagramming, song</td>
</tr>
<tr>
<td>Lesson 8: How do you water the garden? Source: “Water in the Garden” and “Watering the Garden” from <em>Garden Mosaics</em>, Cornell University Cooperative Extension Service</td>
<td>Describe the steps in the water cycle. Explain why plant roots need both water and air. Identify signs of water stress in plants. Demonstrate when, how, how much a garden should be</td>
<td>Learn the water cycle, conduct a PERC test. Vegetable tasting</td>
</tr>
<tr>
<td>Grade 4-5</td>
<td>Objectives</td>
<td>Activities</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>watered. Explain how to conserve water in the garden.</td>
<td>Butterfly lifecycle models, songs, making and planting a paper seed pot, butterfly secret code word activity</td>
</tr>
<tr>
<td>Lesson 9:</td>
<td>Name and describe the four stages in the complete life cycle of Butterflies. Explain and give evidence of plant and animal interdependence. Review and demonstrate the process and sequence of plant pollination.</td>
<td>Book: Caterpillars and Butterflies by Stephanie Turnbull</td>
</tr>
<tr>
<td>What do butterflies and other flying insects have to do with producing food? “A Butterfly’s Life” from Growing in The Garden, Iowa State University Extension and Outreach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesson 10:</td>
<td>Identify creatures and the damage they do to garden plants. Manage harmful creatures in the garden.</td>
<td>Learn the characteristics of different gardens pests and how they damage the garden. Make a Creative Critter Snack.</td>
</tr>
<tr>
<td>How do you manage pests in the garden? Source: “WANTED: Out of My Garden” from Growing in The Garden: Outdoor Classrooms For Young Gardeners, Iowa State University Extension and Outreach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesson 11:</td>
<td>Apply harvesting, cleaning, and salad mixing strategies for salad crops. Plan and implement a Salad Party. Review the importance of eating fruits and vegetables</td>
<td>Eating from the Garden Jeopardy Garden harvest tasting</td>
</tr>
<tr>
<td>When and how do we harvest our salad garden? How do we clean and prepare salads? How do we plan and have a Salad Party? “Garden Celebration” from Eating From The Garden, University of Missouri Extension</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson One: How does food relate to plants?

“My Lunch Came From Soil” from GROWING IN THE GARDEN, LOCAL FOODS AND HEALTHY LIVING, Iowa State University Extension and Outreach

“Carrot Tops” from SCIENCE PROJECTS OF THE WEEK (S.P.O.W.), Nimitz Middle School, LA

Students make surprising connections between the food we eat and soil. Apple Earth illustrates how little soil is left to grow food for almost 7 billion people. What can we do to assure our access to healthy foods? Students conduct experiments and prepare tasty, healthy recipes with a root crop that grows in the soil, carrots.

Content objectives:
Describe how most foods start in the soil and then go through several steps before we eat it; Understand the implications of how little soil is left to grow food for a growing population; Identify ways to have access to healthy foods; Understand characteristics of carrots and conduct an experiment.

Life Skill objectives:
Healthy living, Critical thinking, Communication, Citizenship, Leadership, Decision making, Problem solving, Cooperation

Core and STEM concepts and skills:
Science: Science as inquiry, Earth and space, Life science
Math: Numbers and operations, Algebra, Geometry, Measurement, Data
Language Arts: Speaking, Listening, Writing, Viewing
Social Studies: Behavioral sciences, Economics, Geography, History, Civic literacy

Healthy snack:
Carrots or Carrot Raisin Salad (EATING FROM THE GARDEN) or Moroccan Carrot Salad (GARDEN MOSAICS)

Additional and supporting resources:
Carrot Family and Carrot activities and recipes from GARDEN MOSAICS; Singing in Our Garden (CD), “Dirt Made My Lunch” by the Banana Slug String Band from bananaslugstringband.com
BEFORE THE LESSON

1. Grade 4, Lesson 1:
This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the www.peoplesgarden.wsu.edu Educational Toolkit.


3. Assemble necessary ingredients and materials for the selected recipe(s).

THE LESSON

1. My Lunch Came From Soil and Carrot Tops are meant to be taught over two or more days.

AFTER THE LESSON

Optional activities are included in the lesson plan for a pizza game to reinforce lesson concepts.
Also included is the Carrots Science Page from Garden Mosaics. Consider using some of the activities described.
Recipes

**Cracker Mini Pizza** from lesson
For each student:
1 cracker  
¼ slice of cheese  
Pizza vegetables or 1-piece pepperoni  
Pizza Sauce in a squeeze bottle

Have student squeeze a small amount of pizza sauce on top of a cracker, add cheese, veggies and/or pepperoni.

**Morrocan Carrot Salad** from GARDEN MOSAICS

### MORROCAN CARROT SALAD
**Yield: 5-6 servings**
Carrot salad is a traditional dish in North Africa and the Middle East. In Israel it is eaten at the Jewish New Year. It is a symbol of a sweet and fruitful year to come.

**Ingredients**
* 1 pound (0.9 kg) carrots, grated  
* 1/4 cup (60 ml) vegetable oil  
* 3 to 4 tablespoons (45-60 ml) fresh lemon juice  
* 1/4 cup (60 ml) chopped fresh parsley  
* 2 to 4 cloves garlic, finely chopped  
* 1/2 teaspoon (2.5 ml) ground cumin  
* 1/4 teaspoon (1.25 ml) ground cinnamon  
* 1 teaspoon (5 ml) sweet paprika  
* Pinch of salt  
* 1/4 to 1/2 teaspoon (2 ml) cayenne (optional)

**Instructions**
In a large bowl, mix together all the ingredients. Cover and let marinate in the refrigerator for at least 2 hours or up to 2 days.

**Carrot Raisin Salad** from EATING IN THE GARDEN (next page)
Eating From the Garden Recipes
A nutrition and gardening program

Carrot Raisin Sunshine Salad

Ingredients:

☐ 1 pound carrots (5 or 6), peeled and shredded
☐ ½ cup raisins
☐ 8 ounces low-fat vanilla yogurt

Equipment:

☐ Knife
☐ Peeler
☐ Cutting board
☐ Grater
☐ Measuring spoons
☐ Small bowl
☐ Measuring cup
☐ Plastic wrap

Directions:

1. Wash hands and surfaces.
2. Wash and peel carrots, and grate or shred into small pieces.
3. In a large bowl, mix all ingredients together.
4. Cover with plastic wrap and refrigerate for 15 minutes.
5. Toss again before serving.
6. Refrigerate leftovers.

Servings: 4

Nutrients per serving:

Calories: 157
Fat: 1 g
Protein: 3 g
Fiber: 4 g
Sodium: 83 mg
Carbohydrates: 35 g
Cholesterol: 4 mg
Protein: 5 g

Cooking terms

Peel:
To remove the outer covering.

Shred:
To cut into thin pieces with grater or other tool.

Wash fresh vegetables before peeling.
Describe the steps of food production from natural resources to the things we eat. Understand the implications of how little soil is left to grow food for a growing population. Identify ways to provide food for themselves and others.

Communication through listening, sharing ideas, developing visuals, presenting information, and participating in a positive way; Citizenship by recognizing and respecting the natural resources, people, and places that provide food; Citizenship and leadership by recognizing needs, sharing ideas, and actively participating; Leadership by working together in a team, listening and talking to others before making a decision, and being a good example; Healthy living; Critical thinking; Decision making; Problem solving; Respect; Responsibility; Cooperation.

Worked with others to describe and illustrate how people found and prepared food since the 1800s. Responds to the questions regarding how little soil is left to grow food for a growing population. Follows instructions and helps team in the Soil to Food Relay and to prepare snacks. Identify one way to help their family with the food they eat.

**21st Century Skills:** Health literacy, Civic literacy, Employability skills, Technology literacy

**Science:** Science as inquiry, Life science, Earth science

**Social Studies:** Behavioral sciences, Economics, Geography, History, Civic literacy

**Literacy:** Speaking, Listening, Writing, Viewing

**Mathematics:** Numbers and operations, Algebra, Geometry and measurement, Data analysis

**Linguistic-words; Logical-mathematical; Spatial-visual; Bodily-kinesthetic; Intrapersonal; Interpersonal, Natural**

**Singing in the Garden CD** by the Banana Slug String Band (for “Dirt Made My Lunch” song, go to bananaslugstringband.com, or use the lyrics found at the end of this lesson)

**Materials continued on the next page.**
**MATERIALS CONTINUED**

Soil to Food Relay supplies *(see the chart in the Apply section)*
Corn, soybean, pumpkin, sunflower, or bean seeds, or colored game chips to be used as game markers *(Try to use three or four different kinds of seeds or colors of chips and divide them evenly between the people that will be playing “The Pizza Game”)*.
Dice or spinner
Mini Pizza ingredients:
- One napkin, round snack cracker, quarter-slice of cheese, piece of pepperoni per person
- One squeeze bottle of pizza sauce
MyPyramid and/or MyPlate posters *(go to the Printable Materials and Ordering page on www.choosemyplate.gov)*
“The Pizza Game”, dice or spinner, seeds or game markers *(optional, one copy per person, may choose to enlarge and copy on 11”x 14” paper, see the Optional Activity in the Apply section)*.

---

**TEACHER’S NOTES:** You will need a CD player and the Dirt Made My Lunch or Singing in our Garden CD by the Banana Slug String Band. Find the “Dirt Made My Lunch” song and be ready to play it so that everyone can hear. If these items are not available, please read the lyrics from the song found at the end of this lesson.

*Where does your food come from?*
*Let the students share their ideas and listen to their responses. This is a good way to understand your students’ perspectives and level of knowledge and understanding.*

We are going to listen to a song by the Banana Slug String Band to see where these “edu-tainers”, educators and entertainers, say that foods come from.

*Play the “Dirt Made My Lunch” song on the Dirt Made My Lunch or Singing in the Garden CD by the Banana Slug String Band. If that is not an option, read the song found in the Introduction section of Lesson 2A. If you listen to the CD, use the next paragraph. If you read the lyrics skip the next paragraph.*

Mr. Dirt sounded sort of rough. Dirt, or soil, is kind of rough. After all, soil is made from rocks. Mr. Dirt said something incredible.

**What did he say made your lunch?**
Dirt

*Now that you’ve heard the song, how would you answer the question, “Where does your food come from?”*
Food comes from dirt!

**What is another name for “dirt”?**
The “dirt” they are referring to is actually “soil”. Dirt is what gets on our clothes and skin and what blows onto our window sills and gets on our cars, vans, and trucks. Soil is what we can grow plants out of.

**Do people make soil?**
No, people don’t make soil. Soil is called a natural resource because it is on the Earth naturally. It takes thousands of years to make soil from rocks, weather, and decaying plants and animals.
According to the song, how does dirt or soil make your salad?
The soil in a garden, orchard, or field grows the lettuce, cabbage, carrots, celery, cucumbers, raisins, apples, bananas, peaches, pears, blueberries and other vegetables and fruits that you might like to eat for your salad.

According to the song, how does dirt or soil make your sandwich?
The soil in a field grew the wheat. The wheat was harvested and ground into flour. A baker added more ingredients to the flour to make bread for your sandwich. What you put in it – jelly, peanut butter, meat, cheese, lettuce, pickles – determines how the soil made the rest of your sandwich.

According to the song, how does dirt or soil make your milk?
The answer is kind of tricky.

Where does most of our milk come from?
A cow

What does the cow eat in order to produce food?
A cow eats grasses and grains. Grains such as corn, oats or flax come from grasses.

Where do the grasses grow?
In the soil

Raise your hand if you think that most of your food, whether it is plant or animals-based – comes from the soil.

TEACHER’S NOTES: Make one copy per student of each of the “It’s Lunch Time” activity sheets found at the end of this lesson. Or, make only four copies, one per team. Write one of the following Family Descriptions at the top of four sheets. Divide the students into four teams. Have the team members sit together. Give each team member an activity sheet and a paper plate. Have extra plates ready for students to use, if needed. They can use crayons or colored pencils work well for drawing. Precut several strands of yarn to tie plates together. Be ready to punch holes in the plates and add the yarn when the students are almost finished with their plates.

| FAMILY DESCRIPTIONS | Native Americans before the 1800s | Pioneers during the 1800s | Farmers in the 1900s | Consumers (you) now |

Each group of you is a family described on your “It’s Lunch Time” activity sheet. (Have each group read their description out loud to the rest of the class or group.) The cool autumn days and your many activities make you hungry. Your family is anxious to eat lunch. The menu is turkey sandwiches, berries, and milk or water. Your family needs to work together to answer the questions on your sheet according to the time period which you are living.

After answering the questions, draw and color the steps onto your twelve plates. Suggestions for the plate pictures are listed at the bottom of your activity sheets. Be creative. After finishing the plates, arrange them in sequential order. The last plate should have a picture of your lunch.
You may want them to punch holes in their plates and give them string to connect them together. They can also use masking tape to connect the plates in order.

You will only have fifteen minutes to finish this activity. That means you’ll have to work together the best you can to figure out lunch for your family.

Give them five and ten minute notices. With five minutes left, take around the strings and punch holes at the top and bottom of each plate.

Start with the Native Americans before the 1800’s and have each group hold up their plate chains and show and describe how they made lunch in their time period.

Hang up the plates in sequential order. Make a paper sign describing each of the four family groups, for example, “Native Americans before the 1800s”.

It’s Time for Lunch! Discussion

What differences did you notice between each of the families and the length of time it took to make lunch?

(To make sure you have discussed each of the following differences between the age periods, you might want to make checkmarks in front of each of the following responses as you hear it from the students.)

☐ It took less time to prepare lunch for each time period. (It is fun to ask each group how long it took for lunch to be ready to eat.)

☐ It became easier to find lunch. (Ask each group where they found lunch. For example: in the woods, at the river, on the farm, or in the grocery store or restaurant.)

☐ Different tools were needed or used in each time period. (Have each group share what kind of tools they used to prepare lunch. The current consumers may have gotten in a car and gone to a grocery store or a deli. Note that money seems to be the tool to get lunch now compared to physical labor and hand tools in the past.)

☐ It took less people to find and prepare lunch. (The groups can each share how many family members it would really take to prepare lunch in their time period. Discuss how it can take less time if more people help.)

☐ In the past, the food was grown, found, handled or processed and prepared by the families. Now, most of our food is grown, found, handled or processed and prepared by many people in many places around the world. In fact, research shows that much of the food we eat in the United States has traveled at least 5,000 miles. Some families still grow, process, and prepare their own food or sell it locally.

☐ The food tasted different in the past then it does now. That is because of the way the plants and animals are grown or raised, what they ate, etc. It is also because most of the foods we eat in the United States have gone through a lot of processing. Think about how often you have eaten a fresh peach or pear compared to canned peaches or pears.

There is one thing about most of our food that has remained the same since the beginning of time. What is it?
Most of the food we eat starts in the soil.
How did the soil make the turkey, bread, berries and milk in the lunch menu?
In all time periods, turkeys ate things that grew or lived on or in the soil. The bread was made from plants such as grains from grasses that grew from the soil. The berries came from plants growing in the soil. The milk was most likely from a cow or goat that ate grasses or grains growing in the soil.

Raise your hand if you agree with the following statement made by millions of children and families across the United States. “We don’t need farms anymore because we have grocery stores.”

What is wrong with that statement?
Our food still grows out of the soil. In fact it takes a good combination of soil, water, sun, air and people that can use good agricultural practices to grow our food now and into the future.

Let’s take another look at the importance of understanding that our food comes from the soil.

APPLE EARTH
Place a washed apple on a cutting board or plate and use a knife to cut the apple into sections as described below. Hold the sections up for the students to see as you discuss what they represent.

(Hold up the apple.) This apple represents planet Earth.
What are some similarities between this apple and the Earth?
They are both round, they each have a core, they each have a crust or skin

We are going to cut the apple into pieces to see how much soil is left on planet Earth to grow food for almost seven billion people and the animals in our care.

1. (Cut the apple lengthwise in four equal parts and take away three.)
   These three parts represent the water on Earth.
   Where do we find water on planet Earth?
   In oceans, river, lakes, ponds, streams, etc.
   The piece that is left, one-fourth of the apple, represents the land on Earth.

2. (Cut the remaining quarter in half lengthwise and take away half.)
   This half represents the areas on Earth that are too hot, too cold, or too wet for the plants we eat to grow.
   What places are too hot?
   Deserts, equator
   What places are too cold?
   The poles, places where there is frozen ground
   What places other than bodies of water are too wet?
   Swamps

3. (Cut the remaining portion crosswise into four equal parts and take away three.)
   These three parts represent areas of Earth where the plants we eat can’t grow roots into the ground. We call these surfaces impervious, which means incapable of penetrating or being passed through.
What things cover soil and make the ground impenetrable?
Roads, houses, businesses, shopping malls, schools, parking lots, mountains, rocks, etc.

The fourth portion – only 1/32 of Earth – represents the land that can grow crops for the close to seven billion people and the billions of animals that live on Earth.

Do plants grow into the core of the earth?
No

What do you call the layer of soil where plants grow?
Topsoil

4. (Peel the skin off the remaining section.)
This skin represents topsoil, the part of the soil that plants grow in. This is the amount of soil on planet Earth that grows the food to feed all the people and animals that live around the world.

Is there very much topsoil on planet Earth to grow our food?
No

What do you think about the amount of soil left on planet Earth to grow our food?
There’s not much soil left that can grow our food.

Will we find any more soil to grow our food?
No, water will continue to cover 75% of planet Earth. The poles will still be too cold to grow food. More buildings, roads, parking lots, shopping malls, golf courses, athletic fields and other things will cover the earth. If we misuse or fail to conserve or protect the good soil we have left, we will lose it, too. It takes thousands of years for the earth to replenish one inch of new topsoil. Scientists and growers are finding other ways to grow foods such as hydroponics, which uses water instead of soil.

Will the population of people and animals on planet Earth increase or decrease?
The population on planet Earth is growing by about 80 million people each year. People are living longer and there are more women at the right age to have babies. According to the United Nations Population Division, there will be seven billion people living on planet Earth by the end of 2011 and close to 10.5 billion in 2045.

How much will our population grow between 2011 and 2045 and how many years is that?
10.5 billion – 7 billion = 3.5 billion or 3,500,000,000 billion people
2045 – 2011 = 34 years
In 34 years, there will be 3.5 billion more people eating food grown from the same amount of soil, or less, than there is on planet Earth now. Think about how old you will be and how you be responsible for feeding your own family. Fortunately, scientists are working hard to find ways to sustain our food supply, or keep it going.

What does Apple Earth tell us?
We need to take good care of the Earth and find ways to grow food for more people and the animals in our care.

Think about the things we learned from the Native Americans and Pioneers in our lunch activity. What is one thing we could do to assure our families that they will have something healthy to eat?
We could grow at least some of our own food.
**TEACHER’S NOTES:** Select at least two Fresh/Raw Produce items and their matching Processed Product (tomatoes and pizza sauce) from the first two columns of the Soil to Food Relay chart. Find props as described in the remaining three columns of the chart. You may want to make signs that say Farmer, Processor, Distributor, Grocer, and Consumer. The Mini Pizza’s include one napkin, round cracker, squirt of pizza sauce, quarter slice of wrapped cheese, and slice of pepperoni per student. Keep foods in a cooler or refrigerator until they are ready to use.

**SOIL TO FOOD RELAY**

Place the relay items on the floor, ground, or on chairs in the order of the columns on the Soil to Food Relay chart. Explain to the students that they will soon become farmers or gardeners, processors, distributors, grocers, and consumers in a Soil to Food Relay. The purpose of the relay is to see how fast food can move from the soil in the garden to us, the consumers. Explain each person’s actions in the relay as described in the chart.

Divide the class or group into teams of five students. Have two or three teams stand near their props. Ask the farmers what produce they have and what they are to do with it. Repeat the questions with the other team members. Have fun doing the relay. After everyone has had an opportunity to participate, proceed with the questions after the chart.

### SOIL TO FOOD RELAY

<table>
<thead>
<tr>
<th>Fresh/Raw Produce</th>
<th>Processed Product</th>
<th>Distribution Center</th>
<th>Grocery Store</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardener or Farmer</td>
<td>Processor</td>
<td>Distributor</td>
<td>Grocer</td>
<td>Consumer</td>
</tr>
<tr>
<td>Place a sample of the following produce on the ground and stand the gardener or farmer next to the item. When the relay begins, he or she will pick up the fresh/raw product and run it to the processor.</td>
<td>Place the processed product that matches the fresh produce, such as salsa from tomatoes, on the ground and stand the processor next to the item. When the processor receives the fresh/raw produce, he or she will put it on the ground, pick up the processed product, and run it to the distributor.</td>
<td>Place a real or toy phone on the ground or have the students use their hands and fingers to make a phone receiver. Have the distributor stand next to the phone and be ready to receive the processed product from the processor. When the distributor receives the processed product, he or she will pick up the phone to call the grocer. The distributor makes a ringing sound and the grocer picks up his or her phone. The distributor says, “I have a new shipment of salsa (or whatever the processed product is), do you need some in your store?” The grocer will answer, “Yes.” Then the distributor runs the product to the grocer.</td>
<td>Place a real or toy phone on the ground or have the students use their hands and fingers to make a phone receiver. The grocer should be ready to receive a phone call, then the processed product from the distributor. After receiving the product from the processor, the grocer holds up the product, looks toward the consumer, and yells, “Salsa (or whatever the product is) for sale. Salsa for sale.”</td>
<td>Put a dollar bill or play money and a grocery bag on the ground and stand the consumer next to them. Once the consumer hears “Salsa for sale!” from the grocer, he or she picks up the money and the grocery bag, runs to the store, hands the money to the grocer, the grocer puts the product into the bag, the consumer runs the product back home, takes it out of the bag and pretends to eat it.</td>
</tr>
</tbody>
</table>

**Vegetables**

Choose one or two of the following: tomatoes, peas, beets, green beans, etc.

Choose a juice, canned or dried product made from the fresh produce in the garden produce column.

**Fruits**

Choose one or two of the following: grapes, oranges, apples, berries, etc.

Choose a juice, canned or dried product made from the fresh produce in the garden produce column.

**Grains**

Choose one or two of the following: corn, oats, wheat, rice.

Choose crackers, pasta, cereal, rice cakes, or bread made from the produce in the garden produce column.
What foods reached the consumer the fastest?

How many steps did it take to get the food from the farm or garden to the consumer?

Five

Did it take very long to get from the garden to the consumer?

It didn’t take long in the classroom relay.

How long do you think it takes for food to move from the garden or farm to the grocery store?

Food is moved to the grocery store as fast as possible, keeping it as fresh as possible. In some cases, produce could move from the garden to the store in 3 days or less.

What are some reasons it would take longer than 3 days to get food from the garden or farm to the store?

If you look at the labels of the foods you pretended to buy at our grocery store, some foods are grown or processed or distributed in another state or country. It would take some time to transport them from place to place.

The farmer and gardener, processor, and distributor didn’t really run the food from one place to another.

How does food move from the farm or garden to the processor, then the distributor and finally to the grocery store?

The raw produce at the farm, garden or ranch was probably packed into the back of a large truck, and a truck driver drove it to a processing plant. The food may also go from the processing plant to the distributor and on to the grocery store in trucks.

What if the food is grown in China or South America?

How do you think it came from there to the grocery store?

The food could be moved from place to place on trucks, trains, ships, or planes.

How would you describe the Soil to Food steps if you bought fresh tomatoes or fresh salsa at a farmer’s market?

Local gardeners and farmers that follow proper growing and processing guidelines and rules can sell their own home-grown tomatoes or home-made salsa at community farmer’s markets. There would be only four steps to the relay and the same person can do all the steps except be the consumer. The gardener or farmer would harvest the tomato. He or she would clean it or turn it into salsa (process it) at home. The distribution center and grocery store is replaced by the farmer’s market. The gardener is called a farmer’s market vender and sells his or her own products. The consumer is still you or someone else buying the locally-grown tomato or salsa.

As a consumer, would you rather buy tomatoes and salsa from a grocery store, a farmer’s market, or maybe you could grow tomatoes and make salsa yourself?

Explain what you would like to do and why.

Think about all the people, buildings, machinery, trucks, and advertising that it took to get the food from the soil to you. Do you think that the amount you paid is a good price?

In the United States, we are very fortunate that our fantastic grocery stores have the largest supply of some of the safest, freshest, least expensive food in the world.
How was each fruit, vegetable or grain changed from when it came from the garden or field?

Have them describe the changes such as washing, slicing/chopping/smashing, adding ingredients, cooking, freezing/refrigerating, packaging, etc.

We call changing a raw agricultural product, such as the ones we just talked about, into a new product – **value added agriculture**. Value was added by changing the product so that more people would want it. That would mean more farmers would have to grow more produce, more workers would have to turn the produce into processed products, and the distributors and grocers would have more product to sell to you the consumer. That means more money for everyone involved and that means, you the consumers have more food choices that you like.

**Raise your hand if you would rather eat a fresh, raw tomato over pizza or spaghetti sauce.**

**Raise your hand if you would rather eat pizza or spaghetti sauce rather than a raw tomato.**

In most cases, the students will raise more hands for the value-added tomato products. Have them repeat why it is good to add value to raw products.

**MINI PIZZAS**

You are going to become processors working at a processing plant that makes mini pizzas. The ingredients have come from four different processing plants and you are responsible for assembling them. I have kept the ingredients in a cooler to keep them fresh and safe to eat.

Besides keeping our ingredients cool, cleanliness will assure us that our pizzas will be safe to eat. So the first thing you need to do is to go wash your hands with soap and water and dry them with a paper towel (or air dryer, if available).

While they are washing their hands, select four students to wash their hands first and stand in a line facing the room. Give the first student a stack of napkins, the second one the round crackers, the third one the quarter-slices of cheese, and the fourth one the slices of pepperoni. You or another adult helper can take care of the squeeze bottle of pizza sauce in between the crackers and cheese.

We have four factory workers ready to work on the Mini Pizza assembly line, which will be you. First, let’s figure out where each of our pizza ingredients came from.

The first person will be putting a napkin on your open hands. We won’t trace those ingredients now. The second person will put a cracker on your napkin.

**What is the main ingredient in crackers?**

Wheat is usually the main ingredient. It is a grain that comes from a wheat plant.

**Where did the wheat come from?**

A farmer grew the wheat in the soil. He or she harvested it and a trucker took it to a processing plant to be made into wheat flour. Then it went to another processor to be made into crackers, a distributor sold the crackers to a grocer. We bought these crackers from the grocery store.

The next person will squeeze a little pizza sauce on your cracker.

**What is the main ingredient in pizza sauce?**

Tomatoes are the main ingredient in pizza sauce. Onions, garlic, peppers, basil and other flavorful vegetables and herbs were probably added.
Where did the tomato come from?
Tomato sauce is a good example of a value added agriculture product where the raw tomato from a garden or field was sent to a processor to be changed into something people want more of. The processor turned the tomatoes into pizza sauce and sent it to the distributor. The distributor sold it to the grocery store where we bought it for you to eat.

Next, you will get a quarter slice of cheese with the wrapper still on it. The factory worker will put it next to your cracker with the pizza sauce so you can take it back to your desk and take the wrapper off before you put it on your pizza.

Where does cheese come from?
Most cheese comes from cows. However, you can get cheese from goats and even sheep. Tofu is cheese made from soybeans.

How does cheese start from the soil?
The soil grows the grains that the cows eat. The cows produce milk. The milk is taken to the processor to be made into cheese. The processor sends it to the distributor. The distributor sells it to the grocery store. We buy the cheese from the grocery store.

Is cheese an example of a value added agriculture product? Why?
Yes. Milk is the raw agriculture product that was changed into cheese so that more people will buy it.

We are going to form a line that passes in front of each of our factory workers. If you do not want one of the ingredients in the pizza, please say “No, thank you.” Take you mini pizzas back to your seat and assemble it. Once you have done that, you may eat it.

It is really loud in a factory. That means you can’t talk to one another during this process unless you are saying “No, thank you” because you wouldn’t be able to hear each other. I will play Dirt Made My Lunch and you can pretend it is on your ear phones.

When they are done eating their pizzas, ask them what they thought about their pizzas. Ask them how many people do they think they should thank for making it possible to eat pizza?

Take a minute or two to ask them what food groups from MyPyramid or MyPlate are represented in the pizza. They should identify all but the fruit group. Ask them what they could have with their pizzas to include the fruit group.

Besides eating foods from each of the food groups, what else could you do to make you healthy?
Exercise

Please stand by your desk. If you agree with the following statements, use your arms and legs to march in place, count out loud to ten, one count for each step. If you disagree with the statement, put your hands above your head and touch your toes ten times.

1. Most of my favorite foods start in the soil.
2. We have to take care of the soil because there isn’t much left on planet Earth to grow our food.
3. We don’t need farmers and gardeners for food because we have grocery stores.
4. Our family could easily grow all the food we eat.
5. I can grow some healthy food for me and my family to eat.
You may want to discuss each of these statements; or, explain to the students that they will learn more about these statements throughout the garden lessons.

If you would like to have the students plant a food crop in the soil, you might like to check out the egghead planters in Lesson 2A. Or, you can purchase tomato, pepper, or basil transplants and take care of them until it is time to transplant outside.

**LOCAL CONNECTIONS**

Ask the students to find out what food is being grown or processed in or around your community. Also include places where local foods (foods grown near where you live) are sold. Give them a few days or a week to visit with their parents; use their eyes and ears to investigate; visit a farm, garden, orchard, garden store, or processor; or check other local resources. Have them write down what they find out and be able to report back.

When they report back, discuss the quantity of food items they found. Discuss the condition of the soil and the climate to determine how that affects food production where you live. Discuss if they think there could be more local food production or more opportunities to buy local foods. Ask if they can think of ideas that they could do to improve the access to healthy garden foods in their community. You may want to turn their ideas into a service learning project.

**OPTIONAL ACTIVITIES**

**THE PIZZA GAME**

Distribute “The Pizza Game” found at the end of this lesson, one per student. Use seeds or game chips as markers.

**What time period does this Pizza Game represent?**

Now

**How can you tell?**

There is a processing plant, distribution center, a grocery store, and trucks. It looks like the game players, you, will be buying the pizza from the grocery store instead of growing and preparing all the ingredients yourselves.

**How is soil used in the game, or in real life, to bring you your pizza?**

Soil grows the plants needed to make the pizza crust and sauce. It also grows the plants that the animals eat in order to produce the cheese and meat on your pizza. The roads and building are built on top of the soil. You will be traveling on the soil to get the pizza from the store to you.

**How many buildings did it take to bring you your pizza?**

From the game, it looks like it took three – ABC Processing, Tasty Food Distributing, and Choice Food Store. It probably took more. Think of the buildings you find on farms for animals and for farm equipment. Each pizza ingredient went from the farm to different processing plants. Another business might have assembled the ingredients into the final pizza product before it went to the grocery store.
Start at the garden, which will represent different farms and write the number of buildings that you think it took for the animals and the farm equipment to produce the raw agricultural products for the pizza crust, sauce, cheese and meat. (Give them a minute to write the number by the garden. Then proceed with the number of processing plants and distribution centers. You may want to add a building between the distribution center and the grocery store to assemble the ingredients for the pizza. Have them count up the number of buildings and write “Buildings = number of buildings” in small print at the bottom of the game sheet.)

How many people did it take to bring you your pizza?
Make tiny stick figures near the garden or farm, trucks, processing, distribution center, grocery store and at least one or two people to bring the pizza home and heat it up. Then count up the figures and write “People = number of people” in small print at the bottom of the game sheet” (Give them a couple minutes to complete the task and then have them share and discuss their numbers.)

How many game squares will it take for us to move from the start at the Pizza Garden to the finish at the Pizza?
There are 49 game squares in the Pizza Game. (You may want to present the following information in the form of a math activity for the students to figure out.) Because most processed foods in the United States travel approximately 5,000 miles from the farm to your plate, every ten game squares equals about a thousand miles. That means every square could represent about 200 miles. You will be making a long journey in a short time as you play this game. Food travels remarkably fast between the farm and the grocery store.

Play the pizza game by rolling a die for each kind of seed or chip color. For example, everyone with a sunflower seed or a yellow chip will move 1 to 6 spaces. Then everyone with a corn kernel or red chip will move together, and so on.

INSTRUCTIONS FOR THE PIZZA GAME

Follow the path from the pizza garden to the pizza and see how produce moves through the food system.

1. Put the game pieces (garden produce or different seeds) in the garden. When it's your turn, roll one die.

2. Move the number of spaces on the die.

3. If you land on a truck, you're ahead of schedule, move ahead 3 spaces. If you land on a hand, stop and check your food, and skip your next turn. If you land on a jar, more people want to buy your tomato sauce. Move ahead or back to the warehouse dock.

4. The first person to land on the pizza is the winner!
Why would it be a big challenge for families to grow and process all the ingredients for a pizza? It would be hard to grow the wheat and grind it into flour. It would be a challenge to take care of one cow and change or process the milk into cheese. It would take a lot of time, energy, and equipment to raise one pig, beef cow, chicken, or whatever meat you wanted on your pizza and then process it yourself.

What pizza ingredients would be the easiest to grow on your own? Tomatoes, peppers, onions, and herbs that go into pizza sauce would be easiest to grow.

What other favorite foods also contain tomatoes, peppers, onions, and herbs? Salsa, taco sauce, lasagna, chili, and other soups and sauces are some examples of foods that you could make with the same garden produce as pizza sauce.

Look at the pizza on the game and pretend it is salsa. Let’s say you grew your own salsa ingredients. How many game squares would there be from your garden to the salsa? (Discuss how all the processing plant, distribution center, and grocery store would be removed. Then determine the number of steps from the garden to the house. At the top of the game sheet write, “My garden to me = 1 or 2 game squares”. The game squares would no longer represent 200 miles each. Discuss how many miles each square might represent.)

How many game squares would you have if you bought salsa ingredients or salsa at a farmer’s market where local farmers or growers bring their produce to sell directly to you, the consumer? (Discuss how the local farmers or growers would take their garden produce directly to the farmer’s market and then you would buy them and take them home. If the producers cleaned the produce and made the salsa, you should add another building, such as their house, to process it. Write “Local garden to farmer’s market to me = 2 or 3 grams squares.” The game squares would no longer represent 200 miles each. Discuss how many miles each square might represent.)
Dirt Made My Lunch

By the Banana Slug String Band © 2002

CHORUS
Dirt made my lunch,
Dirt made my lunch,
Thank you Dirt, thanks a bunch,
For my salad, my sandwich
My milk and my munch 'cause
Dirt, you made my lunch.

Dirt is a word that we often use,
When we're talkin' about the earth beneath our shoes.
It's a place where plants can sink their toes;
In a little while a garden grows.

Chorus ...

A farmer's plow will tickle the ground,
You know the earth has laughed when wheat is found.
The grain is taken and flour is ground,
For making a sandwich to munch on down.

Chorus ...

A stubby green beard grows upon the land,
Out of the soil the grass will stand.
But under hoof it must bow,
For making milk by way of a cow.

Chorus ...
1. Where is your family going to find turkey, bread, berries, milk or water?

2. How will you prepare the meal?

3. Who will be responsible for each part of the meal? What tools might each person need? How long will it take each person to get their menu item ready to eat?

4. Once you’ve answered questions 1–3, you are ready to draw and color the paper plates to tell the entire story. You can use a few plates or all twelve plates. After the plates are finished, arrange them in the correct sequence.

Suggestions for the plates:
A. Pictures of animals and plants the lunch item came from.
B. Picture of the places the lunch items probably came from.
C. Pictures of the tools used to hunt, harvest, process, prepare, or buy the food.
D. Pictures of the final product – lunch.
Student Project

SCIENCE PROJECT OF THE WEEK
CARROT TOPS

PROBLEM: Can a plant grow from just the top of a carrot?

NOTE: YOU MUST START THIS PROJECT TONIGHT!

RESEARCH: What kind of root does a carrot have? Why is the root so big? What is needed for a plant to grow?

HYPOTHESIS: Can the carrot top provide what is needed for the plant to grow?

MATERIALS: Shallow container
4 carrots

PROCEDURE:
1. Cut about half an inch off the end of the carrot that has the leaves. Cut the leaves off close to the base of the carrot.
2. Put the carrots into the container with the cut side down.
3. Add enough water to cover about half the carrot top.
4. Place the container in a well-lighted window.
5. Observe the carrot tops each day for any changes. Remember the changes may start out small and change slowly. Look for new leaves and roots.
6. Use a metric ruler to measure any growth you may observe.
7. Continue your observations for six days and write your report on the sixth day.

DATA: Make a chart to record any changes and measurements

CONCLUSION: This is not optional. You must explain what you learned by doing this activity. Remember that you must answer the question you asked in your original problem statement.

NOTE: BE SURE TO HAVE YOUR PARENT OR GUARDIAN SIGNS YOUR WORK. PARENTS: YOUR SIGNATURE SHOWS YOUR STUDENT HAS DONE THE WORK.
Teacher Notes

POSSIBLE HYPOTHESIS: No growth will occur since the carrot is not living.
OR Leaves will grow since even this small part of the plant is still living.

POSSIBLE CONCLUSION: The carrot top should show some new growth each day. The student should discuss the possible reasons for the growth.
Student Project

EL PROYECTO DE CIENCIA DE LA SEMANA

CABEZA DE ZANAHORIAS

PROBLEMA: ¿Puede una planta crecer de la cabeza de una zanahoria?

NOTA: DEBES DE EMPEZAR ESTE PROYECTO ESTA MISMA NOCHE.

INVESTIGACION: What kind of root does a carrot have? Why is the root so big? What is needed for a plant to grow?

HIPOTESIS: ¿Can the carrot top provide what is needed for the plant to grow?

MATERIALES: Un recipiente no muy hondo
4 zanahorias

PROCEDIMIENTO:
1. Córtale a la zanahoria media pulgada del lado donde tiene las hojas. Corta las hojas que están cerca de la base de la zanahoria.
2. Pon las zanahorias en el recipiente con la parte cortada para abajo.
3. Anide suficiente agua para cubrir la mitad de la zanahoria.
4. Coloca el recipiente cerca de una ventana con suficiente luz.
5. Observan las zanahorias todos los días si hay cambios. Recuerda que los cambios pueden empezar pequeños y cambiar despaciamente. Busca por hojas y raíces nuevas.
6. Usa una regla métrica para medir cualquier crecimiento que puedas observar.
7. continua sus observaciones por seis días y escribe su reporte en el sexto día.

DATOS: Haz una tabla para apuntar tus observaciones e inferencias.

CONCLUSION: Esto no es una opción. Explique lo qué aprendió al hacer esta actividad.
Recuerda que tiene que contestar la pregunta del problema.

TOME NOTA: ASEGUEREN QUE SU PADRE O TUTOR FIRME SU PROYECTO. PADRES: SU FIRMA DEMUESTRA QUE SU ESTUDIANTE HA HECHO LA TAREA LO MISMO.
CROSSWORD PUZZLE

Across
3. Carrots live for ____ years.
4. Genus name for carrots.
7. Orange carrots have more ____ than any other vegetable.

Down
1. Purple and yellow carrots are from ______.
2. Carrots should be planted in ____ soil.
5. Species name for carrots.
6. Carrots belong to this family.

QUOTE
"What did the carrot say to the wheat?
Lettuce rest, I'm feeling beet."
Shel Silverstein

MORROCAN CARROT SALAD

Yield: 5-6 servings

Carrot salad is a traditional dish in North Africa and the Middle East. In Israel it is eaten at the Jewish New Year. It is a symbol of a sweet and fruitful year to come.

Ingredients
* 1 pound (0.9 kg) carrots, grated
* 1/4 cup (60 ml) vegetable oil
* 3 to 4 tablespoons (45-60 ml) fresh lemon juice
* 1/4 cup (60 ml) chopped fresh parsley
* 2 to 4 cloves garlic, finely chopped
* 1/2 teaspoon (2.5 ml) ground cumin
* 1/4 teaspoon (1.25 ml) ground cinnamon
* 1 teaspoon (5 ml) sweet paprika
* Pinch of salt
* 1/4 to 1/2 teaspoon (2 ml) cayenne (optional)

Instructions
In a large bowl, mix together all the ingredients. Cover and let marinate in the refrigerator for at least 2 hours or up to 2 days.

SPOTLIGHT ON RESEARCH
A Rainbow of Carrots

Today, most people around the world eat orange carrots, but that was not always true. A thousand years ago, people in Afghanistan ate yellow and purple carrots, and Europeans ate yellow ones. In India people still prefer red carrots.

People all over the world may soon be eating a rainbow of colorful carrots, thanks in large part to scientists at the University of Wisconsin. For several years, they have been cross-breeding carrots from all over the world to develop new carrot varieties that come in many different colors. These new varieties make very colorful dishes, but that is not the main reason they are being developed.

You may have heard that one way to get enough nutrients is to eat vegetables with different colors. In the case of carrots, this is true. Nutritionists have discovered that each different color variety of carrot contains a different nutrient that your body needs. For example, orange carrots are high in beta carotene, which you need for healthy eyes and seeing in the dark. Red carrots are high in lycopene, which protects you against heart disease and some cancers. Purple carrots contain powerful antioxidants that grab and hold harmful chemicals in your body that can cause aging and disease. Yellow carrots are high in lutein, which prevents eye diseases.

If you see these new colorful carrots in your food market, give them a try! They make surprisingly colorful and tasty dishes, and they are good for you, too!

**CARROTS Science Page**

**DID YOU KNOW?**
The first carrots were not orange. In the 1500s, the Dutch bred purple carrots with yellow carrots to develop the first orange carrots.

**ORIGINS**
White carrots are native to Europe and red carrots are native to Asia. Yellow and purple carrots are native to the area now called Afghanistan.

**CLASSIFYING CARROTS**

**FAMILY**
Apiaceae (Umbelliferae)
- There are about 3,000 species in this family.
- celery
- parsnip
- carrot
- poison hemlock
- fennel
- parsley

**GENUS**
Daucus
- This is the Latin word for carrot.
- My carrots are all forked! I guess my soil is too heavy for this variety.
- Harvest carrots when they are at least finger size. The smaller carrots are juicier and more tender.

**SPECIES**
carota
- This comes from the Greek word karoton, meaning carrot.
- Carrots come in all shapes, sizes, and colors.

**THE CARROT PLANT**
The carrot plant lives for two years.

**Year 1**
During the first year, the root grows. It is ready to harvest in 70-150 days, depending upon the variety.

**Year 2**
If not picked the first year, the root over winters. The next year, the carrot plant uses the stored food in the root to send up a flower stalk. Flowering wild carrot has small white roots and is common along roadsides in much of the U.S.

**GROWING AND HARVESTING CARROTS**
Plant carrots in spring in cooler climates and in fall in hotter climates. Prepare the soil well! Most varieties like deep, loose, well-drained soil. If planted in heavy soil, carrots may produce forked roots.

Sprinkle the seeds in rows spaced about 12 to 18 in. (30-46 cm) apart. After they come up, thin them to one inch (2.5 cm) apart. When the tops grow thicker, thin to about 2-3 in. (7-8 cm) apart.

To get nice carrots, I have to thin out the seedlings so they will have room to grow.

**NUTRITIONAL VALUE**
Carrots have more beta-carotene, from which the body makes vitamin A, than any other vegetable. Plant breeders have developed carrot varieties that have about 75% more beta-carotene than the carrot varieties that existed 25 years ago.

A person who does not have enough vitamin A cannot see well in the dark. If left untreated, the person may become blind. Each year an estimated 350,000 children, mostly living in developing countries, go blind because their bodies lack vitamin A.
Lesson Two: How does healthy soil relate to food?

“Get the Scoop on Soil” from GROWING IN THE GARDEN, Iowa State University Extension and Outreach

“Composting” from GARDEN MOSAICS, Cornell University Cooperative Extension

Students will get the scoop on soil from a mole’s or a worm’s perspective; or, they can become soil particles themselves. They will examine the soil near where they live and discover how to make it healthier by composting. The books *Dirt* by Steve Tomecek and *Diary of a Worm* by Doreen Cronin enhance the language arts component of this lesson.

Content objectives:
- Describe sand, silt and clay;
- Explain why loam is a good mixture of soil to grow plants;
- Define composting and describe what compost organisms need to grow and multiply;
- Explain how to build and care for a compost pile

Life skill objectives:
- Learning to learn, Critical thinking, Problem solving, Decision making,
- Communication, Citizenship, Leadership, Healthy living

Core and STEM concepts and skills:

Science
- Earth and space, Life science, Science in personal and social perspectives, Science as inquiry

Math
- Operations and algebraic thinking, Number and operations – fractions, Measurement and data, Geometry, Mathematical practices

Language Arts
- Reading for informational text, Writing, Speaking, Listening, Viewing, Inferring, Interpreting, Sequencing

Social studies
- People, places and environments; Individual development and identity, Global connections, Maps

Healthy snack:
- Melon Salad or Perfect Parfait

Additional and Supporting Resources: GARDEN MOSAICS, Science pages, Soil and Soil test activities
http://communitygardennews.org/gardenmosaics/pgs/science/english/mainscience.htm
BEFORE THE LESSON

1. **Lesson 2**: This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the [www.peoplesgarden.wsu.edu](http://www.peoplesgarden.wsu.edu) Educational Toolkit.

2. Assemble necessary ingredients and materials for the selected recipe(s).

3. Check your library for copies of Dirt by Steve Tomecek and Diary of a Worm by Doreen Cronin.

THE LESSON

1. **Getting the Scoop on Soil** and **Composting** are meant to be taught over two or more days.

AFTER THE LESSON

Optional Activities include 1) assessing soil types; 2) soil percolation test and 3) soil testing (see the GARDEN MOSAICS, Science pages, Soil and Soil test activities) [http://communitygardennews.org/gardenmosaics/pgs/science/english/mainscience.htm](http://communitygardennews.org/gardenmosaics/pgs/science/english/mainscience.htm)
Melon Salad

INGREDIENTS
1/2 cup cantaloupe
1/2 cup honeydew melon
1/2 cup nonfat vanilla yogurt
1/2 graham cracker sheet

PREPARATION
2. Mix both melons and yogurt together.
3. Crush graham cracker over the top.

Makes 2 servings.

Melon Salad

NUTRITIONAL INFORMATION PER SERVING
Makes 2 servings.
One serving (1/2 cup) contains:
- 70 calories
- 0.5 grams of fat
- 1 gram of fiber
- 8% of Daily Value of Calcium
- 30% of Daily Value of Vitamin A
- 40% of Daily Value of Vitamin C

For more free healthy recipes, log on to www.idph.state.ia.us/pickabettersnack

Funded by Iowa Nutrition Network through USDA’s Food Stamp Program, an equal opportunity provider and employer.
The Iowa Food Assistance Program can help you buy nutritious food for a healthy diet. To find out more, call 1-877-YES-FOOD.
<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Directions</th>
<th>Nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yogurt</td>
<td>Measure 2 spoonfuls of yogurt and add to your serving dish</td>
<td>Calcium</td>
</tr>
<tr>
<td>Fruit</td>
<td>Measure 1 spoonful of fruit and add to the layer of yogurt</td>
<td>Vitamin C</td>
</tr>
<tr>
<td>Granola</td>
<td>Measure 1 spoonful of granola and add to the layer of fruit</td>
<td>Carbohydrates</td>
</tr>
</tbody>
</table>

**Ingredient Directions**

**Nutrient**

- **Calcium**: Gives us strong bones!
- **Vitamin C**: Heals our cuts!
- **Carbohydrates**: Gives us energy!

From Washington State University Extension Food Sense Program
Get the Scoop on Soil

CONTENT OBJECTIVES
Describe sand, silt and clay; Explain why loam is a good mixture of soil to grow plants

LIFE SKILL OBJECTIVES
Learning to learn using senses to sort or classify, Decision making, Problem solving, Critical thinking, Communicating in small and large groups, Citizenship by taking care of the earth

INDICATORS
Playing their part as a soil particle throughout the “human soil” activity, Responding verbally to discussion questions, Writing about soil particles from the perspective of a worm

EVALUATIONS

SUBJECT STANDARDS
Science: Earth (properties of earth materials), Life (organisms and environments)

Language Arts: Reading, Factual understanding, Inferring, Interpreting, Summarizing, Vocabulary, Writing, Character development, Listening, Speaking, Asking and answering questions

LEARNER TYPES
Linguistic-words, Bodily-kinesthetic, Interpersonal, Natural

MATERIALS
Clear quart-sized jar with tight-fitting lid
1½ to 2 cups garden soil (you can bring it or dig it from the playground)
1 cup water
Dirt by Steve Tomecek
3” x 5” index cards (one per student)
3 or 4 basketballs in a large, clear plastic dry cleaner’s bag
12 golf balls in a large, clear bag or bowl
Several pebbles in a clear cup or bag (approximately ¼-inch diameter, small playground rocks work well)
Magnifying glass (optional)
Paper and pencils (one per student)
Diary of a Worm by Doreen Cronin
What is the earth material called where seeds are planted to grow into plants?

Soil

What are the characteristics of soil?

Observe, feel and smell the soil that you brought and tell the students where you found it. Discuss what they see, feel and smell.

Do you think our soil sample can grow plants? Why or why not?

Share ideas and explain that by the end of this lesson they should be able to tell what characteristics of soil help plants to grow.

We are going to make a “soil shake” to learn about the different parts or layers of our soil sample. Fill the jar one-third full of soil. Add water to within an inch or two of the top and put the lid on tight. Shake vigorously for about 3 minutes or pass the jar so all the students have a chance to shake it for a little while. When the soil appears to be thoroughly in suspension in the water, set it down, and let the material settle out. The students will look at it at the end of the lesson.

GET THE SCOOP by reading and imagining

Are soil and dirt the same thing?

No.

What is the difference?

Dirt is what you get on your clothes, track into the house or school, or the stuff under your fingernails. Soil is something that is important to life on Earth.


Is it dirt or is it soil?

Soil

Why did the author name the book Dirt instead of Soil?

Which book would you pick up to read first, one that is titled Dirt or one that is titled Soil?

You may want them to vote by raising their hands. Many times book, newspaper, magazine, television, radio, and music lyric writers use the word dirt instead of soil because it catches people’s attention and sounds more fun.

Why is the story about the soil written by a mole?

Moles live in the soil.

Has anyone seen a mole or evidence of a mole? Describe what you saw.

A mole is a small, dark gray animal with tiny eyes and a strange looking nose that leaves raised areas on the ground where tunnels are. Maybe you have heard funny stories about family members or friends who tried to get rid of moles in their yard by standing guard with a shovel or digging in the tunnels and leaving the moles a special present! Moles can damage yards and gardens when they move the soil and roots of plants.

Start reading and showing the pictures in the book Dirt by Steve Tomecek. Stop at the end of page 7.
What are some examples of living things that would die without soil and why would they die? Many plants would die because they wouldn’t have anything to grow in. Many animals, including insects, and people might die because they wouldn’t have plants to eat.

Start reading again from page 8. Take time to look and talk about the illustrations on each page. Stop reading after page 12.

We learned that soil is made up of different sizes of sediment.

**What is sediment?**
Small pieces of rock worn down by rain, ice and wind into different-sized particles (page 8)

To get an idea of the size difference of these sediments or soil particles, let’s pretend that we shrunk and are now the size of a tiny, itsy-bitsy organism found in the soil.

**What do you think the soil would look like to you at that size?**
First of all, we would see that there are many different things in the soil. It has many different-sized particles that look like rocks or boulders. Those rocks are the mineral particles.

*The answers to the following questions are on page 9 of the book *Dirt*.

**According to the book *Dirt*, what are the four different-sized mineral particles in the soil?**
Gravel, sand, silt, clay

**Which particle is the largest?**
Gravel

In the “soil texture triangle” used by people who study plants and the soil, there are three sediment sizes. **What do you think those three sizes are?**
Sand, silt, clay

**According to the “soil texture triangle,” which particle is the largest?**
Sand

**In the book, what is the next largest mineral particle in the soil?**
Sand

Although farmers dig up many small and large rocks in the soil in their fields, we’re going to concentrate on the remaining three mineral particles that we find near the surface of the soil where we live.

*Write “sand” on the board and hold up the bag of basketballs.* This is what a sand particle looks like to a tiny organism.

**Which of these objects would represent the smallest particles in the soil? What are these particles called?**
*Hold up the pebbles or small rocks and write “clay” on the board.*

**What objects represent the medium-sized particles? What are these called?**
*Hold up the golf balls and write “silt” on the board. Put the basketballs, golf balls, and pebbles side-by-side on the table or desk.*

As a tiny organism, you notice that there are a lot of spaces in the soil where there is nothing, only air-like windows. *(Point to the empty spaces between the basketballs and golf balls. Note that the pebbles don’t have visible air spaces.) We call those windows “pore spaces.” *(Write “pore spaces” on the board.)* Sometimes the pore spaces are filled with
water. Because you are very tiny, you can see that there are many different-sized pore spaces in the soil. This is because good soil has particles of all sizes in it: sand, silt and clay. The amount of sand, silt and clay particles in a soil affects the way a plant grows. A soil that contains a good combination of sand, silt and clay is best for growing plants. We call this soil “loam.” (Write “loam” on the board).

Now, we are going to demonstrate how water moves through soil by making a “human soil.”

THE SOIL GAME

You may want to observe the students to see if they understand their roles as soil particles in the following activity.

You may want to move desks aside, go in the hall, or go outside to play this game. Assign one student to be a bean seed and another student to be the water droplet. Divide the rest of the class into three groups by assigning them to be a sand, silt or clay particle, as you would numbering them off.

Have the students who are clay particles stand next to each other, shoulder to shoulder, in a line. Have the students who are silt particles stand about 3 feet in front of the clay line. Ask them to put their hands on their hips and stand next to each other touching elbows. The space between them indicates the amount of pore space between silt particles. Have the students who are sand particles stand in front of the silt particles, stretching their arms straight out and touching the next person’s shoulders to form their pore space. Place the person representing the bean seed behind the clay line and the person representing the water droplet in front of the sand line.

Ask the water droplet to try to reach the bean seed by passing through the layers of sediment – sand, silt and clay. The water droplet should get stuck in front of the layer of clay because there are no pore spaces to go through. Ask the water droplet what happened. Ask the bean seed if it got any water and what will most likely happen to it.

Ask the students how they can improve the soil so that the water can get to the seed and the bean plant can grow. Have them remember how they are standing as sand, silt or clay particles and have some people change to a different line. Each line should have some sand, silt and clay particles in it making different sizes of pore spaces in each line. For example, a silt particle will have his/her elbow touching a clay particle’s arm that is straight down from his/her side.

Ask the water droplet to try to pass through the soil now. Ask the students what happened and if their plan worked to get water to the seed. Once the water reaches the soybean, have the soybean grow through the particles of soil and out into the sunlight where it turns into a soybean plant.

Try different line-ups to see what happens. For example, what happens if all the lines representing soil are sand? The water would pass by so quickly that the seed might be washed out or not benefit from the water because it would flow right past it. What happens if all the lines representing soil are clay? The water could not penetrate the surface to reach the seed and, if somehow it did, the seed would have a hard time pushing the shoots through the clay and up to the surface.
The best soil for growing plants is a mixture of what three mineral particles or sediments? Sand, silt and clay; this mixture is called loam. Have everyone repeat the word “loam” and write it on the board when the students return to their seats.

Now, let’s go back to our seats and remember we are still itsy-bitsy organisms in the soil.

We are not alone because there are thousands of living organisms of many different kinds in the soil. Let’s learn about some of them. Finish reading the story.

MUD PIE AND SOIL RIBBONS (optional)
You may want to explore soil types by making mud pies and soil ribbons. This activity is found in the Optional Activity Ideas at the end of this lesson.

SOIL SHAKE
Refer to the book Dirt by Steve Tomecek and the human soil activity as you proceed through the following questions.

Have the students stand or sit around the soil shake. Try not to move it and don’t tip it so that the shake remains in stratified layers and the water is clear on top. Once the students have had a close look at the soil shake, proceed with the following questions.

How many different layers do you see in the jar?
You should see three layers of soil and water on top. There might also be little particles such as small twigs or leaves floating on the top.

Gravel and rocks are large and heavy; where do farmers usually find them?
Deep in the soil, deeper than the soil sample we used in the soil shake.

What mineral particle or sediment is the largest in soil?
Sand; it looks like tiny little rocks.

In our soil shake, where do you think the sand settled and why?
At the bottom – the lowest layer – because it is the heaviest and settled out first.

What do you think is the second heaviest particle is in our soil sample?
Silt
What layer do you think is silt?
Second from the bottom

What is above the silt layer – the smallest or lightest particles?
Clay

What layer is thickest or is there the most of? The least?
If a loam soil is a mixture of sand, silt and clay, would you call this a loam soil?
What do you think is on top of the clay or floating in the water?
The organic or dead plant material such as tiny sticks or pieces of leaves or insects

**Why do you think the organic or dead material is on top?**
It doesn’t weigh as much.

Let’s make a list of all the kinds of living soil organisms that we read about in the story. *insects, snakes, moles, earthworms, and microbes*

**What is a “microbe”?**
Remember when you turned into a tiny organism and looked at the balls to compare them to the sizes of soil particles? You were pretending to be a microbe or a microscopic, itsy-bitsy organism that can’t be seen without a microscope.

**Why are microbes so important in the soil?**
Some kinds of microbes decompose or break down organic materials and make nutrients available to plants.

**What important role do earthworms play in the soil?**
They tunnel through the soil to create spaces for water and air. Most plants grow better in soil where water and air can reach the roots of the plant.

**What are those spaces in the soil called?**
Pore spaces

**What are the different layers of soil called in the field if we were to dig 3 or 4 feet deep?**
Horizons

**What layer or horizon has the organic material in it?**
The humus or top layer, also called topsoil

**What soil layer or horizon do plant roots grow in?**
Topsoil

**Why is it important to study the different soil horizons?**
Soil scientists can make suggestions on how land should be developed or what that soil should be used for.

**SOIL PERCOLATION TEST (optional)**
*You may want to test what happens as water percolates through different soil particles. This activity is found in the Optional Activity Ideas section at the end of this lesson.*
SOIL WHERE YOU LIVE

You may want to go outside to answer some of the following questions.

Are there places around our school or neighborhood where plants are not growing well or at all?
Examples include sidewalks, playgrounds and parking lots where the soil is covered by rocks, sand, concrete, and so on; where the soil is too packed down; and where the soil is mostly clay or sand. You will often find clay around new buildings, making it hard to grow things next to the building.

What kind of soil is probably there?
You may want to go look at the soil.

What could you do to make this soil better so plants can grow?
Make it into loam or make sure it has a combination of sand, silt and clay particles. If you are actually going to plant something, you may want to add some organic matter to improve drainage or the water-holding ability of the soil. Also make sure the location has enough light to grow plants and that there is good drainage so that the plants won’t sit in water.

Are there plants around your school or neighborhood that seem to be growing well?
Examples include grass in yards, weeds, flower gardens, shrubs, trees, and so on.

What kind of soil is probably there?
Loam (Go look at the soil if possible.)

What agricultural crops are grown in our state?
In Iowa, it would be field corn, soybeans, oats, sweet corn, grapes, and apples.

Why are these crops grown in our state?
Different agricultural crops like different types of soil and climate conditions. Iowa has some of the richest loam on planet Earth. So, Iowa grows more agricultural crops than any other states except Texas and California. Both of those states have more land and longer growing seasons. Almost 90% of Iowa’s land is in some sort of agricultural production (growing crops or grazing animals) because of the rich soil.

What type of soil particle is is pottery made from?
Clay

Why are pots made out of clay instead of sand or silt?
The particles wouldn’t stick together and the pots would leak.

USES OF SOIL PARTICLES

Have the students take out a piece of paper and a marker; number off as sand, silt, clay and loam; write their soil particle in large letters on their paper; remember the balls and pore spaces; and then draw a group of their soil particles as they would appear microscopically in soil. Explain that you will be reading a characteristic or use of the different soil particles. Have them hold up their sign if they think their soil particle finishes your question, “What is _____?” You may want them to trade signs and play again.
This is a mixture of sand, silt and clay soil particles.  
**What is _____? (Loam)**

This tiny soil particle can hold water and is a good base for farm ponds.  
**What is _____? (Clay)**

This large soil particle is found on beaches and in sandboxes.  
**What is _____? (Sand)**

This medium-sized soil particle is found near rivers. It is particularly important to the Loess Hills in western Iowa.  
**What is _____? (Silt)**

This soil particle is used under brick walks and patios to stabilize and even out the surface before laying bricks or stones.  
**What is _____? (Sand)**

This is farmers’ and gardeners’ favorite kind of soil to plant crops.  
**What is _____? (Loam)**

This soil particle is found in the Loess Hills in western Iowa. It blows away easily so farmers have to practice good soil conservation techniques to keep it in place for the plants to grow.  
**What is _____? (Silt)**

This soil particle is common around construction sites where there have been huge holes dug into the ground. If it rains, the water runs off these soil particles, making a slippery mess.  
**What is _____? (Clay)**

This soil is used as a de-icer so you won’t fall on the ice. Your parents might have bags of it in the back of your vehicle for weight to give the tires traction on slippery roads.  
**What is _____? (Sand)**

This medium-sized particle is used on golf courses, where growing special kinds of grass and good drainage are important.  
**What is _____? (Silt)**

This soil mixture is very valuable to us because it grows a lot of our food.  
**What is _____? (Loam)**

This is used to make flower pots, dishes, plates, bowls, mugs, serving bowls, and so on.  
**What is _____? (Clay)**

How do you benefit from loam?

Loam grows plants that we use for food, clothing and shelter. Even if the animals are the primary consumers of our popular grain crops, we benefit from the animals. In Iowa, many families and communities depend on loam to earn an income or money to spend on education, food, clothing, shelter, services, and entertainment.

FROM AN EARTHWORM’S PERSPECTIVE

*Read Diary of a Worm by Doreen Cronin.*

Let’s think about what it would be like to be an earthworm going through the different types of soil. Pretend that you are an earthworm. Choose one type of soil and write what it would be like to visit there. What would you see? How would you feel? Would things be growing there? Write this on the back of a 3”x5” card - postcard style. On the front, draw a picture of yourself (the worm) in the soil with a caption such as “Wish You Were Here” or “Worm Heaven,” etc.
MUD PIES AND SOIL RIBBONS

This is a wonderful activity to see and feel the difference between soil particles and to observe their characteristics. It works best to set up the tests at three learning stations (sand, clay, loam) with an adult volunteer to help at each station. To facilitate cleanup, you may want to do this activity outdoors or indoors with large garbage bags or newspapers under the stations. Have the students put on their paint shirts.

Take a handful of clay soil. Add water, a little at a time with a cup, and make a slimy “mud pie.” Try to form a ball with the soil. Can you do it? Why? Because the small clay particles stick together. Now, squeeze a small amount of soil between your thumb and the side of your index or pointer finger. Keep squeezing it through to form a “ribbon” of soil. See how long you can make a ribbon before it breaks. Does it feel smooth like a satin ribbon? Put your ribbons and clay balls back in the clay pile. Brush your hands off above the clay pile.

Take a handful of sandy soil. Add water, a little at a time with a cup, so that it creates a soggy “mud pie.” Try to form a ball with the sandy soil. There should be enough sand in the soil so that this is not possible. Can you form a ball? Does the soil feel gritty? Now, try to form a ribbon with the sandy soil. It can’t be done. It always breaks off. Put the sandy soil back in the sand pile. Brush your hands off above the sand pile.

Repeat this with the loam soil. What did you find? A good loam soil will hold together at first when squeezed in your fist, but will crumble apart when lightly touched. This is an easy way to determine the texture of soil.

What were the three different textured soils or soil particles we tested?
Sand, silt, clay

What difference does the texture of a soil have on how fast water will go through it?
Pore spaces

How can you tell if a soil is sandy?
Large particles that don’t hold together, won’t form a ribbon, and feel gritty

How can you tell if a soil has a lot of clay?
Small particles that stick close together will form a ribbon.

Which kind of soil works best for growing plants? Why?
Loam because roots would have a hard time growing through clay and may not get enough water and nutrients from sand

Would you have to water gardens in sandy soil more often or less often than ones in clay soil?
More
Why?
The water runs right through the sand particles.
Test the soil in your school garden using the “ribbon test.” What did you find?
How can you change the soil in your garden to be more like loam?

**SOIL PERCOLATION TEST**

This test can also be found with additional activities in Project Food, Land & People. “Perc Through the Pores.” *Project Food, Land & People: Resources for Learning.* Chandler, AZ: Project Food, Land & People, 1998. [www.foodlandpeople.org](http://www.foodlandpeople.org)

**MATERIALS**
- 1 cup each of sand, silt and clay soil types
- 3 empty clear cups with small holes in the bottom
- 3 cups water
- Tray to catch water dripping from cups
- 3 to 6 bean seeds *(optional)*

*Do this activity outside or over a tray because dirty water will come out of the bottom of each cup.*

1. Feel each soil type – sand, silt and clay.
2. Put equal amounts of sand, silt and clay in three separate cups.
3. Give a countdown and have the students pour 1 cup of water in each cup at the same time.
4. Note which cup or soil type has water coming out of the holes first. Sand should be first, followed by silt, and then clay.
5. You may want to plant bean seeds in each cup to see which ones grow best.

**RESOURCES**


WHAT IS COMPOSTING?

Composting is the controlled decay of plant and animal matter to produce compost—a dark, rich soil-like material. Compost can be added to soil to improve its structure and nutrient content.

In nature, bacteria, fungi, worms, and other soil organisms help to break down dead plants and animals, as well as animal wastes. The decomposed organic material becomes part of the soil. This natural decay process usually takes place very slowly.

Leaves that fall to the forest floor slowly decay to form part of the organic matter in soil.

Composters create ideal growing conditions for compost organisms. This speeds up the natural decay process.

WHAT COMPOST ORGANISMS NEED

1. A balanced diet of compost materials

"Browns" are compost materials that are brown and dry.

"Greens" are compost materials that are green and moist.

If I add about 3 parts browns to 1 part greens, then the compost organisms will have a balanced diet.

2. Just the right amount of air and water

If there’s the right amount of oxygen and moisture, microbes can rapidly grow and multiply. Too much—or too little—water, and microbes will die.

Compost materials should have a thin film of water around them, and lots of pore spaces filled with air.

3. The right temperature

Organic materials will eventually decay, even in a cold compost pile. But the decay process is speeded up in a hot compost pile. When bacteria and fungi grow rapidly, they burn a lot of food, and give off a lot of heat. If the compost pile is big enough, the heat will build up inside the pile. Bacteria that grow well at high temperatures take over and speed up the decay process.

A compost pile that is about one cubic meter (1m x 1m x 1m) in size is big enough to hold in heat and warm up.

This compost pile is not big enough to retain heat, so it stays cool.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.

Printed with Permission, February 2012
GARDEN MOSAICS

CROSSWORD PUZZLE

Across
2. Compost materials that are high in carbon.
4. Dark, rich, soil-like material.
6. A compost pile should be big enough so _____ builds up inside it.
7. A balanced diet for microbes is about _____ parts browns to one part greens.

Down
1. Microbes that help break down plant and animal matter.
3. Compost organisms need just the right amount of ________.
5. Compost materials that microbes use to make proteins.

TRY THIS
BUILD A COMPOST PILE

What you need
* 3-meter length of wire mesh fencing
* wire cutters
* twist ties
* compost materials
* duct tape

What to do
1. Choose a site to set up your compost bin. Try to find a shady, well-drained, level place that is convenient.
2. Snip off the fencing close to the cross wires and cover the sharp ends with duct tape to avoid getting scratched. Lap the ends of the fencing together and tie together with twist-ties to make a cylinder one meter high and one meter in diameter.
3. Put a layer of twigs in the bottom of the bin to help air to reach the center of the pile.
4. As you collect compost materials, layer them in the compost pile, as shown in the picture.
5. Stir or turn the compost every week or so to let in more air. To reach the compost, undo the twist-ties and open the fencing.
6. The length of time it takes for compost to be ready depends on many factors, such as weather conditions, the type of materials included, and the amount of turning. If you want your compost to be finished faster, keep it moist and turn it a couple of times a week. Finished compost is about one-third or less of its original size, dark brown, and has a nice, earthy odor.

Spotlight on Research
Compost Can Help Control Plant Diseases
Recent research has shown that compost not only improves soil. It can also help to control plant diseases caused by fungi. Fungi that attack plants include molds, rusts, mildews, and smuts. They over-winter in the soil and in plant debris. When the weather is warm, they produce spores, which can be splashed or blown onto wet leaves. Then the spores can germinate and infect plants.

Scientists are testing different composts to find out what types are most effective at suppressing harmful fungi. In one study, a team of scientists tested different composts to see which one would be best for controlling fruit rot in pumpkins. Fruit rot is a serious problem that affects pumpkins, melon, squash, peppers, tomatoes, and eggplants. In greenhouse trials, scientists first screened composts made of several different materials. One product, made from brewery wastes, stood out as very effective. In the following year, the brewery waste compost was applied to two fields where fruit rot had been a big problem in the past. In one field, no disease occurred, and the growth and yield of pumpkins improved a great deal compared to untreated fields. In the other field, the brewery waste compost was not effective in suppressing fruit rot. Scientists think that perhaps there was just too much of the fruit rot fungi present. If brewery compost were added to this field for several more years, then the disease might be suppressed. Time will tell.


Riddle
Why did the gardener bury money in his compost pile?

Answer: Because he wanted his soil to be rich!

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.

Printed with Permission, February 2012
COMPOSTING Teaching Tips

**LEARNING OBJECTIVES**
Youth will be able to:
* Define composting.
* Describe what compost organisms need to grow and multiply.
* Explain how to build and care for a compost pile.

**HOW TO USE THE COMPOSTING SCIENCE PAGE**

Ask youth what happens to their household food scraps, yard trimmings, and fallen leaves. Explain that these organic materials make up 20-40% of the total wastes that go to landfills and incinerators in the U.S. Yet these valuable resources could be composted to produce a soil amendment that can greatly improve garden soil.

Show youth various materials, some of which can be composted (for example, leaves, newspaper, and kitchen scraps) and others (for example, metal and plastics) which cannot decompose. Have the youth separate the materials into two piles, one with items that will decay, and another with items that will not decompose.

Show youth some finished compost. Let them feel and smell the compost. Ask: How did kitchen scraps and other compost materials become this rich, dark brown, sweet-smelling compost? (Answer: Microbes and physical processes (e.g., heat) broke down the materials into compost.)

Pick up a handful of compost, and tell youth that you are holding more microbes than there are people living on the earth. Although these microbes cannot be seen, evidence of their growth can be observed. If all of their needs are met, microbes grow and multiply very quickly, and turn vegetable scraps and yard wastes into compost. Tell youth that the Science Page contains information on what compost organisms need in order to produce compost.

Emphasize that the more ideal the conditions are for microbes in a compost pile, the faster the decay process. A compost pile can take from several days to several months to finish composting. Turning the pile will help ensure that all parts of the pile have enough air and moisture, which will speed up the decay process.

Explain that brown materials are usually much drier than the food scraps and other green materials in a compost pile. So they help to balance the moisture in a compost pile as well as provide carbon-rich food for microbes. The browns are also usually coarser than the greens, so they create a porous structure that allows air into the pile, and excess water to escape. Warn youth not to include meat, oily materials, dairy products, or bones in the green layers. They may attract pests to the compost pile.


Pick up a handful of compost, and tell youth that you are holding more microbes than there are people living on the earth. Although these microbes cannot be seen, evidence of their growth can be observed. If all of their needs are met, microbes grow and multiply very quickly, and turn vegetable scraps and yard wastes into compost. Tell youth that the Science Page contains information on what compost organisms need in order to produce compost.

**CROSSWORD PUZZLE**

**Answers:**
Across: 2. browns; 4. compost; 6. heat; 7. three.
Down: 1. bacteria; 3. water; 5. greens.

**TRY THIS**

Ask youth to keep a pail or other container in their kitchen for collecting food scraps. Line the container with newspaper to make it easier to empty and to clean. Ask: What items can you collect in your compost bucket? (Answer: Vegetable or fruit scraps, coffee grounds, tea bags, and crushed egg shells.) Ask: What items should not be put in the compost bucket? (Answer: meat, fat, dairy products, bones, or raw eggs.)

Explain that cutting up the food scraps into smaller pieces will make them rot faster.

Discuss where you can find local sources of browns, such as straw, dried leaves, sawdust, or newspaper. Remind youth that they need to have three times as many browns as greens. Ask everyone to collect and bring in greens and browns to add to the compost pile.

Emphasize the importance of size of the compost pile. Ask: What would happen if the compost pile were smaller than one cubic meter? (Answer: It would lose heat, so the composting process would be slowed down.) Talk about the importance of moisture and air in the pile. Ask: How can we make sure that the compost organisms have enough air and moisture? (Answer: Make sure the pile stays as moist as a damp sponge. Turn it at least once a week so that all parts of the pile get enough moisture and air.)

Schedule times for youth to turn the pile once a week. Once the compost is finished, youth may wish to use it in a garden, or for potted plants.

**SPOTLIGHT ON RESEARCH**

Planning a Healthy Garden

Lessons Three & Four:  How do we make a garden plan and a garden calendar?

“Our Healthy Garden Plan” from GROWING IN THE GARDEN: LOCAL FOODS AND HEALTHY LIVING, Iowa State University Extension and Outreach

Students decide what cool season and warm season crops they want to grow by making and eating Lettuce Wraps and Fresh Garden Salsa. Using science and math concepts, they create their own Healthy Garden Plan, markers to go with it, and a calendar.

Content objectives: Identify and select locally grown fruits and vegetables to plant, grow, harvest and eat; Use a variety of mathematic and science concepts and skills to create local garden plans and calendars.

Life skill objectives: Critical thinking, Problem solving, Decision making, Healthy living, Communication, Citizenship, Leadership

Core and STEM concepts and skills:
Math Operations and algebraic thinking, Number and operations, Measurement and data, Geometry, Mathematical practices
Science Science as inquiry, Earth and space, Life science
Language Arts Reading, Speaking, Listening, Viewing
Social Studies Economics, Geography

Healthy snack: Lettuce Wraps and Fresh Garden Salsa

Additional and supporting resources: “How do you plan a garden?” General Information for planning unit in GROWING IN THE GARDEN: LOCAL FOODS AND HEALTHY LIVING; The Vegetables We Eat by Gail Gibbons (book available from libraries or for purchase); Extension Master Gardeners
BEFORE THE LESSON

1. **Grade 4, Lesson 3 and 4:**
   This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the [www.peoplesgarden.wsu.edu](http://www.peoplesgarden.wsu.edu) Educational Toolkit.

2. Check your school or local library for a copy of *The Vegetables We Eat* by Gail Gibbons, *Too Many Pumpkins* by Linda White.

3. Assemble necessary ingredients and materials for the selected recipe(s).

4. Potential local partners who can provide expertise, time, energy, supplies and/or funding to assist you include: other school staff, volunteers, and older students (from classrooms, foodservice, maintenance, administration, high school organizations); Extension staff, volunteers, and organizations (such as Master Gardeners, 4-H Club members, nutrition programs such as EFNEP or SNAP-Ed, specialists or agents); local foods producers; gardeners; farmer’s market vendors; local foods restaurants; grocery store produce managers; local organizations, businesses, and interested and knowledgeable individuals of all ages and cultures. These people can help you use this lesson and apply the activities to where you live and your garden program.

THE LESSON

1. **Our Healthy Garden Plan** is meant to be taught over two or more weeks.

AFTER THE LESSON

This is a good time for students to start a gardening journal. They will be able to record various facts about the garden that they plan, plant, grow and harvest.
GARDEN CHOICES THROUGH TASTE TESTING

Make sure that everyone washes their hands and that the demonstration table is washed. Set up the table with the Lettuce Wrap ingredients (see Lettuce Wraps recipe), cutting board, knife, gloves, paper plates, paper towels, and napkins. Have the student volunteers put the paper plates out on the table so that they can place one sample of each vegetable on each plate. When the other students are done washing their hands, have them pick up their sample plates and take them back to their seats. Instruct them not to eat anything on their plate until they are told.

<table>
<thead>
<tr>
<th><strong>LETTUCE WRAPS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Makes 24 samples</td>
</tr>
</tbody>
</table>

1. **Wash all produce before starting.**

2. **Prepare the ingredients.**
   - 1 Bundle of Romaine or leaf lettuce (*tear into 24 pieces*)
   - 12 Large (*tear in half*) or 24 small spinach leaves
   - 6 Radishes (*slice thinly*)
   - 6 Green onions (*slice the white part and 1½ inches of the green part into thin rings, discard the roots and the tops*)
   - Squirt bottle of ranch dressing

3. **Have each student do the following.**
   - Lay the lettuce leaf on the paper plate. (Adult should help.)
   - Lay the spinach leaf or leaves on top of the lettuce leaf.
   - Put the radish slices on the spinach.
   - Put the onion slices on the radish slices.
   - Squirt a line of ranch dressing across the layer of veggies. (Adult should help.)

   **After teacher demonstrates how, roll up the wrap or fold one side over the other.**

**EAT IT!**
**Fresh Garden Salsa**

3 large tomatoes, seeded and coarsely chopped  
1 small fresh jalapeno chile seeded and minced (optional)  
1 clove garlic, minced  
¼ cup finely chopped onions  
2 tablespoons finely chopped cilantro  
2 tomatillos, husks removed, finely chopped  
Juice from 1 small lime  
¼ teaspoon salt  
¼ teaspoon freshly ground black pepper

In a large bowl, combine all the ingredients. Stir together until well blended.  
Cover and chill for 30 minutes or more before serving.  
Keeps for up to 4 days in the refrigerator.  
Makes about 2 cups.
# Our Healthy Garden Plan

## CONTENT OBJECTIVES
Identify and select locally grown fruits and vegetables to plant, grow, harvest and eat.
Use a variety of mathematic and science concepts and skills to create local garden plans and calendars.

## LIFE SKILL OBJECTIVES
Critical thinking, Problem solving, Decision making, Healthy living, Communication (listening, asking and responding to questions), Citizenship (teamwork), Leadership (sharing an idea to improve something)

## INDICATORS
Students will develop a productive garden plan that will demonstrate how much healthy food can be grown in a limited amount of space.

## SUBJECT STANDARDS
**21st Century Skills:** Employability skills, Health literacy

**Science:** Science as inquiry, Earth and space, Life science

**Mathematics:** Operations and algebraic thinking, Numbers and operations, Measurement and data, Geometry, Mathematical practices

**Social Studies:** Economics, Geography

**Literacy:** Reading, Speaking, Listening, Viewing

## LEARNER TYPES
Linguistic-words, Logical-mathematical, Spatial-visual, Bodily-kinesthetic, Interpersonal, Intrapersonal, Natural

## MATERIALS
*Too Many Pumpkins* by Linda White

Garden Grid *(This is a two page worksheet. Make one copy, front and back, per group. See the Introduction and Reflect sections. These pages are found at the end of this lesson.)*

Pencils

Rulers

Seed Catcher *(one per student, found at the end of this lesson)*

Lettuce Wrap ingredients and Ranch dressing *(See the TEACHER’S NOTES following this Materials List and at the beginning of the Do section.)*

Lettuce Wrap preparation supplies *(See the TEACHER’S NOTES at the beginning of the Do section.)*

Small plates *(one per student)*

Napkins *(one per student)*

Salsa ingredients and chips *(See the TEACHER’S NOTES following this Materials List and at the beginning of the Do section.)*

Salsa preparation supplies *(See the TEACHER’S NOTES at the beginning of the Do section.)*

*Materials continued on the next page.*
**MATERIALS CONTINUED**

Square-foot gardening templates and 1 poster board (Use the poster board to make one example of each template found at the end of this lesson.)

Plant Spacing for Square-foot Gardening (see RELECT section, found at the end of this lesson)

Plant Spacing for Rows in the Garden (see REFLECT section, found at the end of this lesson)

Paint sticks, wooden spoons, recycled plastic, used vinyl blind slats, or any creative re-usable materials for garden labels (2 per crop, see APPLY/EXPAND section)

Thin or medium line permanent markers in various colors

Garden Calendar (copy and post where everyone can see it, see APPLY/EXPAND section, found at the end of this lesson)

**TEACHER’S NOTES:** Here is a list of potential local partners who can provide expertise, time, energy, supplies and/or funding: School staff, volunteers, and older students (from classrooms, foodservice, maintenance, administration, high school organizations); Extension staff, volunteers, and organizations (such as Master Gardeners, 4-H Club members, nutrition programs such as EFNEP, specialists or agents); local foods producers; gardeners; farmer’s market venders; local foods restaurants; grocery store produce managers; local organizations, businesses, and interested and knowledgeable individuals of all ages and cultures. These people can help you use this lesson and apply the activities to where you live and your garden program.

The Do/Explore section includes taste-testing activities with Lettuce Wraps and Fresh Salsa. You will need cool season crops such as lettuce, spinach, radishes, and onions for the Lettuce Wraps. Garden fresh salsa may be purchased in the produce department at your local grocery store, or you can have your class make salsa using the Summer Garden Salsa recipe found at the end of this lesson. See the TEACHER’S NOTES at the beginning of the Do/Explore section.

---

**INTRODUCTION**

**ENgage**

SET THE STAGE

30 MINUTES

**TEACHER’S NOTE:** Plan to have students work with a partner or small group for this activity.

Raise your hand if you have seen a carpenter or construction worker building a home or other building.

Do they have a plan for what they are building?
Yes

What is the plan called? Hint: It starts with a color.
Blueprint

Why do you think they need a blueprint plan?
So several people can work together and know where to build the walls, add plumbing and electricity, etc.

Could they build the structure without a blueprint?
Maybe, but it may not turn out as it was intended and there may be a lot of mistakes. It will probably take them longer, too.

Planting a garden is a bit like building a house. A good plan will make the job easier and will result in a productive garden.
What kind of help would a plan provide a gardener?

Write the answers on the board. A garden plan will:

- help the gardener determine what kind of and how many plants or seeds to buy
- assure the plants have plenty of room to grow
- help determine what supplies and how much are needed
- help a gardener determine how much produce to expect from the garden
- help a gardener know when the crop will be ready to eat

We are going to read *Too Many Pumpkins*, by Linda White, a story about a woman who doesn’t plan what grows in her yard.

*Read the story*, *Too Many Pumpkins* by Linda White, and ask the class the following questions:

**Rebecca Estelle grew a little bit of everything in her garden except what?**

Pumpkins

**Why?**

She was tired of pumpkins because that is all she ate when she was young.

**Did Rebecca Estelle have a plan for her pumpkin patch?**

No, she didn’t intentionally plant the pumpkins.

**Did the pumpkins grow well?**

Yes, very well.

**What was the problem with the pumpkins?**

There were too many and they took over the entire yard.

**How did she solve the problem?**

She made pumpkin treats and jack-o-lanterns and shared them with neighbors and friends.

**Do you think she will include pumpkins in her garden plan next year?**

Yes

**How do you know?**

She saved some of the seeds.

Let’s plan Rebecca Estelle’s garden for next year. I am going to assign each of you a partner or group. Your group will have 5 to 7 minutes to plan Rebecca Estelle’s garden for next year.

*Assign partners or groups, distribute one Garden Grid per group. Have the students take out their pencils and rulers.*

**What vegetables did Rebecca Estelle plant in her garden?**

Let’s go back to the story and list the crops that Rebecca Estelle plants in her garden and add pumpkins. (*These are found on the first page of the story.*) “Every year at springtime, Rebecca Estelle planted just enough seeds in her garden to grow vegetables for the long winter. She planted carrots, beans, tomatoes, peas, corn, and rutabagas.” (*Write the crops on the board.*)
Please write these vegetables in the empty space on the right hand side of your garden grid. Work with each other to draw a plan for Rebecca’s garden on your garden grid. You may use any plan you would like but be sure to include all the vegetables on your plan. You will have five to seven minutes. Do it any way you like. (Avoid telling students how to make their plan. Let them come up with their own garden plan as kind of a pre-test.)

**It’s time to share your garden plans. How did your group do?**

Give each group one minute to show and tell about their garden plan. Or, use the “garden gallery” method by having students hold up their plans at the same time so everyone else can see. Ask them to look for similarities and differences.

**What problems did you have while you were designing Rebecca’s garden?**

Possible answers include:
- Couldn’t agree with partner
- Didn’t know how much space each plant needed in the garden
- Didn’t know how many plants we needed to grow
- Didn’t know how to use the garden grid
- What is a rutabaga anyway?

**How could we figure out how to resolve these problems before we make our own garden plans?**

Possible answers include:
- Use some of the good ideas from the plans we just made.
- Find people to help us who know what they are doing.
- Look at plant seed packages or plant labels.
- Do an online search for information on the crops.
- Look at someone else’s garden plan and garden.

Have the students put their names on their garden grids and collect them. Explain that they will be using them again.

**TEACHER’S NOTES:** Copy the Seed Catcher pattern and instructions found at the end of this lesson, one per student. See the Lettuce Wraps and Fresh Garden Salsa activities and recipes in “Garden Choices Through Taste Testing”. Wash and precut samples and store them in bags. Save a whole lettuce leaf, spinach leaf, radish, and green onion to show the students and to demonstrate how to prepare or cut it. Invite a few students to help distribute the samples. You may want them to wear gloves or use tongs to put the samples on one paper plate per student.

**SEED CATCHERS**

Distribute the Seed Catcher patterns and have the students use their scissors to cut them out. Follow the instructions and make the seed catchers together, step by step. Give the students time to take turns using their new seed catchers and reading the tips about gardening.

**What was your favorite gardening tip?**

Ask three or four students to share the tip from their seed catchers.
What did you learn by making and playing with your seed catchers?

Possible answers include:
- You have to follow step by step instructions before you can make the seed catcher work.
- There were lots of steps and decisions to make before you could read the garden tip.

They might repeat the tips.

What was the first decision you had to make to start playing with your seed catchers?
Someone had to choose a food that grows in a garden.

What was the first decision Rebecca made about gardening?
She chose what food she wanted to grow in her garden.

We will start our own garden plan by first deciding what we want to grow and eat.

**GARDEN CHOICES THROUGH TASTE TESTING**

Make sure that everyone washes their hands and that the demonstration table is washed. Set up the table with the Lettuce Wrap ingredients (see Lettuce Wraps recipe), cutting board, knife, gloves, paper plates, paper towels, and napkins. Have the student volunteers put the paper plates out on the table so that they can place one sample of each vegetable on each plate. When the other students are done washing their hands, have them pick up their sample plates and take them back to their seats. Instruct them not to eat anything on their plate until they are told.

---

**LETTUCE WRAPS**

Makes 24 samples

1. Wash all produce before starting.

2. Prepare the ingredients.
   - 1 Bundle of Romaine or leaf lettuce *(tear into 24 pieces)*
   - 12 Large *(tear in half)* or 24 small spinach leaves
   - 6 Radishes *(slice thinly)*
   - 6 Green onions *(slice the white part and 1½ inches of the green part into thin rings, discard the roots and the tops)*
   - Squirt bottle of ranch dressing

3. Have each student do the following.
   - Lay the lettuce leaf on the paper plate.
   - Lay the spinach leaf or leaves on top of the lettuce leaf.
   - Put the radish slices on the spinach.
   - Put the onion slices on the radish slices.
   - Squirt a line of ranch dressing across the layer of veggies. *(Adult should help.)*

   **After teacher demonstrates how, roll up the wrap or fold one side over the other.**

   **EAT IT!**

We are going to make Lettuce Wraps so we can taste some early, cool season vegetables.
**Why are some vegetables called “cool season crops”?**

*Possible answers from students could include:*
- They are neat or awesome
- They don’t like heat
- They grow best when it’s cool outside
- They like to be in the refrigerator

Cool season crops grow best when they are planted outside as soon as the soil can be worked. These crops tend to dry up and die when hot summer weather arrives. They could also be planted inside our classroom in containers.

*Have the students read the crops on the chart that grow best in the spring and are called cool.*

We are going to taste some cool season vegetables that grow near where we live and that we might be able to grow in our garden. I grew/bought these at _______________. I kept most of these in the refrigerator to keep them fresh until we needed them. Then I washed them and cut them into sample sizes. Before we make our lettuce wraps, let’s see if you can identify the vegetables on your plates.

*Show one vegetable at a time. Start with the largest lettuce leaf. Have students tell what it is. Continue naming the other vegetables. As vegetables are identified, have students stack them on their lettuce leaf. Give each student a squirt of ranch dressing, if desired, then show how to roll everything up into their own Lettuce Wrap.*

**How did you like your Lettuce Wraps?**

*Raise your hand if you tried a vegetable that was new to you.*

*Have the students name the ingredients in the lettuce wrap. Write them on the board or a large sheet of paper, leaving space for tally marks. Have them vote for their top two favorite vegetables in the wraps. The most popular choices could be the cool season crops they grow in their garden.*

*Have the students save their plates for the salsa activity.*

**TEACHER’S NOTES:** As time allows, you can continue with the warm season crops and salsa tasting or save this activity for another day. You need to allow 20-30 minutes extra if you make the Summer Garden Salsa recipe with your class. If you choose to make salsa, students can participate by cutting up ingredients on plastic plates using plastic knives. A teacher or adult helper should cut and clean out the peppers. Mix ingredients in large bowl or ice cream pail.

Now we are going to taste test some warm season crops.

**Using what we learned about cool season crops, why might these foods be called warm season crops?**

*Possible student answers include:*
- They like warm weather.
- They taste hot and spicy.
- They don’t grow well in cool weather.
- They grow best during warm weather.
Warm season crops thrive in warm, sunny summer weather. These crops could also be planted inside in containers, then transplanted outside when the temperatures warm up. Some local producers are planting warm season crops in greenhouse-type buildings, called high tunnels, so their crops will be ready to eat earlier. Consumers enjoy eating summer vegetables early because they have waited a long time for the vine-ripened, just-picked flavor.

*Put a little salsa in small 3 ounce cups and put a cup on each student’s plate. Pour two or three chips on each plate.*

Fresh garden salsa contains many warm season vegetables. I will put a serving of salsa on each of your plates. Put a small portion of salsa on each plate.

You have fresh garden salsa on your plates. We can also buy salsa at the store in jars. Salsa can be processed so it can be stored on shelves for long periods of time.

*Raise your hand if you have eaten fresh salsa.*

*Raise your hand if you have eaten processed salsa.*

*Is it one of your favorite foods?*

**What are the ingredients in our fresh salsa?**
Tomatoes, onions, peppers, not sure

We can read the ingredient label if we aren’t sure. Let me show you what each ingredient looks like. We will list the ingredients on the board.

*Show uncut examples of each of the vegetables in the salsa. You may want to cut up small samples to taste.*

**How do we usually eat salsa?**
On tacos, with chips

*Raise your hand if this is the first time you tried salsa.*

**How did it taste?**

List the vegetables from the salsa and the “Too Many Pumpkins” book on the board or a large sheet of paper. Have the students vote for their top two choices. Put a star by the four to six crops that received the most votes. These are the crops they could plant in their garden.

**Which vegetables had the most votes? Which ones had less?**

Class could make a bar graph plotting the results of the tally voting.

We will want to remember our favorites when we plant our garden. It is also important to plant a variety of crops so we can harvest in spring, summer, and fall.
TEACHER’S NOTES:

- Select the Garden Grid, found at the end of this lesson that best suits the type of garden you will grow – tilled, raised bed, or container such as EarthBox™. Copy one per student or pairs of students and one or two as working copies for the entire class. Have the same pairs or small groups of students that worked on Rebecca’s garden from the Introduction section, work together on these garden plans.

- Everyone will need to see the list of crops that they chose to plant from the DO/EXPLORE section. They will also need to see the “Plant Spacing for Rows in the Garden” and the “Plant Spacing for Square Foot Gardening” charts found at the end of this lesson. Use poster board to prepare an example of each of the square foot garden templates found at the end of the lesson.

- It would be best if students measure the actual gardens they will be planting. If not, have the measurement available.

- With help from garden experts in your community such as Extension Master Gardeners, local producers, garden store employees, local gardeners such as parents and grandparents; use the list of crops you want to grow and discuss what varieties are their favorites and how much they typically harvest from the crops on the list. Although you can find the information you need online, you miss the connection with the community and their local experiences growing fruits and vegetables.

Now that we have identified what we want to grow in our garden, we are going to make a plan.

Redistribute the Garden Grids with another copy of the 10’ x 15’ grid or the raised bed and container gardens on the back of the sheet. Have the students write the crops they will be planting in the margins of the new grids.

Take another look at your plans for Rebecca’s garden and think about what you learned about the fruits or vegetables we want to plant in our garden.

What information do you think you need to help you make new plans for our actual garden?

Discuss answers with your partner or group and be ready to share them with the rest of us. Give them three minutes for discussion then have each group share one thing they need to know. Have all the students raise their hands if they feel that information would also help them. Then write it on the board. Possible answers include:

- How many plants will we need?
- How much space do we have?
- How big will the plants grow?
- How do you arrange the crops in the garden – rows, sections, mounds or small hills, etc.?
- Could we grow an early crop, harvest it, and then plant something else in the same spot?

Let’s start with finding out how much space we have in our garden.

Look at the Garden Grid and how each square equals 1 square foot. Measure one square foot on the floor as an example of what it will be in the garden.

How many feet long is the garden grid?
The length of the garden grid depends on which one you will be using. The large grid is 15 feet, the raised bed is 4 feet, and each container has 14 inches of space to plant things.

How many feet wide is the garden grid?
The width of the garden depends on which one you will be using. The large grid is 10 feet, the raised bed is 8 feet, and each container has 29 inches of space to plant things.
Use one copy of the appropriate garden grid to work with the students to identify the type and sizes of the gardens they will be planning and growing. If possible, measure your actual gardens and make sure the grids will work for your plans.

**NUMBER OF PLANTS**

Unless you have large gardens, you probably won’t have enough room to grow large amounts of crops for each of the students and their families to try. So, you may want to help them figure out how many plants they will need for everyone to have a sample. Encourage them to grow more at home or in a community or neighborhood garden.

Discuss each of the crops you will be planting. Have the students provide their knowledge and experiences to figure out how many fruits or vegetables come from one plant. Offer what you discovered from local gardeners. Upon consensus from the group, record the numbers of the plants you will need next to the crops on the main list and have the pairs or groups write them next to the crops on their garden grids.

**AMOUNT OF SPACE PER PLANT**

If you are using large container or raised bed gardens, you will want to use the Plant Spacing for “Square-foot Gardening” chart. If you are using a traditional tilled garden in the ground, you will want to use the “Plant Spacing for Rows in the Garden” chart, or both charts. When talking about square foot gardening, show the square foot gardening guides.

Select small, medium, and large sample crops and work together on the sample size grids and use the charts to mark the plants on the grid. You may use dots and label them or draw a picture of the fruit or vegetable to mark them on the grid. Point out that the squares on the chart are the same as the squares on the garden grid, they both represent one-foot squares. Leave one foot between rows or follow the space guides on the row guide. Square foot gardens are planted with square foot grids. Raised bed gardens are usually planted in square feet and don’t require walkways because gardeners are working from outside the bed. If the plants you chose do not appear on the grid, help the students to find a plant on the chart that grows similarly to that one and requires about the same amount of space in the garden.

**OPPORTUNITY TO DOUBLE CROP**

Discuss what they learned about the cool season and warm season crops they tasted. Put a “C/F” for “cool” and “fast” in front of the crops you chose that can be harvested and the space can be used to grow something new in the same space.

**CREATE GARDEN PLANS**

Creating a garden plan is similar to putting a puzzle together. The pieces of the puzzle are the crops that you want to plant in the garden. The outside edges or the puzzle are the edges of the shape and size of the garden grids. Be sure you start lightly with pencil so that you can erase.

If you use dots to represent plants, you will have to label them with the name of the crop written nearby. If you can draw a picture of the fruit or vegetable to represent each plant, you don’t have to label them. You can use both dots and labels, and pictures depending on how much space you have.
Allow 10 minutes for this activity and walk around to help them out. If they aren’t completely done after 10 minutes, assure them that everyone will help each other out to come up with the best plan.

Select a group who believe they have figured out the garden plan or puzzle using all the crops. Have them show their plan to the rest of the group. Compare their garden plan with others. Identify the best qualities of the students’ plans. Combine those qualities together on a new garden grid to use when the students mark and plant their real garden.

TEACHER’S NOTES:

1. Prepare garden labels ahead of time. If you are using vinyl blind slats, use heavy scissors to cut vinyl blind slats into 8-10 inch sections. Cut points at one end of the blind slats and paint sticks. Each garden row or section of square foot gardening space will need two garden labels. Write crop names on paper strips and place them in a bowl or envelope so students can draw out their crop. For example, If you are planting lettuce, you should write lettuce on two strips of paper.

2. In the upper left hand corner of each day on the working copy of the Garden Calendar, write the date. You may want to do that on just the months when you will be planning, planting, maintaining, and harvesting your garden. Everyone will be working together to mark significant gardening dates on the calendar, so enlarge it on the wall or larger sheets of paper.

3. You may want to show examples of commercially-available garden calendars from the Internet or from your local extension office or garden store.

GARDEN LABELS

Now that we have our garden puzzle/plan put together, we need to make garden labels for each crop.

Why do we need garden labels for our garden?

• So we remember what we planted
• So we can show people where each crop is located if we don’t have our garden plan

How many garden labels will we need for each row or section?
Two – one at each end of the row or two per section

Distribute garden markers, one per child, depending on number of crops. Each child will also need a thin line permanent marker.

I have given each of you sticks to make garden markers. Will these be good for outdoor use? Yes

Why?
Wood is somewhat waterproof and plastic is very waterproof.

What did I make at one end of each stick to help us push it into the ground?
Points
I will walk around and let each of you draw out a name of a fruit or vegetable crop for your garden label.

Using permanent markers, draw a picture of your fruit or vegetable at the top of the label (not the pointed end) and then neatly print the crop name below the picture. (*If you are using wooden spoons, draw on one side of the spoon and print the name on the other side.*)

**Why did I give you permanent markers?**
Because the plant labels will get wet and the names could wash off if the marker wasn’t permanent.

Please place your garden markers in my tub (*or box, bucket, envelope*) so we have them on garden planting day.

**GARDEN CALENDAR**
Put the Garden Calendar up so that everyone can work with it. Show examples of garden calendars and have students read what is written on them. Think about some of the activities that are done in the garden. Find planting dates for the different crops, tips for maintenance, and harvest dates. Use your seed packets, planting guides, or help from local garden experts to start writing dates about your garden on the master Garden Calendar. Throughout the planting season, the class can write gardening tips in the calendar squares. This would be a good whole group activity once a week. Log items like planting dates, weeding times, watering days, harvesting, weather, temps, and tasting. If students have gardeners in their families, they might get fun garden tips from them to add to their calendar pages.

**SHARING YOUR ABILITY TO CREATE GARDEN PLANS**
Where can you use your new garden planning knowledge and skills?
*Possible answers include:*
- For a garden next year
- At home
- Neighborhood or community garden
- Help with gardens at community centers, senior living homes, residential facilities, etc.
- To write up the steps and put it in your school news, in a local newspaper, etc.
- To share with beginning gardeners
**Garden Grid**

**OUR FOOD GARDEN PLAN**

Name

**4' x 8' RAISED GARDEN**

```
        4
        3
        2
        1
        0
        1  2  3  4  5  6  7  8
```

1 square foot

**15" x 30" EARTHTOBox™ CONTAINER GARDENS**

```
[Blank]
```

14"

29"
1. Cut along the solid dark lines and place face down.
2. Fold the square in half diagonally, corner to corner, to form a triangle. Crease the fold firmly. Unfold and repeat this in the opposite direction to leave an “X” fold through the center.
3. Fold each corner point into the center of the “X” to form a smaller square.
4. Flip the square over so you don’t see any of the cut edges and fold each corner into the center of the “X” to form a smaller square.
5. Fold the square in half to form a rectangle. Unfold and repeat the process the other direction.
6. Put your thumbs and first or index fingers into the four pockets left by your folds. Try moving your fingers to move the four pockets in two directions.
7. Ask someone to select one of the four garden crops on the pockets. Move the seed catcher back and forth as you spell out the crop. Ask them to choose a number. Move the seed catcher back and forth as you count out the number. Ask them to choose another number. Take your fingers out of the seed catcher, open the flap, and read the garden tip under the number they chose.

---

SEED CATCHER

4

- Zucchini
- One zucchini plant will produce all the zucchini you will need!
- Plant outdoors at the right time because the soil has to be warm enough for the seeds to grow.

---

1

- Pumpkin
- Hundreds of small green plants will produce tomatoes!
- Two cherry tomato plants will produce hundreds of tomatoes!
- Onions can be planted 3 ways: seeds, small green plants, small dry “sets”
- Don’t plant seeds too deep or they won’t grow.
- Pumpkins take 4 months to grow—plant seeds in May.
- The Native American Three Sisters Garden contains: beans, corn, and squash.
- Plan 4 cucumber seeds in each hill: “One for the cutworm, one for the crow, one for the ground squirrel, and one to grow!”

---

2

- Tomato
- Tomatoes grow by August
- One squash plant will produce a “giant squash!”
- One zucchini plant will produce all the zucchini you will need!
- Beans, corn, and squash are the “Three Sisters.”
- The Native American garden contains: beans, corn, and squash.
- Plan 4 cucumber seeds in each hill: “One for the cutworm, one for the crow, one for the ground squirrel, and one to grow!”
**Fresh Garden Salsa**

3 large tomatoes, seeded and coarsely chopped  
1 small fresh jalapeno chile seeded and minced *(optional)*  
1 clove garlic, minced  
¼ cup finely chopped onions  
2 tablespoons finely chopped cilantro  
2 tomatillos, husks removed, finely chopped  
Juice from 1 small lime  
¼ teaspoon salt  
¼ teaspoon freshly ground black pepper

In a large bowl, combine all the ingredients. Stir together until well blended.  
Cover and chill for 30 minutes or more before serving.  
Keeps for up to 4 days in the refrigerator.  
Makes about 2 cups.

© Copyright 2011 Iowa State University
1. Make a copy of this page.
2. Cut around the 4 inch squares and cut out the circles.
3. Place one template on one corner of a poster board.
   Draw around the outside of the square and around the circles.
4. Use the same template four times to make a square foot gardening guide.
5. Cut around the square foot and cut out the circles.
6. Write the names of the crops in the center of the guide.
7. It is best to laminate these guides to keep them in good shape from year to year.
SQUARE-FOOT GARDENING

TEMPLATE 2

peas, bush beans
## Plant Spacing for Square-Foot Gardening

Use the following key to plan how much space plants need when they are planted in squares.

<table>
<thead>
<tr>
<th>CROP</th>
<th>Number of Plants in each square</th>
<th>Number of Squares for each plant</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>onions</td>
<td>16</td>
<td></td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>lettuce</td>
<td>16</td>
<td></td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>spinach</td>
<td>16</td>
<td></td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>peas</td>
<td>9</td>
<td></td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>cauliflower</td>
<td></td>
<td>4</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>cabbage</td>
<td></td>
<td>4</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>broccoli</td>
<td></td>
<td>4</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>radishes</td>
<td>16</td>
<td></td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>carrots</td>
<td>16</td>
<td></td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>sweet corn</td>
<td>1</td>
<td>(must be planted in a block at least 10’ x 5’ for good pollination)</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>potatoes</td>
<td></td>
<td>2</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>zucchini</td>
<td></td>
<td>9</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>squash</td>
<td></td>
<td>9</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>pumpkins</td>
<td></td>
<td>9</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>bush beans</td>
<td>9</td>
<td></td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>peppers</td>
<td></td>
<td>1½</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>tomatoes</td>
<td></td>
<td>9</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
<tr>
<td>cucumbers</td>
<td></td>
<td>9</td>
<td><img src="image" alt="Plant Example" /></td>
</tr>
</tbody>
</table>
### PLANT SPACING FOR GARDEN ROWS

The following key will help you plan how much space your crops will need in rows and between rows.

Use a string stretched along the row as a guide to make straight rows.

\[
\underline{\text{———}} = 1 \text{ foot}
\]

#### EARLY PLANTING

<table>
<thead>
<tr>
<th>Crops</th>
<th>Spacing between plants</th>
<th>Spacing between rows</th>
</tr>
</thead>
<tbody>
<tr>
<td>onions</td>
<td></td>
<td>1 foot</td>
</tr>
<tr>
<td>sets or plants</td>
<td>3”</td>
<td></td>
</tr>
<tr>
<td>lettuce</td>
<td></td>
<td>1 foot</td>
</tr>
<tr>
<td>seeds</td>
<td>Thin to 2”</td>
<td></td>
</tr>
<tr>
<td>peas</td>
<td></td>
<td>2 feet</td>
</tr>
<tr>
<td>seeds</td>
<td>3”</td>
<td></td>
</tr>
<tr>
<td>broccoli</td>
<td></td>
<td>2 feet</td>
</tr>
<tr>
<td>cabbage</td>
<td>18”</td>
<td></td>
</tr>
<tr>
<td>cauliflower</td>
<td></td>
<td></td>
</tr>
<tr>
<td>radishes</td>
<td></td>
<td>1 foot</td>
</tr>
<tr>
<td>seeds</td>
<td>Thin to 2”</td>
<td></td>
</tr>
<tr>
<td>carrots</td>
<td></td>
<td>1 foot</td>
</tr>
<tr>
<td>seeds</td>
<td>Thin to 1’-1½”</td>
<td></td>
</tr>
<tr>
<td>sweet corn</td>
<td></td>
<td>2 feet</td>
</tr>
<tr>
<td>seeds</td>
<td>6’-8”</td>
<td></td>
</tr>
<tr>
<td>beets</td>
<td></td>
<td>1 foot</td>
</tr>
<tr>
<td>seeds</td>
<td>Thin to 1’-1½”</td>
<td></td>
</tr>
</tbody>
</table>

#### MID-MAY PLANTING

<table>
<thead>
<tr>
<th>Crops</th>
<th>Spacing between plants</th>
<th>Spacing between rows</th>
</tr>
</thead>
<tbody>
<tr>
<td>pumpkins</td>
<td>3 seeds / hill 36”</td>
<td>3 feet</td>
</tr>
<tr>
<td>squash</td>
<td>36”</td>
<td></td>
</tr>
<tr>
<td>bush beans</td>
<td></td>
<td>2 feet</td>
</tr>
<tr>
<td>seeds</td>
<td>3”-4”</td>
<td></td>
</tr>
<tr>
<td>zucchini</td>
<td></td>
<td>3 feet</td>
</tr>
<tr>
<td>seeds</td>
<td>3 seeds / hill 36”</td>
<td></td>
</tr>
<tr>
<td>sweet potatoes</td>
<td></td>
<td>3 feet</td>
</tr>
<tr>
<td>plants</td>
<td>24”</td>
<td></td>
</tr>
<tr>
<td>peppers</td>
<td></td>
<td>2 feet</td>
</tr>
<tr>
<td>plants</td>
<td>18”</td>
<td></td>
</tr>
<tr>
<td>tomatoes</td>
<td></td>
<td>3 feet</td>
</tr>
<tr>
<td>tomatillas</td>
<td>36”</td>
<td></td>
</tr>
<tr>
<td>cucumbers</td>
<td></td>
<td>3 feet</td>
</tr>
<tr>
<td>seeds</td>
<td>3 seeds / hill 36”</td>
<td></td>
</tr>
<tr>
<td>sweet potatoes</td>
<td>24”</td>
<td></td>
</tr>
<tr>
<td>plants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>beets</td>
<td>Thin to 1’-1½”</td>
<td>1 foot</td>
</tr>
<tr>
<td>seeds</td>
<td>Thin to 1’-1½”</td>
<td></td>
</tr>
</tbody>
</table>
# Garden Calendar

<table>
<thead>
<tr>
<th>JULY</th>
<th>AUGUST</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="Calendar for July" /></td>
<td><img src="Image" alt="Calendar for August" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEPTEMBER</th>
<th>OCTOBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="Calendar for September" /></td>
<td><img src="Image" alt="Calendar for October" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOVEMBER</th>
<th>DECEMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="Calendar for November" /></td>
<td><img src="Image" alt="Calendar for December" /></td>
</tr>
</tbody>
</table>
## COOL- AND WARM-SEASON CROPS

### COOL-SEASON CROPS*

<table>
<thead>
<tr>
<th>VEGETABLE</th>
<th>DAYS TO HARVEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beets</td>
<td>60 - 80</td>
</tr>
<tr>
<td>Broccoli (transplants)</td>
<td>60 - 80</td>
</tr>
<tr>
<td>Carrots</td>
<td>60 - 80</td>
</tr>
<tr>
<td>Cabbage (transplants)</td>
<td>60 - 80</td>
</tr>
<tr>
<td>Cauliflower (transplants)</td>
<td>60 - 80</td>
</tr>
<tr>
<td>Collards</td>
<td>50 - 60</td>
</tr>
<tr>
<td>Kale</td>
<td>50 - 60</td>
</tr>
<tr>
<td>Kohlrabi</td>
<td>50 - 60</td>
</tr>
<tr>
<td>Lettuce</td>
<td>30 - 40</td>
</tr>
<tr>
<td>Mustard greens</td>
<td>40 - 60</td>
</tr>
<tr>
<td>Green onions (sets or transplants)</td>
<td>35 - 45</td>
</tr>
<tr>
<td>Peas</td>
<td>50 - 75</td>
</tr>
<tr>
<td>Potatoes</td>
<td>110</td>
</tr>
<tr>
<td>Radish</td>
<td>30 - 35</td>
</tr>
<tr>
<td>Spinach</td>
<td>35 - 40</td>
</tr>
</tbody>
</table>

*These cool-season crops can be planted as soon as the soil can be worked in early spring so that they can be harvested before school dismisses in May and June. Plan to harvest these crops a week or two before school is out so that you can plant warm-season crops that will be ready for harvest when the students return to school in August or September. To determine if you have enough time to harvest a crop from your garden, count backwards on the calendar from a potential harvest date. If possible, plant early-maturing varieties.

The cool-season crops listed above, except for potatoes, can also be grown successfully in the fall. Plant the broccoli, cabbage, cauliflower, and kale so that they mature around the average first frost date in your area; count back from that date for the appropriate planting time. Wait until the daytime temperatures average no higher than 80 and the evening temperatures are in the 60’s or below.

### WARM-SEASON CROPS*

<table>
<thead>
<tr>
<th>VEGETABLE</th>
<th>DAYS TO HARVEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snap beans</td>
<td>50 - 60</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>65 - 110</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>50 - 70</td>
</tr>
<tr>
<td>Eggplant</td>
<td>75 - 80</td>
</tr>
<tr>
<td>Muskmelon or cantaloupe</td>
<td>90 - 120</td>
</tr>
<tr>
<td>Onions, dry (sets or transplants)</td>
<td>90</td>
</tr>
<tr>
<td>Okra</td>
<td>70 - 90</td>
</tr>
<tr>
<td>Peppers</td>
<td>70 - 75</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>140 - 150</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>90 - 120</td>
</tr>
<tr>
<td>Summer squash and zucchini</td>
<td>60 - 75</td>
</tr>
<tr>
<td>Winter squash</td>
<td>90 - 120</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>70 - 80</td>
</tr>
<tr>
<td>Tomatillos</td>
<td>70 - 80</td>
</tr>
<tr>
<td>Watermelon</td>
<td>85 - 120</td>
</tr>
</tbody>
</table>

*Warm-season crops are planted after the threat of frost is past in the spring. For most parts of the country, they will not be ready to harvest until after school has dismissed for summer. However, if you plant it just before summer recess or a few weeks later, they will be ready for harvest when the students return and later into the fall. You may want to count back from the day school begins to determine the optimum planting time. Remember, if you plant these crops to grow through the summer, you will need someone to be responsible for the general care and watering of the garden.
Lesson five: Where do garden seeds come from?

“Banking on Seeds” from FOOD, LAND & PEOPLE: RESOURCES FOR LEARNING, Food, Land & People

You’ll need seeds for your new garden; but, where do you get them and how did they get them? What is a seed bank and why are seed banks important? Start a seed bank while you start your new gardens.

Content objectives: Give examples and compare the use of seeds by people in the past, today, and in the future; gather, store and plant seeds; Create a seed bank and explain its importance; Label the basic parts of a seed

Life skill objectives: Learning to learn, Critical thinking, Problem solving, Decision making, Citizenship, Communication, Healthy living

Core and STEM concepts and skills:
Science Life science, Earth and space, Science as inquiry
Math Operations and algebraic thinking
Language Arts Reading for informational text, Writing, Speaking, Listening, Viewing

Healthy snack: Seed Medley: sunflower, pumpkin or other squash, dried corn kernels, dried peas (wasabi peas add zip), soy nuts

Additional and supporting resources:
Lesson 5: Banking on Seeds

Banking on Seeds is a lesson developed by Project Food, Land and People. This lesson, appropriate for Grade Level 3-7, explores the critical role that seeds play in the world.

Lesson objectives include:

- Compare the use of seeds by people in the past, today and in the future;
- Gather, store and plant seeds;
- Create a seed bank and explain its importance;
- Label the basic parts of a seed.

Although Healthy Gardens, Healthy Youth received permission to use the lesson during the research study, we do not have permission to post the lesson at this time. To purchase this lesson, go to http://www.foodlandpeople.org/ordering/gardenwise/

Look for Banking on Seeds. You can purchase this single lesson as a digital download.

The recommended tasting for this lesson is a seed medley: sunflower, pumpkin or other squash, dried corn kernels, dried peas (wasabi peas add zip), soy nuts.

After the Lesson

Have the students label the basic parts of seeds in the journal. Part of the lesson involves planting squash seeds. Have students monitor seed growth and record the outcomes in the journal.
Lesson six: How do you plant a garden?

“Planting Our Healthy Garden” from GROWING IN THE GARDEN: LOCAL FOODS AND HEALTHY LIVING, Iowa State University Extension and Outreach

Students play games about seeds, sets, transplants, seed pieces, tools and tool safety to prepare them to plant their gardens. Then they mark their garden and plant it in an organized and fun way that involves everyone.

Content objectives: Identify and implement efficient and productive methods to prepare the soil for gardening; Mark a garden; Plant seeds, sets, or transplants; and water the garden for the first time

Life skill objectives: Critical thinking, Problem solving, Decision making, Communication, Citizenship, Leadership, Healthy living

Core and STEM concepts and skills:
Science Earth and space, Life science, Science as inquiry
Math Operations and algebraic thinking, Measurement and data, Number and operations; Geometry, Mathematical problems
Language Arts Reading for information, Listening, Vocabulary, Viewing, Speaking, Listening

Healthy snack: Water and a juicy fruit or vegetable

Additional and supporting resources: Extension Master Gardeners
BEFORE THE LESSON

1. Grade 4, Lesson 6:
This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the www.peoplesgarden.wsu.edu Educational Toolkit.

2. Prepare flash cards at end of lesson.

3. There is no recipe for this lesson. Serve water or a tasting of a juicy fruit or vegetable.

THE LESSON
Planting Our Healthy Garden will be conducted both in the classroom and garden, and may be done over several days.

AFTER THE LESSON
Have students record what they planted in the their journals. Make a plan for watering and monitoring the garden.
Planting Our Healthy Garden

**CONTENT OBJECTIVES**
Plant a garden using “Our Healthy Garden Plan” from Lesson 4B and the most appropriate planting methods according to the type of garden and the plants that have been chosen for the garden.

**LIFE SKILL OBJECTIVES**
Critical thinking, decision making, cooperation, communication, citizenship, leadership, healthy living

**INDICATORS**
Students will make appropriate decisions and work together to successfully plant their gardens.

**EVALUATIONS**

**SUBJECT STANDARDS**

**CORE CONCEPTS AND SKILLS**

**21st Century Skills:** Employability skills, Health literacy

**Science:** Science as inquiry, Earth and space, Life science

**Mathematics:** Operations and algebraic thinking, Numbers and operations, Measurement and data, Geometry, Mathematical practices

**Social Studies:** Behavioral sciences, Geography

**Literacy:** Reading, Speaking, Listening, Viewing

**LEARNER TYPES**
Linguistic-words, Logical-mathematical, Spatial-visual, Bodily-kinesthetic, Interpersonal, Intrapersonal, Natural

**MATERIALS**
Our Healthy Garden Plan (This is the students’ garden plan from lesson 4B.)

- Garden Challenge flash cards (found at the end of the lesson)
- Paper clips
- Get Ready, Get Set, GROW! Worksheet (one per student, found at the end of the lesson)
- Pencils

**Optional:** Samples of seeds, transplant or seedling, onion set, potato seed piece

- Seed packets and plant labels (from the seeds or transplants that will be planted in your garden)
- Garden tools (see Reflect and Apply to determine what you will need)
- Know Your Garden Tools (copy one per student, or do together on an interactive board or screen, found at the end of this lesson)
- Garden Tools Crossword Puzzle (copy one per student, found at the end of this lesson)
- Craft sticks (one per student)
- Rulers (one per student)
- Fine-tipped permanent marker or ink pen (one per student)
- Square foot garden template (found at the end of this lesson or use the one from Lesson 4B)
- Newspapers or poster board (see Reflect, Activity 4: Square-foot garden templates)
- Scissors
- Garden Rules sign (see Apply)

*Materials continued on the next page.*
Garden Markers (from Lesson 4B)
Garden(s) (The garden spaces should be built, filled with soil and ready to mark and plant.)
Paper towels or rags to use near the garden
Soap and water to wash hands
Water (one bottle or cup per student, see Apply – Wrap Up)
Fruit and or vegetable samples with dip (see Apply – Wrap Up)

**TEACHER’S NOTE:** Display a copy of Our Healthy Garden Plan from Lesson 4B and keep it posted where everyone can see it throughout this lesson. The responses to the questions in this section will vary and are intended to engage the students’ thinking without being right or wrong. Therefore there are no responses written after many of the questions.

If you are ready to plant the vegetables (or fruits) in Our Healthy Garden Plan, stand near your chairs and use hand motions to pretend you are planting a garden. Give them a minute to start planting their pretend gardens. Then ask one side of the room to keep planting while the other side watches. Then reverse the process. Then have everyone sit down.

Did everyone plant their gardens the same way?
What different methods did you see?

What methods could we use to plant our garden and why?

What will we need to plant our garden?
We will need seeds, tools, markers, soil, water, sunshine, air, and each of us.

Raise your hand if you have planted a garden before.
For those of you who have planted a garden, have you always planted crops starting with seeds?
What did you use?
You may have used small plants called transplants, sets that look like the beginning of a vegetable such as onions, seed pieces that could be pieces cut from a potato, or seeds that come from the same kind of plant that you wanted to plant.

Are we planting container, raised bed or traditional in-the-ground tilled gardens?

What kind of tools do you think we will need to plant that kind of garden and why?

Pull on your ear lobes if you think we need to listen and learn in order to figure out a few more things before we jump into our gardens and start planting.
For those of you that are ready to plant, you can help the rest of us to make the best decisions for our plants, tools, and gardens.
We just discovered that some plants can be started as seeds, but some plants will grow better in our garden if we start them in another way.

**Why would it be a good idea to start some of our crops as small plants or transplants instead of direct seeding them in our garden?**

A transplant is a small plant that is started from a seed and grown in a greenhouse until it is ready to be moved or transplanted into another container or the garden. By planting transplants or small plants called seedlings, the plants can get a few weeks head start and we can harvest them earlier than if they were planted by seed. Some crops don’t sprout well when direct seeded in the garden and do better when started as seed in a greenhouse and planted in the garden as transplants.

**Have you ever planted a small transplant or seedling?**

**What kind of plant did you plant?**

**Did you have to be careful when handling and planting the seedling and why?**

Small transplants or seedlings are fragile. You have to be careful so that you don’t damage the root system or break the stem.

**Besides seeds and transplants, what is another way in which crops are planted in the garden?**

Some crops are started as parts of plants. For example, onions are planted as small onion bulbs that were started from seed the year before. They are called sets. Sometimes onions are planted as little plants and sold in bundles that were also started earlier.

Potatoes are planted from pieces of a cut-up potato called a seed piece. Each piece has a bud on it that will grow. *(If possible, show a potato that is starting to sprout. Point out the eyes or sprouts.)* A potato is actually a swollen, fat underground stem. Each one of those sprouts is like a bud that will grow into a shoot that grows up and above the ground. We plant potatoes from pieces of the potato with an “eye” or two on it. Each piece is planted in the garden about 4 inches deep.

**Do you think it makes a difference which way the piece is put in the ground?**

Not really, but they emerge from the ground sooner when the sprout is on top.

**How do you know how deep a seed should be planted?**

The planting depth depends on the size of the seed. Typically, seeds are planted two to three time the diameter of the seed. Small seeds are planted shallow, larger seeds are planted deeper.

**What could happen if the seed is planted too deep?**

It won’t germinate.

**What could happen if the seed is planted too shallow?**

It might sprout then dry out and die. It might get washed away when it rains, blown away in the wind or eaten by an animal.
GET READY, GET SET, GROW!

Distribute the Get Ready, Get Set, GROW! activity sheets. Go over the instructions and have the students complete it. They should be able to correctly match the crop with the way in which it is planted. You may want to display one large copy of the worksheet on the interactive board, flip chart or some other way so that students can take turns drawing the lines between the categories as a way to check everyone’s answers.

GARDEN CHALLENGE MATCHING GAME

Divide the class into groups of seven. If there isn’t the right number per group, increase the size of the groups. Then divide each group into three teams of at least two students each. Choose one student to be the moderator for his or her group. Give each team a set of flashcards for the game and give the moderator the key with the answers.

Team 1 in each group will have the cards with pictures of the crops. Team 2 will have cards showing the planting depths. Team 3 will have cards that list the different ways crops are planted (seeds, sets, transplants, and seed pieces). The game begins with Team 1 holding up a picture for Teams 2 and 3 to see. Teams 2 and 3 quickly decide the match for that crop and hold up the appropriate card. The moderator decides whether the answers are right or wrong by following the answer key. The moderator says “ding” if the team is correct or “buzz” if the team is incorrect. The teams should use the process of elimination to determine whether they have guessed correctly. Play the game three times to give all teams a chance to use each set of cards.

Have the students gather the flash cards, paper clip each team’s cards together and put them in a set. One person from each group can bring their set of cards to the front of the room.

<table>
<thead>
<tr>
<th>ANSWER KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumpkin     Seed       Deep</td>
</tr>
<tr>
<td>Onion       Sets (occasionally small green transplants)</td>
</tr>
<tr>
<td>Tomato      Transplant</td>
</tr>
<tr>
<td>Pepper      Transplant</td>
</tr>
<tr>
<td>Lettuce     Seed       Shallow</td>
</tr>
<tr>
<td>Broccoli    Transplant</td>
</tr>
<tr>
<td>Cabbage     Transplant</td>
</tr>
<tr>
<td>Spinach     Seed       Shallow</td>
</tr>
<tr>
<td>Carrots     Seed       Shallow</td>
</tr>
<tr>
<td>Beets       Seed       Medium</td>
</tr>
<tr>
<td>Snap bean   Seed       Deep</td>
</tr>
<tr>
<td>Corn        Seed       Deep</td>
</tr>
<tr>
<td>Pea         Seed       Medium</td>
</tr>
<tr>
<td>Potato      Seed piece</td>
</tr>
<tr>
<td>Cucumber    Seed       Medium</td>
</tr>
<tr>
<td>Radish      Seed       Medium</td>
</tr>
<tr>
<td>Squash      Seed       Deep</td>
</tr>
<tr>
<td>Sweet potato Transplants</td>
</tr>
</tbody>
</table>


TEACHER’S NOTE: In this section, you will need the students’ Our Healthy Garden Plan, the completed Get Ready, Get Set, Grow worksheets, seed packets or plant labels from the plants you will plant in your garden, Know Your Garden Tools (one copy for everyone to work on together), Garden Tools Crossword Puzzle (one copy per student), the tools you will use to plant your garden, craft sticks, rulers, permanent markers or ink pens, and scissors. Read Activity 4 in the Choosing Tools and Learning How to Use Them section and choose which type(s) of square foot garden template(s) you will need and be ready with the supplies. If possible, use the interactive board, a screen, or a large copy of the Get Ready, Get Set, Grow activity sheets so that everyone can work from the same sheet.

Distribute the seed packets or plant labels from the plants that you will be planting in your garden.

CHOOSING THE BEST METHOD AND TIME FOR PLANTING CROPS

We are ready to figure out how we are going to plant the crops we chose for Our Healthy Garden Plan.

Look at Our Healthy Garden Plan and the Get Ready, Get Set, Grow! activity sheet and circle the crops that we will be planting on the activity sheet.

Are there any other plants that we will be planting that aren’t on the activity sheet? What are they? Add them to the list and decide how they should be planted. Refer to the seed packets or plant labels for more information.

Some of you have seed packets or plant labels from the plants we will be planting. Look at the packets and labels and tell us the answers for these questions. We will write them on the Get Ready, Get Set, Grow next to the crop on the activity sheet.

What is the name of the crop? When is the best time to plant it? How deep should we plant it? How far apart should we plant it? How far apart should the rows be? How many days until it should be ready to harvest and to be eaten?

Pass the packets or plant labels around so the students can see the pictures and read the information while you continue to discuss the following questions.

What vegetables are cool-season crops that can be planted as soon as the ground has thawed and harvested before the end of the school year and again in the summer for a late summer or early fall harvest?

What plants can we start inside now and transplant to the garden when it is warmer?

What tools will we need to grow these crops in the types of gardens we plan to plant? Have the students guess and then proceed to the next activity.
CHOOSING TOOLS AND LEARNING HOW TO USE THEM

Put the Know Your Garden Tools sheet on the interactive board, a screen, or make copies that everyone can see. Have the actual tools ready to show and use. Proceed with the following four activities.

ACTIVITY 1: TOOL IDENTIFICATION

Work through the Know Your Garden Tools sheet together, showing some of the actual tools, discussing the answers, and applying them to your garden space.

Use the Garden Tools Crossword Puzzle as a take home follow-up activity sheet. They can have their families help them finish the puzzle. Then have them bring the completed puzzle back and turn it in to see if they are ready to use the tools properly in the garden.

ANSWER KEY

<table>
<thead>
<tr>
<th>Across</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Rake</td>
<td>1. Trowel</td>
</tr>
<tr>
<td>5. Labels</td>
<td>2. Watering can</td>
</tr>
<tr>
<td>7. Hoe</td>
<td>8. Hose</td>
</tr>
<tr>
<td>10. Tiller</td>
<td>9. Fork</td>
</tr>
<tr>
<td>12. String</td>
<td>11. Shovel</td>
</tr>
<tr>
<td>13. Tape measure</td>
<td>13. Tape measure</td>
</tr>
</tbody>
</table>
ACTIVITY 2: TOOL SAFETY

Do the following Tool Safety Game.

TOOL SAFETY GAME

I am going to show you some right ways and wrong ways to use and store our tools. If you think I’m showing you the right way, clap. If you think I’m showing you the wrong way, stomp your foot.

• Lift the hoe so that the blade is over your head like you are swinging a hatchet. **STOMP.**
  I have lifted the hoe too high. I am not chopping the soil. I am hoeing it. It doesn’t work very well this way. Also, you may hit someone who is nearby if you swing the hoe this high in the air.

• Lift the hoe so that it is about 1 foot off the ground and bring it down in a gliding motion through the surface of the soil. **CLAP.**
  This is the correct way to use the hoe to cut through crusty soil and remove weeds.

• Repeat the same motions with the rake.

• Lay the rake down, teeth up. **STOMP.**
  You should never set a rake or a hoe on the ground like this. What do you think would happen? You may want to demonstrate what would happen if someone stepped on the teeth of the rake or blade of the hoe. Be careful to stand to the side so the handle doesn’t smack you in the face.

• Stand the rake and hoe, handles up, against a wall or hang them. **CLAP.**
  Rakes and hoes should be stood against a wall or in the shed or garage when they are not being used.

• Walk with the trowel blade up. **STOMP.**
  Always carry your tools such as this trowel with the sharp blade facing down.

• Run a short distance holding a hoe and a trowel. **STOMP.**
  Never run with tools in your hands.

• Pretend to wash dirt from the trowel, hoe, or shovel. **CLAP.**
  It is always a good idea to clean the soil off your tools before you put them away. This shows you are responsible for taking care of your tools.

• Pretend to fight with a student over a trowel or hoe. **STOMP.**
  Show respect by taking turns.
ACTIVITY 3: DIBBLES

Since Roman times, long before Christopher Columbus discovered America, people made dibbers or dibbles, which are pointed wooden sticks that helped them make the right sized hole for planting seeds. One person would use the dibble for making the holes and another person would follow and plant the seeds. We are going to make our own dibbles and use the same process to plant the seeds in our garden. We will use craft sticks, rulers, and permanent markers or ink pens to make our dibbles.

Distribute the supplies. You might want to display the illustration on this page in a place for everyone to see. You may want to make your own dibber along with the students.

Line your craft stick up with the zero inch mark at the start of your ruler. Find ¼ inch on your ruler and make a little line from ¼" on your ruler onto about a fourth of your craft stick. Do the same at ½", ¾", 1", 1½", 2", 3", 4", 5". Then move your rulers to the other side of the stick and do the same thing. In between your two lines, mark the measurements using the number and the inch symbol.

Write your name on the back of your new dibble and store it where you can find it when we are ready to plant our gardens.

Katie Jones
ACTIVITY 4: SQUARE-FOOT GARDEN TEMPLATES

If you are using the square foot gardening method, use the square foot garden templates found at the end of this lesson and have the students work in groups of three or four to make one full-size template for small plants and one for large plants. You can make them out of newspapers. If you do that, you can stake the templates in the garden using small sticks or your dibbles. Throw some soil over the top to keep them in place. You can make re-usable templates with poster board and laminate the poster board once the circles have been marked and the plant names have been added.

(The length of time required for this activity depends on types and sizes of gardens. You may want to start seeds indoors for late-summer or early-fall harvest crops. You can plant the seedlings or transplants in the garden once you have harvested the cool-season crops.)

TEACHER’S NOTES: Collect the Garden Tool Crossword Puzzle activity sheet and check for understanding. If you find that they aren’t familiar with the tools, you may have to do a review. This section could be much easier with the help of Extension Master Gardeners or members of your community who are familiar with gardening. Make sure that they have read over this section to know how to include all the students in the gardening process.

Choose the activities in this section that best match the type of garden and garden methods you will be using to plant your gardens. Regardless of the type of garden you will be planting, please be sure to do the Garden Rules and Wrap-Up activities.
GARDEN RULES

Establish the ground rules for the garden. You may want to write these on a re-usable poster board that can be creatively posted every time the class goes to the garden. Have the students repeat the three R’s – Respect, Responsibility, Readiness and give examples of how each of them applies to the garden.

RESPECT

Yourself – Wear shoes that cover your entire foot and clothes that protect your skin from the sun and from being too cold or too hot, practice safety

Your gifts – Share your energy, use your skills and knowledge to help others.

Other people – Be a good listener, consider others’ ideas, share tools, say please and thank you, ask questions rather than assuming things, do not get into each other’s spaces, practice safety

Other people’s things – Do not bother or borrow things without asking, keep things clean and undamaged, practice safety

The environment – Take good care of the garden and the space around it and remind others to do the same

RESPONSIBILITY

Be on time and stay where you are suppose to be

Listen and follow instructions

Use garden tools and supplies safely, clean them, and put them away correctly

Share in the work and the fun of the garden (Remember the Little Red Hen?)

READINESS

Be ready to listen, learn, have fun, work hard, share, and most of all grow healthy food!

Establish a “Gardeners Go” cue with a clap or noise to indicate that gardeners can start their tasks and a “Gardeners Stop” cue with two claps or a noise to indicate when gardeners should stop what they are doing and look at you for more directions. Have students practice going and stopping while they pretend to be hoeing or digging with trowels. Explain that this will make it easier to work with so many people in the garden, it will give everyone a chance to garden, and it will help to get the garden chores done in a limited amount of time.

CONTAINER GARDENS

You will need Our Healthy Garden Plans, garden markers from Lesson 4B, trowels, rulers, dibbles, seeds, transplants, watering can, extra soil and possibly other garden supplies and watering equipment according to the type of container gardens that you are working with and where they are located. Have the students help to place the supplies near the container and then have them sit or stand near the container as you proceed with the following steps.
1. **Checking container placement**
   Do you think our container(s) are sitting in the best place to get the most sunlight?
   Look at your light sources and have the students move the containers if needed.

2. **Checking the soil**
   Most container gardens are filled with specially prepared soil.

   **Why do you think we should not use soil dug from the ground in our containers?**
   Although it may grow plants well outside, it becomes very packed in a container and
   the plant's roots will not be able to get the air and water they need. Potting soils contain
   the right blend of materials to allow for good drainage while holding water in the soil
   for the plants. Some potting soil already contains fertilizer to help the plants grow.
   The white pieces in the mix are called perlite which is actually a volcanic glass that
   softens and expands when heated. It helps to prevent water loss and soil compaction
   so that the plants have a better chance to grow.

   **Why do you think specially prepared soil for container gardens is lighter in weight
   than garden soil?**
   That makes it easier to move the containers outdoors in the summer or to move them
   around indoors.

   **Do you think we have enough soil in this container? Why or why not?**
   If the plants are surrounded by the sides of the container, they won’t get enough light
   and air to grow. If the soil is right at the top of the container, it may overflow when
   you water it. The soil should be within 1 inch from the top edge of the container. We
   may need to add a little soil after watering because it will settle.

   *Have the students check the soil level with their dibbles. If you need to add some soil,
   you should do it now.*

   *Have the students take turns turning the soil or smoothing the soil with a trowel.*

   *The students can feel the potting soil and look for the different ingredients in the soil
   mix. Have them describe what they feel and see. Compare it to the soil outdoors.*

   *Using a watering can filled with warm water, have a few students lightly water the
   soil in the containers. (This step can be skipped if using self-watering containers such
   as EarthBoxes®.)*

   **Why do you think we are watering the soil before we plant?**
   Watering the soil before planting makes it ready for the seeds and plants. Watering
   now will settle the soil and we can add more soil if we need to. If we watered the
   soil for the first time after planting, the seeds may be washed out of position in the
   lightweight soil mix.

   **Should we water the soil before we plant outdoor gardens?**
   That is not necessary because outdoor tilled gardens have some moisture present in
   the soil from rains or melted snow.
3. Marking your container for more than one crop
   If you are planting more than one crop in a container garden, help the students to use
   the plans, rulers, and the edge of their dibbles to mark out the sections. The students
   can then put the garden markers in the sections or containers to identify what they
   will be planting.

4. Planting the seeds, sets, or transplants
   a. Have the students hold up the right number of fingers as they number off as 1-dig,
      2-plant, and 3-cover. After the students have numbered off, have the 1-dig students
      pretend to dig a hole with their dibbles, the 2-plant students pretend to plant a seed,
      and the 3-cover students pretend to cover the seed with soil.

   b. Demonstrate how to dig a hole ¼" deep using a dibble. Then use the edge of the
      dibble like a ruler to measure 3" from the first hole and make another hole ¼" deep.
      Have the students refer to the plans and seed packets or plant labels to help the 1-dig
      students use their dibbles to make the right size and depth of the holes and to measure
      the distance between seeds. All the 1-dig students should have an opportunity to dig
      and measure.

   c. Demonstrate how to take a seed out of the seed packet (or a small bowl or cup) and
      plant it. Have the 2-plant students plant the seeds, sets, or transplants in the holes.

   d. Using your dibble or your fingertips, demonstrate how to carefully cover a seed. Have
      the 3-cover students use their dibbles or fingertips to carefully cover the seeds, sets
      or transplants with soil.

5. Watering the seeds, sets, and transplants
   Water the seeds according to the method that comes with the kit; or, one student can
   be delegated (per container) to gently water the seeds with a watering can.

6. Cleaning up
   Have everyone help to clean off the trowels, wipe off the dibbles, and put them in the
   proper place for storing. Then have everyone wash their hands thoroughly.

RAISED BEDS AND TILLED OR TRADITIONAL GARDENS

You will need Our Healthy Garden Plan and garden markers from Lesson 4B, Garden Rules
sign, hoes, trowels, square foot garden templates, dibbles, two balls of string, garden stakes
(from a garden store; or, wooden spoons or large craft sticks), two or three tape measures,
watering can, garden hose – according to the type and size of garden. The raised beds
should be constructed and the soil should be evenly filling the beds to within an inch from
the top edge of the bed. The tilled gardens should be tilled, amended and ready to plant.
You may want to take the Garden Rules to review at the garden.

1. Moving out to the garden
   Have the students bring their dibbles, garden gloves (optional), and at least one of the
   items they will be using to plant their gardens and go stand around one of the raised
   beds or at one end of the tilled garden. Have the students put their supplies on the
   ground behind them and have all eyes on you.
What are the three basic garden rules that start with the letter “R”?
Respect, Responsibility, Readiness

What cues are we using to start and stop what you are doing in the garden?
Practice the cues.

2. Preparing the soil
Why should we hoe and rake our garden(s)?
Hoeing and raking loosens up the soil so that water can pass through the pore spaces and reach the seed and the roots and the sprouts can grow through it. It will also make it easier to plant the seeds.

Demonstrate how to use the hoes and rakes to carefully work and level the soil. Have the students form lines to each use a hoe to work the soil, get back in line, and then use a rake to smooth out the soil. If you have more than one garden space, divide the students into groups to prepare each space. Limit each student’s time by counting to 10 in thousands. Start the hoeing and raking with the “Gardeners Go” and “Gardeners Stop” cues.

3. Marking the garden
Use Our Healthy Garden Plan to decide where and how to plant the garden. Remind students that in raised bed gardens, they will be working from the outside edges of the garden and not walking into the garden. Therefore they won’t have to make walkways in the raised bed gardens.

a. If you are using the square foot gardening method throughout the raised bed, have the students lay down and stake (with their dibbles, extra craft sticks, or broken twigs) as many of the corresponding newspaper templates as they can in each section. Label the sections with the appropriate garden marker. You may want to write or circle the name of the crop you are planting right on the square foot templates.

b. If you are using just a few re-usable square foot templates, use them as measuring devices. Have students stand along the edges of the garden to measure out each section using the templates and the corner edge of a hoe to make trenches designating each section. Place the garden markers so that everyone knows what to plant in each section. A tilled garden should have walkways between each section so you can easily work in each section.

c. If you are planting rows in the tilled garden, you can have students make a Human Grid. Instructions follow in sections c1 through c3. It will keep everyone occupied and in place, especially when there are more than twenty students. It will also sharpen their math skills.

c1. Have four students stand at the four corners of the garden. Have two students hand one end of the tape measure to the corner students standing across from each other on the short end of the garden and stretch the measuring tapes to the corner students standing at the other end of the long sides of the garden. Have the corner students lock the tape measures and lay them on the ground along the longest sides of the garden.

Everyone but the four corner students should count off by threes so that there will be students standing across the garden from each other at the 3′, 6′, 9′, 12′, 15′, 18′
markings on the measuring tape. If your garden is less than 20 feet, you may want them to count off by twos and stand at the 2′, 4′, 6′, 8′ markings.

If your tilled garden has a center walkway, use a third measuring tape and have two students stretch it across the short end of the garden. From your garden plan, determine where the walkway will go. Then have two more students each take a stake to mark out the walkway. Repeat this process at the opposite end of the garden. Then have two more students each take a ball of string, wrap and tie one end of the string to the garden stakes, stretch it across the garden to mark the edges of the walkway, and wrap, cut, and tie it on the opposite stake.

Any students who haven’t participated in these tasks will help with the rest of the marking tasks.

c2. Stand with the remaining students somewhere that everyone can see and hear. Show the garden plan and determine where each row or section of the garden will be. Starting at one end of the garden, determine where the first row or square foot section will go. Have the students standing nearest that measurement on both sides of the garden (for example, 3′) squat down and touch that measurement on the tape measure. Give a student a ball of string and two stakes and tell them to take it to one of the students pointing to the measurement. The student pointing to the measurement puts the stake securely into the ground. He or she may need help from the students standing nearby. The student with the string wraps and ties the string to the stake. Then she or he stretches it across the garden to the other student pointing to the measuring tape and repeats the same procedure. Take the scissors over to the students and have them cut the string before they tie it.

Have another student find the garden markers that match the crop to be planted in each row or section and stick it in the ground at the each end of the row or in a corner of a square foot garden section. This will tell the students what to plant in each row or section.

Have students take turns marking out the garden until all rows or sections are marked. Everyone can participate by helping one another find the right measurement, sticking in stakes, tying and cutting the string, finding and putting in the garden markers. Repeat this procedure to mark all the rows or sections. Remember to leave walkways around square foot gardening sections in tilled gardens, but not raised beds.

c3. If you are using newspaper square foot templates, have the students put them in the garden according to the plan and stake them with little sticks or craft sticks. If you are planting the same day, you may get by with staking just two corners of each template. If you are using poster board square foot templates, put them in the sections of the garden where they are to go according to the plan.

Have the students remain in place to start planting the garden.

3. Planting the garden
For raised bed gardens and tilled gardens using the square foot planting method: Using the holes in the right-sized square foot templates, demonstrate how to use the dibble to make and measure a hole according to the planting instructions on the packet.
Then carefully use your fingertips to plant one seed and cover it with soil. Show them how tiny the seeds can be and tell them that they can easily blow away so keep a hold of the seed packet and use fingertips to retrieve a few seeds out of the packet at a time.

Have students work in pairs to plant the seeds in all the holes of one or two square foot garden templates (according to the number of students and the size of the garden so that everyone has an opportunity to plant). One student can use their dibble to make the holes and the other can plant the seeds and carefully cover it with their fingertips. Then they can trade tasks. Use the “Gardeners Go” and the “Gardeners Stop” cues.

For rows in a tilled garden:

a. Hand hoes to the students standing on the sides that didn’t have an opportunity to mark the garden. Have another student read how deep to plant the seeds for that particular row. Have another student put their dibble right next to the string at the end of the row to measure how deep the furrow or shallow planting ditch should be. Then the student with the hoe can carefully put one corner edge of the hoe close to the dibble and next to the string to start the furrow by dragging the hoe half way across the garden. She or he should take the hoe to the student across the garden from him or her and that student can complete the furrow for the other half of the garden. In many cases, you may be stopping at the each edge of the center walkway.

b. The two students standing on either side of the person making the furrow can work together to plant the seeds in the furrow on their half of the garden. Students can use their dibbles to make sure they plant the seeds at the right depth and that the seeds are planted the right distance apart.

c. Use the trowels to dig holes for the transplants. The measuring tapes will help the students determine the distance between the plants.

d. The students that weren’t standing along the side of the garden can help with the supplies and making sure that everyone is following the garden plan by planting the right seeds or transplants in the right places. They can also help the person planting by removing the transplant carefully from the cell pack or small container that it came in. If necessary, loosen the roots of the transplant.

4. Watering the garden

Make sure the tools are out of the garden before watering. You can leave the newspaper templates in the garden because they will decompose and prevent weeds from germinating. Water the entire garden area to make sure that everything is well watered. Use a hose with a water breaker to thoroughly water the garden. Do not spray directly down on the garden and the seeds or it may wash away the seeds. Make it rain on the garden. Take turns watering sections of the garden.

You will need to water the garden weekly unless it rains an inch or more during the week or the ground is already too wet.

5. Cleaning up

Make sure the hoes, rakes, trowels and dibbles are scraped free of soil or wiped clean with paper towels or rags. Put them away according to tool safety rules. Have everyone wash their hands.
STARTING SEEDS INDOORS

At least four weeks before harvesting cool-season crops, you may want to start some of your seeds inside so that you can transplant them in your open garden spaces. Have each student make and plant their own pots. Make a few extra.

PAPER POTS

1. Wrap a 4 inch strip of newspaper around an empty frozen juice can or a water bottle with about 1½ inches hanging over the bottom of the can.
2. Fold the excess paper up around the bottom of the can or bottle to form the bottom of the pot. Press it down on the tabletop or pinch around the bottom edges to secure the paper pot and remove the can or bottle.
3. With one hand under the bottom of the pot, completely fill the pots with potting soil.
4. In the center of the pot, use a dibble to make a hole the right depth of soil for the seed you are planting.
5. Plant the seed and cover it with soil.
6. Place the pots close together on a flat or tray.
7. Water gently with a small watering can, a squirt water bottle.
8. To encourage faster growth, cover the tray with a large, clear plastic bag, such as a dry cleaner’s bag.
9. Set it in a location that receives bright, indirect light.
10. Keep the soil moist.
11. Remove the plastic bag immediately after the seeds germinate or start to grow.
12. When the plants are 2 to 3 inches tall, use a trowel and plant the entire newspaper pot into your garden. Make sure the top edge of the newspaper is covered with soil so that it won’t act like a wick and pull the water away from the soil around the plant’s roots. The newspaper will decompose.

EGGSHELL PLANTERS

1. Tap the smallest end of an egg on a hard surface and peel it away. Poor the egg contents into a clean container. (*If you are using clean hands, surfaces and equipment, you can cook the eggs into scrambled eggs – eggs are packed with complete proteins to nourish and energize our bodies. You can use an electric skillet, surface spray, add a little water to make fluffy eggs, and add salt and pepper – or salsa and cheese.*)
2. You may want to wash out the eggshell planter and then put it back into the egg carton or tray.
3. Using a plastic teaspoon, carefully fill the eggshell with soil. Lightly pat the soil down and add more to fill the egg. Add a teaspoon or two of water to the soil.
4. Follow instructions 4 through 12 from Paper Pots above. When you transplant the pots outside, gently crush the eggshell before planting it in the ground. The eggshell will provide plant nutrients to the soil.
You may also choose to use peat pots purchased at local garden stores. You can plant the entire peat pot in the garden.

If you use small paper cups, gently take the plant out of the container or peel off the sides and bottom of the cup before you transplant the plant into the garden.

WRAP-UP

After the tools have been put away and everyone has washed their hands, it is time to re-energize with a healthy snack.

The healthy snack should be water and fruits or vegetables and dip. As the students eat and relax from the gardening experience, ask the following question and share possible answers. Conclude that maybe they will discover more about the answers as their garden grows.

Are we eating or drinking anything that we grew or used in our garden?
We are drinking water like we sprayed on our garden. (Discuss any of the snacks that you may have planted. If there aren’t any snacks that were planted from your garden, talk about whether the snacks grew in a garden, berry patch, vineyard, or an orchard.)

Why do seeds, sets, seed pieces, transplants, and growing plants need water?
They need water to start or continue to grow. While the plants are growing, they will need water to grow and produce the leaves, fruit and other edible parts of the plants.

Why do you need water?
We need water just as much as plants need water. Our bodies need water to stay alive and to help all parts of our bodies to work like they should. Our bodies are made up mostly of water, so it is important to keep our water levels up. Water helps us clean our bodies inside and out.

Look at the fruits and vegetables you are eating. How can you tell they have water in them?
They are firm and not shriveled; the skin looks shiny and not wrinkly. You can see and or taste the juice.

How do you know that you aren’t getting enough water?
You may have dry skin and hair, poor skin complexion, dull eyes, dry throat, get sick more often, don’t go to the bathroom regularly, you might pass-out, you don’t feel good, or you can’t think clearly.

We get vitamins and minerals that help our bodies to be healthy from eating vegetables and fruit. How do the vegetables and fruits get the vitamins and minerals that they pass on to us when we eat them?
The plant takes up nutrients from the soil. The plant uses water, carbon dioxide from the air, and sunshine or light to makes its own nutrients or plant food that becomes the food we eat, such as carrot roots, lettuce leaves, tomatoes, and strawberries.

Raise your hand if you are trying a new fruit or vegetable today.
What is it and what do you like about it?
GARDEN CHALLENGE

TEAM 1

potatoes

TEAM 1
tomato

TEAM 1

peas

TEAM 1

onion

TEAM 1

carrots

TEAM 1

lettuce
GARDEN CHALLENGE

TEAM 1 pumpkin

TEAM 1 pepper

TEAM 1 broccoli

TEAM 1 cabbage

TEAM 1 spinach

TEAM 1 beets
GARDEN CHALLENGE

TEAM 1  green beans | TEAM 1  corn

TEAM 1  cucumber | TEAM 1  radish

TEAM 1  squash | TEAM 1  sweet potatoes
**GARDEN CHALLENGE**

**Team 2 shallow**

**Team 2 medium** (¼" deep)

**Team 2 not seed transplant, set, seed piece**

**Team 2 deep** (½" to 1" deep)
**GARDEN CHALLENGE**

**Team 3**

- *seed pieces*
- *transplants*
- *sets*
- *seeds*
Get Ready, Get Set, GROW!

Our Healthy Garden Plan

Name

Instructions:
Draw a line from the plant to how it is usually started in the garden.

Put a star by the plants that you would like to grow sometime.

- pumpkins
- onions
- peas
- sweet potatoes
- cabbage
- squash
- lettuce
- carrots
- tomatoes
- beans
- broccoli
- peppers
- potatoes
- cucumbers
- corn
- radishes

transplants
seeds
sets
seed pieces
# Grow in the Garden: Local Foods and Healthy Living

## Introduction to Local Foods and Healthy Living

### Lesson 5b

## Know Your Garden

### Our Healthy Garden Plan

<table>
<thead>
<tr>
<th>Tools</th>
<th>Garden Tool Use</th>
<th>Tilled Garden</th>
<th>Raised Bed Garden</th>
<th>Container Garden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>Gloves protect hands and keep them clean.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rake</td>
<td>The short, stiff teeth on a garden rake are strong so that it can break up clods and make the soil smooth for seeds and plants.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fork</td>
<td>A garden fork loosens the soil and turns it over. It also can be used to harvest underground crops such as carrots and potatoes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hose</td>
<td>A hose is used to take water from the water spigot to the garden. Several hoses can be connected so that the garden can be watered a fairly long distance from its source.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trowel</td>
<td>A trowel looks like a small shovel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shovel</td>
<td>A shovel is used to dig larger holes for planting larger things in the garden and landscape, like trees and shrubs. It also can be used to turn soil over. Gardeners use shovels to add things, such as compost and manure, to their garden.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tiller</td>
<td>A tiller is a machine that a gardener walks behind to turn over the soil.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Instructions:**
The right tools make gardening much easier and more fun. Here are some of the tools commonly used for gardening.

Put an “X” in the box under container garden, raised bed garden, and tilled garden if you think the tool is needed for that type of garden.
**Know Your Garden**

<table>
<thead>
<tr>
<th>Tools</th>
<th>Garden Tool Use</th>
<th>Tilled Garden</th>
<th>Raised Bed Garden</th>
<th>Container Garden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape measure</td>
<td>A tape measure that is long enough to stretch the length of the garden is important to have when it comes to determining where crops should be planted and giving them enough room to grow.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labels</td>
<td>Garden labels or markers are important to identify the crops and know where everything is planted. Using the tape measure and your garden plan, the labels can be put in just before the garden is planted.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watering can</td>
<td>A watering can holds one to two gallons of water and has a spout that allows you to gently water plants by hand. It is ideal for small gardens, but not very efficient for large, tilled gardens.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water breaker</td>
<td>A water breaker is typically attached to the end of a hose to “break up” the flow of water into fine spray or forceful spray. On the “shower” setting, it wets the soil gently without washing the soil away from the roots or damaging the plants.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>String</td>
<td>A string is used to stretch from a stake on one side of the garden to one on the other side. It is used as a guide to keep seeded and transplanted crops in a tidy straight row.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mulch</td>
<td>Mulch comes in many different forms – grass clippings, straw, leaves, newspaper, black plastic, etc. It is laid over the soil to help conserve soil moisture. It also blocks light from reaching the soil so it prevents weed seeds from sprouting and growing.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Garden Tools Crossword Puzzle**

Read the handout, “Know Your Garden Tools” to find the answers to the crossword puzzle.

Name

---

**ACROSS**

1. A tool used to plant small plants in the garden

2. A tool used to water plants by hand (two words)

3. A tool used to cover the soil to reduce weed growth and conserve soil moisture

4. A tool used to smooth the soil to make a fine seed bed

5. Tools used to mark where crops are planted

6. A tool that fits on the end of a hose to gently water garden plants (two words)

7. A tool used to lightly cultivate the soil and remove weeds from the garden

8. A tool used to move water from the source to the garden

9. A tool used to dig underground crops, such as carrots and potatoes

10. A motorized tool used to prepare the garden soil for planting

11. A tool used to dig and add things to the garden, such as compost

12. A tool that is stretched down the row to assist with planting row crops

13. A tool used to accurately determine plant and row spacing (two words)

---

**DOWN**

1. A tool used to plant small plants in the garden

2. A tool used to water plants by hand (two words)

3. A tool used to cover the soil to reduce weed growth and conserve soil moisture

4. A tool used to smooth the soil to make a fine seed bed

5. Tools used to mark where crops are planted

6. A tool that fits on the end of a hose to gently water garden plants (two words)

7. A tool used to lightly cultivate the soil and remove weeds from the garden

8. A tool used to move water from the source to the garden

9. A tool used to dig underground crops, such as carrots and potatoes

10. A motorized tool used to prepare the garden soil for planting

11. A tool used to dig and add things to the garden, such as compost

12. A tool that is stretched down the row to assist with planting row crops

13. A tool used to accurately determine plant and row spacing (two words)
1. Make a copy of this page.
2. Cut around the 4 inch squares and cut out the circles.
3. Place one template on one corner of a poster board.
   Draw around the outside of the square and around the circles.
4. Use the same template four times to make a square foot gardening guide.
5. Cut around the square foot and cut out the circles.
6. Write the names of the crops in the center of the guide.
7. It is best to laminate these guides to keep them in good shape from year to year.
SQUARE-FOOT GARDENING

TEMPLATE 2

peas, bush beans
## Lesson seven: What do plants need to grow?

“Photosynthesis” from GROWING IN THE GARDEN, Iowa State University Extension and Outreach

How and what do plants eat? Find out why some scientists think that photosynthesis is the most important energy process on planet Earth. Students role play as chefs inside a leaf making food for the plant. The best part is that we get the photosynthesis leftovers!

### Content objectives:
- Define photosynthesis;
- Identify the basic ingredients in photosynthesis and describe the process;
- Give reasons why photosynthesis is important to plants and animals.

### Life skill objectives:
- Critical thinking, Learning to learn, Problem solving, Communication, Healthy living

### Core and STEM concepts and skills:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Concepts and skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>Earth and space, Life science, Science as inquiry</td>
</tr>
<tr>
<td>Math</td>
<td>Operations and algebraic thinking</td>
</tr>
<tr>
<td>Language Arts</td>
<td>Reading, Foundational skills, Speaking, Listening, Writing, Viewing</td>
</tr>
</tbody>
</table>

### Healthy snack:
- Pick a leafy vegetable (Chinese Cabbage Stir-Fry, Quick Sautéed Collard Greens, Oriental Cabbage Salad or Strawberry Spinach Salad)

### Additional and supporting resources: None
BEFORE THE LESSON

1. Grade 4, Lesson 7:
This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the www.peoplesgarden.wsu.edu Educational Toolkit.


3. If you plan a food tasting, prepare recipe ingredients.

THE LESSON

Photosynthesis is meant to be taught over two or more days. Although the lesson does not have a specific place for a recipe tasting, consider having a tasting at the end of one of the section. The recipes suggested contain leafy greens, similar to those used in the experiment.

AFTER THE LESSON

Have students record garden progress and changes in their journal.
## Recipes

### CHINESE CABBAGE STIR-FRY

**Yield:** 4 servings

**What you need**
- 1 pound Chinese cabbage
- 1 tablespoon sesame seeds
- 2 tablespoons canola oil
- 2 cloves of garlic, minced
- 2 teaspoons ginger root, grated
- 1 tablespoon soy sauce
- 1 teaspoon sesame oil
- 4 cups of cooked rice

**What to do**
1. Heat the oil in a wok or heavy skillet over high heat.
2. Stir-fry the garlic and ginger for about 30 seconds.
3. Add the cabbage and cook, tossing, until it just begins to wilt (about 2 minutes).
4. Stir in the soy sauce and sesame oil and sprinkle with sesame seeds.
5. Serve over rice.

Reprinted with permission from “Chinese Cabbage and Bok Choy Science Page”, Garden Mosaics:

### QUICK SAUTÉED COLLARD GREENS

**Yield:** 6 (1-cup) servings

**Ingredients**
- 1 tablespoon olive or canola oil
- 2 pounds fresh collard greens washed, stems removed, and cut into shreds
- 1 bunch scallions or 2 medium yellow or red onions, sliced
- 3-4 cloves garlic, minced
- 1/4 teaspoon salt (optional)
- 2 tablespoons water
- A dash of crushed red pepper or hot sauce (optional)

**Instructions**
1. Heat oil in large skillet over medium heat until hot.
2. Add garlic and scallions or onions, and sauté until slightly wilted, about 1-2 minutes.
3. Add the greens, seasonings, and water, stirring the ingredients well.
4. Cover the pan, and cook the greens over low heat for 10 to 20 minutes, stirring occasionally.

**Healthful Hints for Cooking Collards**
- Cook greens as little as possible to retain more of their bright, darkgreen color and nutrients.
- If cooking collards with ham hocks or salt pork, boil meat in water for at least half an hour, and drain off the water and fat. Then put new water in the pot, and continue to cook until the meat is done. Then add greens.
- When collards are boiled, nutrients are leached out into the water. Do not pour this water down the drain. It is full of valuable nutrients. Save it to add to soups or soak it up with a piece of hot cornbread.

Reprinted with permission from “Collard Page”, Garden Mosaics:
Oriental Cabbage Salad

1/2 head of cabbage
4 green onions, chopped
1/2 cup slivered almonds
1 pkg chicken ramen noodles, including seasoning packet
2 T sugar
3 T vinegar
1/2 C oil
1/4 tsp pepper

Chop cabbage and place in a salad bowl. Add almonds and onion to cabbage and toss. Break uncooked noodles in package and add to salad. Make dressing with the sugar, vinegar, oil, pepper, and seasoning packet from the ramen noodles; pour over salad and toss lightly.

Reprinted from How to Nourish with Cabbage, Utah State University Food Sense Program. 
**Strawberry Salad**

**Prep time:** 15 minutes  
**Makes 6 Servings**

**Salad**

**Ingredients**
- 1 bunch of washed spinach, 1 bag (9-ounce) baby spinach, or 1 head of leaf lettuce
- 10 to 12 medium strawberries, sliced
- Tangy Sunshine Dressing

**Directions**
1. In a large bowl combine spinach, feta cheese, and strawberries.
2. Add tangy sunshine dressing.

**Tangy Sunshine Dressing**

**Ingredients**
- 3 Tablespoons canola oil
- 3 Tablespoons frozen orange juice concentrate
- 1 Tablespoon red wine vinegar
- Water (to make 3/4 cup dressing)
- (Optional)
  - 1 Tablespoon chopped fresh chives
  - 1/4 teaspoon dried thyme leaves

**Directions**
1. Pull all ingredients into a jar or container with a tight fitting lid.
2. Shake jar to mix. Store in the refrigerator.

Reprinted from Washington State University Extension Food $ense
Photosynthesis

Lesson 6

Content Objectives

Define photosynthesis, identify the basic ingredients in photosynthesis and where they come from, describe the basic photosynthesis process, and give reasons why photosynthesis is important to plants and animals.

Life Skill Objectives

Critical thinking, learning to learn by experimenting and observing, problem-solving.

Indicators

Draw the photosynthesis formula and diagram, respond to questions, list reasons plants and animals benefit from photosynthesis.

Subject Standards

Science: Life (characteristics of organisms, organisms and their environment)
Language Arts: Vocabulary, character development, main idea, interpreting, inferring, sequencing, writing
Math: Algebra

Learner Types

Linguistic-words, logical-mathematical, bodily-kinesthetic, spatial-visual, music, intrapersonal, interpersonal, natural.

Materials

At least 4 paper circles (the size of a quarter, see the Photosynthesis Experiment in the Introduction section of this lesson)
4 paper clips (one paper clip per circle)
2 sheets of green paper (in big letters write “Chloro” on one and “Phyll” on the other)
Tape to attach the green paper as name tags
Large, plastic mixing bowl
Big mixing spoon
1 cup of water
Green construction paper with small holes punched in it
Flashlight
Marker board or large sheet of paper
Markers
Transparency of “Photosynthesis” lyrics and “Diagram of Photosynthesis Process” (found at the end of this lesson)
Overhead projector
Were You Born in a Barn? cassette tape by Chris Rowlands
Cassette player
Blank sheets of white paper (one per student)
**INTRODUCTION**

**ENGAGE**

SET THE STAGE

15 MINUTES

1 WEEK BEFORE LESSON

**Life Science:**
Characteristics of organisms

**Language Arts:**
Vocabulary, Character development

---

**One week before the rest of the lesson**

Talk to the school grounds maintenance staff to identify one or two plants to use for a photosynthesis experiment described in this section. You also could use plants in your school classroom. The plants need to have large leaves and a sunny location. You may want to try the experiment on two different plants. The experiment works best outside in the spring and early summer. Have the paper clips and circles ready for the experiment.

---

Everyone stand up.

**What are some wild animals that live in our area?**

Go around the room for answers such as rabbits, mice, insects, wild turkeys, deer, raccoons, snakes, frogs, birds, and so on. Have the students stand like their favorite animal and give them 30 seconds to pretend to find and eat their food.

---

**What are some examples of domestic animals that live with us or on farms and depend on our care?**

Go around the room for answers such as dogs, cats, horses, beef cattle, dairy cattle, pigs, layers (chickens that lay eggs), turkeys, sheep, and so on. Work in pairs and have one student be a person who cares for the animals and the other one choose which kind of domestic animal to be. Pretend that the caretaker is feeding the domestic animal. Switch roles.

---

**What are some examples of plants that naturally grow in our area?**

Trees, some grasses and flowers, weeds, etc.; stand like you are one of those plants and pretend to get your food.

---

**What are some examples of plants or crops that people plant in our area?**

Corn, soybeans, oats, grass, flowers, vegetables, apple trees, berries, grapes, etc.

In pairs, one person names a crop and stands like the plant. The other person is the one that grows that crop. Pretend that the plant needs food and act out what might happen such as watering or fertilizing the plant.

---

Think about pretending to be animals and plants trying to find food while you answer the following questions.

**Plants and animals are living things; what makes them alike?**

They both need food and water, and they reproduce. They both live and die.

**What makes them different?**

Plants cannot move to find food. They can make it for themselves from natural resources. Sometimes people help to feed plants with water and nutrients such as plant food, fertilizer or animal manure.

---

**Is it important to animals if plants get fed?**

Yes.

**Why?**

Most animals eat plants. Plants are also used for shelter and protection.

---

**What are the two major plant crops grown in Midwestern states such as Iowa that feed domestic animals on the farm such as pigs, cattle, sheep, dairy cows, chickens, and turkeys, and are major ingredients in thousands of the food products we eat?**

Corn and soybeans
We are going to figure out what plants need in order for them to make their own food in a process called photosynthesis. We’ll start our investigation with an experiment and then we’ll check on the results of our experiment next week.

PHOTOSYNTHESIS EXPERIMENT

Have the students gather around the plant and explain that they are going to do an experiment. Have four (or more, depending on the number of plants or leaves available) students clip a circle securely on four different leaves. Remind them not to touch the circles until the class comes back to look at them. Return in a week to see what happens.

Before class, put the mixing bowl, mixing spoon, cup of water, green construction paper with holes, and flashlight on a table in the front of the room. Draw a blank “recipe card” on the board or flip chart.

Have the students return to the plants that have the circles clipped on their leaves. Have the students carefully remove the circles.

Do you see any differences in the leaf from when we put the circle on it?
The area under the circle should be lighter green.
What do you think caused that?
Lack of light to that area of the leaf

Let’s go back to the classroom to see how this could happen.

The way plants make food is similar to the way a chef makes bread. It takes a combination of ingredients and someone to mix them. Plant food begins with green pigment in the plants called chlorophyll. (Write “chlorophyll” on the board.) Chlorophyll gives plants their green color. These are very tiny molecules that act as “solar receptors” and absorb light in the plant. Plants need light to make chlorophyll.

Have you ever seen a house with solar receptors or panels on it?
What do they do?
They gather light and turn its energy into another form of energy. That is similar to what the chlorophyll does.

What happened to the leaves that we put circles on?
The circles shaded the leaves so they didn’t have enough light to make chlorophyll, the green pigment.

What color were the areas that didn’t have as much chlorophyll?
Lighter green or yellow

Do you think the circles on the leaves will turn a deeper green again if we leave the circles off?
We’ll check it again in a few days and see what happens.

There is a lot more to making plant food than that, though.
I need two volunteer chefs to come to the front of the room and mix a batch of plant food in a bowl. *(Attach the “Chloro” and “Phyll” name tags on their shirts.)*

**What are the names of our chefs?**
“Chloro” and “Phyll”

**Together, what is their name?**
Chlorophyll

**What color are they?**
Green

**Where is their kitchen?**
In the leaves of plants

“Chloro” and “Phyll” need a recipe to make their tasty plant food. We need one person to write the recipe on the recipe card I have drawn on the board. First, in big letters at the top of the card, write “Plant Food Recipe.”

Phyll, you can add the ingredients. Chloro, you can mix them up. The first ingredient we need in order to make this batch of plant food is water. Write “water” on our recipe. Next to the word water, write the short name for water, which is $\text{H}_2\text{O}$. This formula name means water is made up of two molecules of hydrogen and one molecule of oxygen. Phyll has some water in a cup to add to the mixing bowl.

**Where do you think Phyll got the water from?**
Water came into the plant through the plant’s roots, then it traveled up the stem and into the leaves where Chloro and Phyll are making plant food.

The stem is like a straw. We could have Phyll suck the water up through a straw and add it to the bowl, but that would be gross. Phyll, pour the water into the big bowl. Chloro, start stirring very carefully. Water is a precious natural resource. We don’t want to spill any of it.
Now, we need the next ingredient. The recipe says to add carbon dioxide. Write “carbon dioxide” on the recipe. Next to the word, write the formula name for carbon dioxide, CO$_2$. This formula name means that carbon dioxide is made up of one molecule of carbon and two molecules of oxygen.

**Where is Phyll going to find carbon dioxide?**
Carbon dioxide is a gas in the air. Air is a natural resource, which means we don’t make it. Actually, people and animals can help us add carbon dioxide to the recipe. How can we do that?
We can breathe into the mixing bowl. What people exhale or breathe out is carbon dioxide. We need just the right amount of carbon dioxide. Four people ought to do it.

**Who wants to come up and blow carbon dioxide into the bowl?**
The carbon dioxide enters the plant through tiny openings in the leaves called stomata (stow-MA-ta). Pick up the piece of paper filled with tiny holes or stomata and blow through the paper. Chloro, stir the water and carbon dioxide very carefully. It’s important to have them thoroughly mixed.

Chloro and Phyll are missing one last ingredient that causes the water and carbon dioxide to change to plant food. In order to make something change, you need energy.

**Nature has provided the water and air containing the carbon dioxide, but where in nature can we find energy?**
The sun

Phyll, turn on the sun (a flashlight). The sun provides light, which is a source of energy. The energy changes the water and carbon dioxide into the plant’s food. Shine that light into the bowl and stir it in. Add the word “light” to the recipe.

**What have we done to make this recipe work?**
We have Chloro and Phyll. They took water from the soil through their roots, carbon dioxide from the air through their leaves, light from the sun through their leaves, and they mixed them together. The water and carbon dioxide are changed by the sun and the chlorophyll to make food.

In the directions under the recipe ingredients, write “Chlorophyll mixes the ingredients together to make plant food for one plant.”

**Is there anything left in the bowl?**
Yes.

**What is it?**
We can’t see it, but it’s there. It’s oxygen. When the ingredients are mixed together, oxygen is left over. Plants don’t use oxygen for plant food.

**What do they do with it?**
Similar to the way we exhale carbon dioxide because we don’t need it, plants give off oxygen because they don’t need it.

**Who needs oxygen to live?**
People and animals need oxygen to breathe. Phyll, tip the bowl out toward your classmates and scrape the oxygen out at them. The rest of the class, breathe in and fill your lungs with oxygen from the plants. Everybody is happy. The plants grow from the food they made and people get to breathe.

---

*Thanks for your help, Chloro and Phyll.*
This process is called **photosynthesis**. (Write “photosynthesis” on the board.) Photosynthesis comes from the Latin words “photo,” which means light, and “synthesis,” which means make something. Chloro and Phyll used light to make plant food from water and carbon dioxide.

**What are the three natural resources needed for photosynthesis to occur?**

Sun, water, air

**What would happen if there were no water, air or light?**

Photosynthesis wouldn’t happen, and we wouldn’t have food to eat or oxygen to breath.

Let’s look at the process of photosynthesis using the formula names. It is kind of like a math equation. (Write the following on the board and discuss what each symbol means, whether all the equations mean the same thing, and whether the equations would end up the same if part of the equation was missing or the answer was incorrect.)

\[ \text{H}_2\text{O} + \text{CO}_2 + \text{light} = \text{plant food} + \text{oxygen} \]

\[ \text{Light} + \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{plant food} + \text{oxygen} \]

\[ \text{CO}_2 + \text{light} + \text{H}_2\text{O} \rightarrow \text{plant food} + \text{oxygen} \]

People and animals eat the food made by photosynthesis. Fruits and vegetables store that food. Leaves from herbs also store the food made through photosynthesis. Potatoes are swollen underground stems that store starch, a sugar made through photosynthesis. The starch in the potato tuber is food for the new plant that grows from it. It’s also an important source of food for people.

(Show the transparency with the lyrics to “Photosynthesis” by Chris Rowlands. Follow the lyrics while you play the song from *Were You Born in a Barn?* by Chris Rowlands. Ask the students where the nutrients come from. They enter the plant in the water coming from the soil up through the roots and to the stems and leaves. Write the new words such as *autotropic*, *cells*, *organelles*, and *chloroplasts* on the board and discuss them.)

**PHOTOSYNTHESIS DIAGRAM**

Take out a blank sheet of paper and draw a diagram of the photosynthesis process.

1. **Start by drawing yourself or an animal standing next to a leafy plant.**
   (Give them time to draw.)
2. **Draw the natural resources needed for photosynthesis.**
3. **What does the sun provide?**
   Write “light” under the sun.
   **What could you do if you wanted to grow plants indoors where there are no windows?**
   Grow them under special lights.
4. **How does the plant get water?**
   Through its roots; draw an arrow in the direction the water moves.
5. **What gas is needed by plants?**
   Carbon dioxide
   **Where does it come from?**
   Air, people and animals; draw arrows from those places to where the plant takes it in.
6. **What gas is given off by the plants as a byproduct of photosynthesis?**
   Oxygen; draw arrows showing where the oxygen is coming from and going to.
**PHOTOSYNTHESIS**

by Chris Rowlands

**Chorus**

Photosynthesis is a chemical process  
In which plants take things they use  
Turn it into food  
Energy from the sun, water, CO₂ and nutrients  
These are things they use  
When they’re making their own food.

Sun shines down on the little plants  
Visible light is what they eat  
Autotrophic is what they call the plant  
They make their own food naturally  
From the smallest plant to the biggest tree  
They have their own food factory  
They give us lots of things we need  
Like food and they give us air we breathe.

In the leaves plants have cells  
Inside the cells are organelles  
Organelles like chloroplast  
Are where the sun’s energies are stored and stashed.

In the chloroplasts there still are  
Smaller things called chlorophyll  
Chlorophyll and chloroplast  
Are where the sun’s energies are stored and stashed.
Why do some scientists think that photosynthesis is the most important biological process?
It is essential to plant growth because it makes the food that they eat. Plants are the basic source of food, even for carnivorous animals that eat other animals that probably eat plants.

Why is it important for scientists to study the process of photosynthesis?
To keep our food supply going
In some cases, plants are used to produce more oxygen, which is a byproduct, or it comes from the photosynthesis process.

PLANTS AND ANIMALS AS PARTNERS
Are plants, animals and people good partners?
Yes.

Let’s make a list of all the things that people, animals and plants do for each other. Work in small groups to discuss one of these relationships: what plants do for animals, what animals do for plants, and what people do for plants and/or animals. Have someone in your group be the recorder and write down all the things your group comes up with. Someone else from your group will report your ideas to the class. (Give them 10 minutes for discussion in their groups. As you hear each group’s report and discuss it, have a student write their ideas and others on the board in the appropriate column.)

<table>
<thead>
<tr>
<th>What plants do for people and/or animals</th>
<th>What animals do for plants</th>
<th>What people do for plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give us oxygen</td>
<td>Give them carbon dioxide</td>
<td>Give them carbon dioxide</td>
</tr>
<tr>
<td>Give us food</td>
<td>Fertilize the soil (manure)</td>
<td>Cultivate them</td>
</tr>
<tr>
<td>Give us clothing (cotton)</td>
<td>Move their seeds</td>
<td>Sow their seeds</td>
</tr>
<tr>
<td>Give us shelter (wood)</td>
<td>Thin out populations by eating plants</td>
<td>Protect them from animal grazing</td>
</tr>
<tr>
<td>Give us beauty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFERENCE AND RESOURCE

REFERENCE

RESOURCE
## Lesson eight: How do you water the garden?

“Water in the Garden” and “Watering the Garden” from GARDEN MOSAICS, Cornell University Cooperative Extension Service

Explore the water cycle and figure out how to use the cycle to water your garden. While the plants grow, learn more about garden vegetables by tasting and exploring them one or two at a time.

### Content objectives:
- Describe the steps in the water cycle;
- Explain why plant roots need both water and air;
- Identify signs of water stress in plants;
- Demonstrate when, how, how much a garden should be watered;
- Explain how to conserve water in the garden

### Life skill objectives:
- Critical thinking, Decision making, Problem solving, Communication, Citizenship, Leadership

### Core and STEM concepts and skills:

**Science**
- Earth and space, Life science, Science as inquiry

**Math**
- Measurement and data, Operations and algebraic thinking,
- Mathematical practices

**Language Arts:**
- Reading, Vocabulary, Listening, Speaking, Viewing

**Social Studies**
- Behavioral; Geography; Economics; People, places and environments

**Healthy snack:**
Try different greens, such as different types of lettuce, kale, chard, collard. Serve with a dipping dressing, such as Ranch™, Thousand Island or homemade dressing. For more ideas, go to [http://idph.iowa.gov/inn/pick-a-better-snack/fact-sheets](http://idph.iowa.gov/inn/pick-a-better-snack/fact-sheets)

### Additional and supporting resources:
GARDEN MOSAICS Science Pages, Plants
BEFORE THE LESSON

1. Grade 4, Lesson 8:
This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the [www.peoplesgarden.wsu.edu](http://www.peoplesgarden.wsu.edu) Educational Toolkit.

2. Prepare for tasting: Try different greens, such as different types of lettuce, kale, chard, collard. Serve with a dipping dressing, such as Ranch™, Thousand Island or homemade dressing. For more ideas, go to [http://idph.iowa.gov/inn/pick-a-better-snack/fact-sheets](http://idph.iowa.gov/inn/pick-a-better-snack/fact-sheets)

THE LESSON

1. **Water in the Garden and Watering the Garden** is a lesson that you develop for your class, based on the Science Pages from Garden Mosaics. It includes an experiment on drainage, and review too little and too much water in the garden.


AFTER THE LESSON

Water and weed in the garden. Continue the garden journals or records. Each time you do a lesson or go out in the garden, there is an opportunity to add something new to the Garden Journal.
WATER IN THE GARDEN Teaching Tips

LEARNING OBJECTIVES

Youth will be able to:

* Describe the steps in the water cycle.
* Explain why plant roots need both water and air from the soil.
* Identify signs of water stress in plants.

HOW TO USE THE WATER IN THE GARDEN SCIENCE PAGE

To demonstrate transpiration, place a small plastic bag over the leaf of a house plant or garden plant, and secure the bag around the stem with a twist tie. After about an hour, check the bag. Water from the transpiring leaf will collect on the inside of the bag.

To demonstrate evaporation, condensation, and precipitation, heat some water until it is near the boiling point. Place it in a clear, heat-proof dish. Cover the dish with an upside-down lid or aluminum foil. Put ice on top of the lid or foil. Water will evaporate from the dish, condense on the cool surface, and fall in droplets back into the dish. Tell youth to look for steam rising from warm water (clouds) and drops forming on bottom side of lid (rain). Ask:

What happens to the water when it gets heated up? (Answer: It evaporates and becomes water vapor.) What effect does the ice have on the water? (Answer: It causes the water vapor in the air to condense to form water droplets.) How is this demonstration similar to or different from the water cycle that occurs in nature? (Answer: The same processes of evaporation, condensation, and precipitation occur in nature, only on a much larger scale. In nature, other processes such as transpiration are also important.)

You may wish to review the following scientific terms, and ask youth where they occur in the natural water cycle:

**Evaporation** is the changing of water from a liquid to a gas.

**Condensation** is the changing of water from a gas to a liquid.

**Precipitation** is the process by which water condenses to form drops heavy enough to fall to the Earth’s surface.

**Transpiration** is the process by which moisture is carried through plants from roots to leaves, where it changes to vapor, and is released to the atmosphere.

**Capillary action** is the climbing of liquids in narrow tubes or in tiny openings of porous material, such as soils. (This is due to forces of cohesion and adhesion.)

**Surface run-off** is the flowing of water over the land from higher to lower ground.

**Infiltration** is the process of water filling the porous spaces of soil.

Emphasize the fact that plants need a constant supply of water and oxygen. Too little water does not allow the roots to replace water lost by the plant through transpiration. Studies have shown that production is almost doubled if plants have a constant water supply. Also, plants need to take oxygen from the soil pore spaces. Without enough oxygen, plant roots suffocate and die. Plant parts above ground exhibit symptoms of lack of oxygen, including: wilting, yellowing drying foliage, and leaf drop. Constant over-watering kills most plants. These symptoms might be mistaken for the symptoms caused by lack of water. Youth may be interested in setting up a demonstration to compare the symptoms in potted plants when they are given too much or not enough water.

Puzzle

Answers: RUNOFF; TRANSPRIES; CAPILLARY ACTION; EVAPORATES; CLOUDS; RAIN; PLANTS; SOIL.

Final message: WATER CYCLE.

Try This

Youth should discover that sandy soils drain very rapidly, and clay and compacted soils drain very slowly. Sandy loams will accept about 1.25 to 7.5 centimeters of water per hour. A clay-loam may absorb only 0.25 to 1.5 centimeters of water in the same amount of time. A very dry clay-loam soil could therefore take as long as 120 hours to become completely wet to a depth of 30 centimeters, whereas a sandy loam may take as little as 4 hours. Adding organic matter to all soil types will cause them to behave differently. Sandy soils with organic matter added will hold water longer. Adding organic matter to clay or to compacted soils allows water to penetrate more quickly. Challenge youth to set up a demonstration to show how water drainage changes when organic matter is added to different soil types.

Spotlight on Research

Some water flows away over the top of the soil. This is called runoff.

Some water seeps into the soil, filling spaces between soil particles. Water seeps through sandy soils much faster than through clay soils or compacted soils.

Water soaks into the soil down to the roots of plants. Water taken up by roots moves through the stems to the leaves.

Water may seep through the soil beyond the root zone.

Some water evaporates directly from the soil surface, especially in hot, dry climates. This causes water from lower layers in the soil to be pulled to the surface. As water is pulled up through the soil, it may carry dissolved salts. When the water evaporates, salt deposits are sometimes left on the surface of the soil.

These tomatoes have blossom end rot because they did not get enough water when they were forming fruits.

Our garden did not get enough water, so this carrot has a hard core. The lettuce is bitter, and the cucumbers are small and misshapen.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
What to do
1. Use the can opener to cut the bottoms and tops off 3 of the cans. Mark each can 9 cm from one end.
2. Go to a garden and pick out three sites where you think the water will soak in at different rates.
3. On each of the sites you have selected, set a can on the ground, so that the 9-cm level is near the ground. Place the block over the can and tap with the hammer so the can is pushed into the ground to a depth of 9 cm, and the 9-cm mark is level with the ground (see picture).
4. Make a chart similar to the one shown in the next column.
5. For each site, fill the fourth can with a liter of water, and pour the water into the can in the ground. Record the time when the water was added.
6. Observe the water level every minute for the first 10 minutes, and every 10 minutes or every hour after that, depending on the rate of water flow. Record the time when the water has completely soaked into the ground.
7. Figure out the time it took for water to soak into the ground at each site. Where does water soak into the ground the slowest? The fastest? Can you explain your results?

Unscramble each clue word related to how and where water moves in a garden. Take the letters that appear in boxes, and unscramble these letters to complete a final message that describes what keeps going round and round in the garden.

FOUNRF
SINAPRTRES
PACRYAILL
OTNCAI
TOPEVREAAS
CODLUS
RIAN
NALTPS
SILO

message

W

SPOTLIGHT ON RESEARCH
Can plants help solve the salty soil problem of irrigated lands?

Irrigation makes it possible to grow crops in dry regions, where they would otherwise not grow. For example, under irrigation, the San Joaquin Valley in California has become one of the world’s most productive agricultural areas, sometimes referred to as “the nation’s salad bowl.” However, irrigating soil can cause problems in hot, dry places. As irrigation water evaporates from the soil surface, salts in the water are left behind. Salty soil makes it harder for plants to absorb the water they need to grow. As salts from irrigation build up year after year, the soil may gradually become too salty to grow any crops at all. About 30% of the irrigated land in the U.S. and 50% worldwide are salt-affected.

Scientists with the U.S. Department of Agriculture are helping farmers in the San Joaquin Valley to deal with this problem. One way to reduce the amount of salts in soils is to drain off excess irrigation water from the fields, instead of letting it evaporate, which makes the soil saltier. But what can you do with the salty drainage water? The scientists asked, “What if we planted crops that can tolerate salty water to take up excess salt in the drainage water?” In lab trials, they tested crops that produce feed for sheep and cows. They grew a number of different feed crops in tanks, adding salts at different levels to the soil. Overall, alfalfa performed best. Next scientists will conduct field tests on alfalfa, and also test the nutritional value of the feed produced.


RIDDLE
Why are mushrooms like little umbrellas?

Answer: Because they come out in rainy weather!
WATERING GARDEN PLANTS Teaching Tips

LEARNING OBJECTIVES
Youth will be able to:
* Explain when and how much a garden should be watered.
* Describe several different watering methods that can be used in a garden.
* Evaluate watering methods to determine which is most suitable for a given situation.
* Explain how to conserve water in the garden.

HOW TO USE THE WATERING GARDEN PLANTS SCIENCE PAGE
Have youth do a survey of watering techniques being used in the community garden. Find out where the water comes from and how gardeners transport it to their gardens. Observe how and when crops are being watered and compare their vigor. For example, look for different types of drip irrigation systems, including both homemade and store bought devices. Observe how the plants are doing under these watering systems. Are they being watered enough, and in the right way?

Look for plants that appear wilted and stunted because of lack of water. Try to figure out why they are stressed. Are they getting enough water? Is there enough organic matter in the soil? Are plants being mulched?

Look for techniques being used to conserve water. For example, do gardeners collect water in rain barrels? Do they add organic matter and mulch to their soil?

Youth may want to visit several gardens and possibly a farm or university agricultural experiment station to learn about different watering methods. They may also want to do research about watering techniques on the internet. Go over the general watering tips below with the youth. After youth have learned about watering methods for gardens, have them discuss what recommendations on watering they would give to gardeners. They may wish to draw a poster to illustrate their recommendations, and post it in the garden. Or they may want to make a poster on watering for children and other visitors to the garden.

Here are a few tips that many gardeners could use to improve water use in the garden. Water infrequently, but thoroughly. Frequent shallow watering causes plant roots to concentrate close to the surface, making the plant more susceptible to water stress. How often you must water depends on many factors, including the type of soil you have (sandy soils need watering more frequently than do clay soils), how much organic matter and mulch is present (soil without mulch or organic matter dries out faster), whether or not you have raised beds (raised beds tend to dry out faster), and the weather (obviously, you have to water more often in hot, windy, dry weather, and less often in rainy weather). Generally, unless the weather is very hot and windy, about 2 1/2 centimeters (1 inch) of water per week is adequate for most garden plants. To find out how much rainwater the garden is getting, you can place a straight-sided can in the soil, and then measure how much water is in the can after a rainstorm. If the garden is not getting 2 1/2 centimeters of rain, then you need to make up the difference by watering.

To find out for sure if you need to water, check the soil to the depth of the roots. When the soil is dry to a depth of 15-30 cm, water thoroughly until the soil is moist to the depth of the roots (at least 60 cm deep for tomatoes, pumpkins, winter squash, sweet potatoes, and watermelon; at least 45-60 cm deep for beans, beets, carrots, cucumbers, peas, peppers, and summer squash; at least 30 cm for cole crops, corn, lettuce, potatoes, radishes, spinach, and berries). 2 1/2 centimeters of water will penetrate to a 38 cm depth in a loam soil.

CROSSWORD PUZZLE
Answers
Across: 1. morning; 4. drip; 7. compaction; 9. trickle; 11. soaker.
Down: 2. organic; 3. sprinklers; 5. rain; 6. barrels; 8. mulch; 10. roots.

TRY THIS
This is a very simple drip irrigation device that works well for widely spaced plants in the garden. Youth should observe that crops irrigated with this device are more vigorous and have higher yields, compared to crops that are not watered during dry spells.

SPOTLIGHT ON RESEARCH
WATERING GARDEN PLANTS Science Page

TO WATER OR NOT TO WATER?
In most areas, rain alone does not meet all the water needs of garden plants. You need to water the garden.

The soil in raised beds dries out faster, so we have to water more often.

At least these beds drain well. If the soil were compacted, the water would not drain and the plant roots would drown.

The soil is dry all the way down to the depth of the plant roots. It’s time to water.

You need to add enough water so that it seeps all the way down to the plant roots. If you just water the soil surface, the roots will grow close to the surface and then the plants will wilt more quickly.

WATERING METHODS
1. A watering can and hose are useful for small gardens.

Direct the water to the base of the plant, not on the leaves.

I’m using a gentle rain nozzle so the water can slowly soak into the soil.

2. Sprinklers are cheap and convenient, but they waste a lot of water to evaporation, especially on hot, windy days.

I’ll move the sprinkler around to other spots so all the garden gets enough water.

3. A drip or trickle irrigation system applies water directly to the area in the soil where roots are growing.

Many farmers in hot, dry places use drip or trickle irrigation.

Little water is lost to evaporation or run-off when you use the drip or soaker hose methods because the water goes into the ground near the plant.

4. A soaker hose is a plastic or canvas hose with holes all along its length. It is placed along one side of plants or underneath mulch. Water seeps out slowly.

The gentle stream of water causes little or no compaction of the soil.

SAVING WATER IN THE GARDEN
Make the most of available water in the garden.

Collect rain water from roof-tops in rain barrels. Keep the rain barrel covered to prevent mosquitoes from breeding.

Add organic matter to the soil. It holds the water, which then can be used by plants.

Water during early morning. At this time temperatures are cooler and it is less windy, so there is less evaporation.

Cover the soil with mulch, which smothers weeds and allows water to seep slowly into the soil. A mulch cover also reduces evaporation of water from the soil.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
CROSSWORD PUZZLE
Across
1. Water in the ______ when it is cooler.
4. This type of irrigation system applies water directly to the roots of plants.
7. Watering with a gentle stream of water causes little ______.
9. Farmers in hot, dry countries use this method of watering.
11. A hose with holes all along its length is called a ______ hose.
Down
2. Add ______ matter to soil so that the soil will hold more water.
3. They waste a lot of water to evaporation.
5. Use a gentle ______ nozzle for watering plants.
6. Gardeners can collect rain in rain ______.
8. ______ will help reduce evaporation from the soil surface.
10. When watering add enough water so it seeps all the way down to the ______.

TRY THIS
DRIP IRRIGATION FOR GARDEN PLANTS
What you need
* plastic one-gallon milk jugs
* candle
* clothespin with spring
* matches
* pin
What to do
1. Light the candle. Use the clothespin to hold the pin. Place the sharp end of the pin in the candle flame until it is hot. Use the hot pin to melt about 8 to 10 small holes in the bottom of the milk jug. CAUTION: Do this only under the supervision of an adult.
2. Put some water in the jug to make sure the water will slowly drip out of it.
3. Bury the milk jug between widely spaced plants in the garden, such as tomatoes, peppers, eggplants, or squash. The bottom 15 cm of the jug should be buried (see picture).
4. Fill the jug with water every few days during dry spells.
5. Observe how well the plants near the jug grow, compared to plants without drip irrigation.

SPOTLIGHT ON RESEARCH
Dream up a watering invention
Can you think of a creative irrigation idea for gardeners and small farmers? Each year the World Bank and the United Nations sponsor a contest to promote irrigation systems for small farmers and gardeners. The irrigation systems must be affordable, creative, easy to operate, and useful in many areas around the world.

One of the contest winners was a “Dream Kit” for drip irrigation, designed by Stephen Ngigi at the University of Nairobi in Kenya. The Dream Kit consists of a bucket mounted on a wooden stand above the ground. The bucket is connected to pipes with tiny holes in them, through which water drips out along a row of crops. In dry areas, the bucket is filled twice a day. Thanks to the Dream Kit, small farmers in Kenya have been able to grow much needed vegetables to sell and to eat.

The kit can easily be put together and repaired by farmers, and costs only U.S. $15.00. Within three months, farmers can make four times this much by selling crops that would otherwise be difficult to grow. The Dream Kit truly deserves its name!


RIDDLE
Where do vegetables go to have a drink?

Answer: A salad bar!
Lesson nine: What do butterflies and other flying insects have to do with producing food?

“A Butterfly’s Life” from GROWING IN THE GARDEN, Iowa State University Extension and Outreach

The students review the butterfly’s life cycle, including how they help to pollinate plants. Students discover plant and animal interdependence. They study what to plant to attract butterflies.

**Content objectives:**
Name and describe the four stages in the complete life cycle of butterflies;
Explain and give evidence of plant and animal interdependence;
Review and demonstrate the process and sequence of plant pollination.

**Life skill objectives:**
Learning by modeling, Observing, Critical thinking, Communication, Citizenship if using Optional Activity of planting a butterfly garden for others to enjoy

**Core and STEM concepts and skills:**
**Science:** Life (characteristics of organisms, life cycles)
**Math:** Number and operation, Measurement, Data analysis, Connections, Representations
**Language Arts:** Factual understanding, Summarizing, Sequencing, Interpreting, Inferring, Vocabulary, Speaking

**Healthy snack:** Select items to sample that have flowers before the item grows, such as tree fruits, beans, peas or tomatoes

**Additional and supporting resources:** 1) Check with local beekeeper associations for possible classroom presentation on bees as pollinators. 2) “Buzzy, Buzzy Bee” from FOOD, LAND & PEOPLE: RESOURCES FOR LEARNING, Food, Land & People, available for $4.00 digital download from [http://www.foodlandpeople.org/ordering/gardenwise/](http://www.foodlandpeople.org/ordering/gardenwise/) (for Grade Level: 2-7; Students play a game in which they pretend to be honeybees and apple trees. In the process, they learn about plant pollination).
BEFORE THE LESSON

1. **Grade 4, Lesson 9**: This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the [www.peoplesgarden.wsu.edu](http://www.peoplesgarden.wsu.edu) Educational Toolkit.
2. Check with your library for a copy of *Caterpillars and Butterflies (Beginners Nature, Level 1)* 2007 by Stephanie Turnbull (Author), Rosanne Guille (Illustrator), Uwe Mayer (Illustrator).
3. Prepare tree fruit, beans, peas or tomatoes for taste testing.

THE LESSON

*A Butterflies Life* is a lesson that should be taught over several days.

AFTER THE LESSON

1. Several optional activities are included at the end of the lesson. Consider inviting local beekeepers to give a presentation about pollinators.
2. Continue your garden journals or records. Each time you do a lesson or go out in the garden, there is an opportunity to add something new to the Garden Journal.
CONTENT OBJECTIVES
Name and describe the four stages in the complete life cycle of butterflies, Explain and give evidence of plant and animal interdependence

LIFE SKILL OBJECTIVES
Learning to learn by modeling, observing and planting; Critical thinking; Communication through creating visuals, asking questions, and talking in small and large groups; Citizenship if using the Optional Activity of planting a butterfly garden for others to enjoy

INDICATORS
Build and use models that demonstrate the four stages in a butterfly's life cycle, Complete the Butterfly Secret Code activity sheet, Identify evidence of plant and animal interdependence on a garden plan, Define vocabulary words, Successfully plant and grow a plant that butterflies like

EVALUATIONS

SUBJECT STANDARDS
Science: Life (characteristics of organisms, life cycle of organisms, organisms and environments)
Language Arts: Factual understanding, Summarizing, Sequencing, Interpreting, Inferring, Vocabulary, Speaking in small and large groups
Math: Number and operations, Measurement, Data analysis, Connections, Representations

LEARNER TYPES
Linguistic-words, Spatial-visual, Logical-mathematical, Music, Intrapersonal, Interpersonal, Natural

MATERIALS
8½" x 11" sheets of white paper for painting or coloring (one sheet per student, see the Introduction section)
Finger paints, tempera paint, or markers or crayons (enough to share between students, see the Introduction section)
Pencils (one per student)
Scissors (one per student)
Caterpillars and Butterflies by Stephanie Turnbull (Usborne Beginners)
8½" x 11" sheets of white paper cut into eighths or small Post-it® notes (one per student, see the Do section)
Many colors of pipe cleaners (cut in half; one per student)
Empty toilet paper or paper towel rolls cut into thirds (one per student)
"Birth of a Butterfly" lyrics (enlarge and copy on a transparency or write the words on the board, see the Refect section)
MATERIALS LIST continued on next page
**MATERIALS continued**

- 7 - 5” x 7” cards or regular sheets of paper (write “butterfly,” “coneflower,” “milkweed,” “pollination,” “pollen,” “host plant,” and “nectar” on them; see the Reflect section)
- Tape
- Butterfly Secret Code (one set per person, found on two pages at the end of this lesson)
- Butterfly Garden plan (make one transparency, found at the end of this lesson)
- Zinnia seeds
- 12” x 4” strips of black and white newspaper (at least one per person)
- 4 or 5 empty frozen juice cans
- Fresh potting soil
- Garden flat or tray
- Large, clear plastic dry cleaner’s bag
- 3” x 5” cards or quarter sheets of paper for “Vitalize Your Vocabulary” (see in the Apply section)

---

**INTRODUCTION**

**ENGAGE**

**SET THE STAGE**

15 MINUTES, POSSIBLY 1 DAY BEFORE THE DO/EXPLORE ACTIVITIES

---

**A CLASSROOM OF BUTTERFLIES**

Set out the paints, brushes (or use fingers), cups of water (or use markers and crayons instead of paint), paper, pencils, and scissors, and proceed with the following instructions. Read through the instructions before you begin. Try making an example for your class or enlarge the graphics to show where the students are heading if they follow the instructions. You may want to do this activity the day before you go to the Do/Explore section to let the paint dry on the butterflies.

What is the most colorful, delicate-looking insect you can think of? A butterfly is the most popular answer.

We are going to make butterflies. Listen to the following instructions to create your own personalized butterfly.

1. Fold your paper in half lengthwise so you have two long halves of paper. Each half will eventually be a butterfly wing.

2. *(If you are using markers and crayons instead of paint, skip this step and color your butterfly wings after cutting them out.)* Unfold your paper. On one half of your paper, finger paint or use brushes to make colorful splashes or designs. Remember, the more water you use, the lighter the color and the wetter the paper. Clean your brushes between colors. If you want to blend colors, blend them on the paper, but too many colors together make a dull brown. Try not to brush or rub the paper too hard or you’ll make a hole. When you are done, fold the paper in half to transfer your colors and patterns to the other butterfly wing. Butterflies have the same color and patterns on the top of each wing, like a mirror image.

3. Put the folded paper on the floor. Carefully place one of your stocking or bare feet on the paper, lining up the inner or outer edge of your foot with the fold line. Your foot will determine the shape of the butterfly’s wings. Try not to move your foot around on the paper. Trace around your foot with a pencil.

4. Cut around the outer shape of your foot but **DON’T** cut the side of your foot along the fold line because that will be the body of your butterfly holding the two wings together.

5. Unfold your butterfly and let the wings dry. If you are using markers or crayons, color the top sides of the butterfly wings so the wings look the same.

---

**BUTTERFLY FEET**
How has your foot changed since you were a baby?
It has changed in size, but it still has the same parts.

How has your body changed since you were a baby?
Our bodies change in size, amount of hair, and what you can do with your muscles. We still have the same body parts and basic appearance.

How are the changes in your body throughout your life different than the changes in the life cycle of a butterfly?
We basically stay the same and a butterfly completely changes appearance from an egg, to a caterpillar, to a chrysalis, and then to a butterfly. Although people and butterflies both depend on plants for food, we basically eat the same kinds of foods from plants and animals throughout our life. When a butterfly is a caterpillar, it eats plant leaves and twigs; when it is a butterfly, it sips nectar from flowers.

Butterflies have what is called a complete life cycle. That means they go through major changes from an egg to a butterfly. The change from an egg to an adult butterfly is called complete metamorphosis. Maybe you have heard the word metamorphosis on some cartoons where something changes its looks into something else completely different. Metamorphosis is a real process during a butterfly’s life cycle.

We are going to have fun learning about complete metamorphosis in the life cycle of butterflies. We are also going to find out how butterflies and plants need each other.

MAKING BUTTERFLY LIFE CYCLE MODELS

1. Read pages 3-5 and look at the pictures in Caterpillars and Butterflies by Stephanie Turnbull. Distribute the eighth sheets of paper or Post-it® notes, one per student. Have the students draw and color butterfly eggs. The eggs will be much larger than real butterfly eggs. Have them put the eggs in front of them on their desks. Then continue with the question and reading.

What hatches out of the egg?
A caterpillar

2. Continue reading pages 6-13 in Caterpillars and Butterflies.
Distribute one half of a colorful pipe cleaner to each student. Have them coil it around their finger to make a caterpillar. Have them put their caterpillars next to their eggs.

3. Continue reading pages 14-17 in Caterpillars and Butterflies.
Pass out the empty paper rolls. Have the students color them with crayons or markers to resemble a chrysalis.

4. Continue reading pages 18-29 in Caterpillars and Butterflies.

How many wings do butterflies have?
Four
How are moths different from butterflies?
Most moths fly at night, not during the day like butterflies. Moths typically have fatter, furrier bodies and feathery antennae rather than thin, club-shaped antennae on butterflies.

Using a marker or crayon, the students can outline the two sets of wings, or four wings, on their butterflies. They can turn them over and color the back side with crayons (so it doesn’t show through on the front side.) Mark the two sets of wings so they match fairly closely to the watercolor wings. When they are finished with their butterflies, have them line up their eggs, caterpillars, chrysalises, and butterflies in the correct order on their desks.

REFLECT
EXPLAIN
DEVELOP CONCEPTS
20 MINUTES, POSSIBLY DIVIDED BETWEEN 2 DAYS

Life Science:
- Characteristics of organisms,
- Life cycle of organisms,
- Organisms and environments
Language Arts:
- Factual understanding,
- Interpreting, Inferring,
- Sequencing, Vocabulary
Math:
- Number and operations

Write on the board the lyrics to the “Birth of a Butterfly” song found in this section. You may choose to enlarge the lyrics and copy them on a transparency.

BUTTERFLY LIFE CYCLE FINGER PUPPET PLAY

How many stages are in a butterfly’s life cycle?
Four

What is the term used to describe the changes in a butterfly’s life cycle from egg to butterfly?
Complete metamorphosis

Use the models you just made to learn about the four stages in a butterfly’s life cycle in the song “Birth of a Butterfly.” We’ll learn and act out the words slowly the first time through. Then we will sing and act out the song. (The lyrics to the song are written below. The instructions for acting out each verse are written beside each verse starting on the next page. The discussion questions are written after each verse. The responses to the questions are found in the book Caterpillars and Butterflies by Stephanie Turnbull, which was read in the Do/Explore section.)

BIRTH OF A BUTTERFLY
Words from 101 Science Poems and Songs for Young Learners
by Meish Goldish and sung to the tune of “Hush Little Baby”

A mama butterfly lays all her eggs,  
Out pops a caterpillar, crawling on its legs.

The caterpillar first is rather thin,  
But then it eats till it bursts through its skin.

After growing nice and big,  
The caterpillar climbs on a leaf or twig.

It makes a shell where it hangs inside.  
The shell then cracks and the parts divide.

Inside the shell, a change was going on,  
The form of the caterpillar now is gone.

When the shell opens, what comes out?  
A beautiful butterfly fluttering about!
**Birth of a Butterfly**

*Words from 101 Science Poems and Songs for Young Learners*

*by Meish Goldish and sung to the tune of “Hush Little Baby”*

---

**VERSE ONE**

_A mama butterfly lays all her eggs._

Fly your butterfly to your desk. Pretend she lays her eggs. Have her fly away. Roll the butterfly up and put it in the tube chrysalis.

_Out pops a caterpillar, crawling on its legs._

Make your caterpillar look like it comes from an egg.

Where do butterflies lay their eggs?  
On leaves and twigs

What do butterfly eggs look like?  
(You may want to show the pictures on page 5.) They can be round, long and thin, or attached like a string of beads. They can be rough or smooth. They come in all sorts of colors and patterns. Hold up the eggs you made so we can all see how different they are.

How long does it take for a caterpillar to hatch from its egg?  
Five to 10 days

How many legs does a caterpillar have?  
(You may want to show the pictures on pages 8 and 9 in Caterpillars and Butterflies by Stephanie Turnbull.) A caterpillar has sixteen legs.

What do the legs do?  
The front legs help them grab their food and the back legs are suction cups that grip onto surfaces to help the caterpillar move and cling to things.

---

**VERSE TWO**

_The caterpillar first is rather thin,_

Gently pull the pipe cleaner caterpillar to make it look thin.

_But then it eats till it bursts through its skin._

Pretend that the caterpillar is eating leaves or the paper with the pictures of eggs on it.

Why do you think butterflies lay their eggs on leaves and twigs of plants?  
When the caterpillar comes out of the egg, it has something (leaves) to eat. The plant that provides the food for the caterpillar right after it hatches from the egg is called a **host plant**.

How many times do most caterpillars change their skins?  
Four times

Is their new skin the same pattern as the previous one?  
No, the patterns change and become more complex.

*Continued on next page.*
VERSE THREE

After growing nice and big, | Squeeze the pipe cleaner caterpillar together to make it wider and pretend it’s eating.

The caterpillar climbs on a leaf or twig. | Move the caterpillar to a pretend leaf or twig.

What are some things that caterpillars do to keep their enemies away?
They are camouflaged, taste bad, have “eye spots,” etc. (You may want to show the pictures on pages 10 and 11 in Caterpillars and Butterflies.)

How long do you think a butterfly is in a caterpillar stage?
It depends on the type of butterfly – it can be a week to 2 months or more.

VERSE FOUR

It makes a shell where it hangs inside | Put the caterpillar in the tube chrysalis.

The shell then cracks and the parts divide. | Pretend the tube is cracking but don’t break it; we will need to use it again.

What are the first two stages of the butterfly life cycle so far?
Egg and caterpillar

What is the third stage called?
Pupa (pupae is plural); the pupa is inside the hard shell or casing.

What is the hard shell or casing called?
The hard casing is called a chrysalis. You may have heard the term cocoon. A cocoon is a softer, silky casing that protects a moth pupa.

What is the hard shell or case made out of?
The caterpillar’s skin

VERSE FIVE

Inside the shell, a change was going on,

The form of the caterpillar now is gone. | Take the caterpillar out and put it aside.

How long is the pupa stage?
It may take a few weeks or several months before the pupa changes into an adult butterfly and breaks out of the chrysalis.

VERSE SIX

When the shell opens, what comes out?

A beautiful butterfly fluttering about. | Remove the butterfly carefully from the chrysalis, unroll it, and hold it so that the wings can flutter and fly above you and your desktop.
Are a butterfly’s wings wet or dry when they come out of a chrysalis?
Wet

Were your paper butterfly wings wet or dry when you first painted them?
Wet

Why do a real butterfly’s wings and your paper butterfly’s wings need to dry before the butterfly can fly?
The wings become lighter in weight and stiffer so they fly easier.

What natural resource helps to dry a butterfly’s wings?
The sun

How many wings do butterflies have?
Four or two sets on each side of their bodies

What do butterfly wings and fish have in common that help them to fly and to swim?
They both have scales. (You may want to look at the microscopic picture of butterfly scales on page 19 of Caterpillars and Butterflies.)

Do all butterflies live their entire lives near where they were born?
No.

What do you call the flight where some birds and butterflies fly thousands of miles to a warmer climate?

Migration
What is the name of a popular orange and black butterfly that flies more than 1,000 miles from Midwest states such as Iowa to Mexico when the days get shorter in the fall?
Monarchs
Raise your hand if you have seen a monarch.
Take your butterflies and fly or migrate to another part of the room.

Give them a minute to migrate and then come back to their desks. Talk about what it would be like for a butterfly to migrate. Later, you may want to contact your county conservation office to see if someone can help you tag butterflies to track their migration.

After you’ve run a long distance or played hard, besides resting your muscles, what else do you want or need?
You probably want something to drink, especially water. An energizing snack renews your energy, too.

Do you think butterflies drink water and have snacks?
Yes, butterflies need water to drink.

What do butterflies like to eat?
They like nectar from flowers. Butterflies have a proboscis, which is like a tiny straw. When the butterfly lands on a flower, it unrolls its proboscis and puts it deep into several different places near the center of the flower to sip up the sweet liquid called nectar. (You may want to show the pictures of a butterfly sipping nectar with its proboscis on pages 22 and 23 in Caterpillars and Butterflies.)

While the butterflies are getting nectar, what else is the butterfly doing to help the plant?
Butterflies get powder-like pollen stuck to their bodies and legs when they visit flowers. They carry the pollen to other flowers, where they leave some and pick up more. The exchange of pollen helps to pollinate flowers. Pollination is necessary for fruits and seeds to develop. (In another session, you may want to do the pollination activity found in Optional Activity Ideas at the end of this lesson.)
Now, using your models, do the motions to the song as you read or sing the words to the tune of “Hush Little Baby.”

You may want to do this a couple times and watch the students. Check if they are using the correct model in the correct way to correspond with the words in the song.

### PLANT AND ANIMAL INTERDEPENDENCE

Write the words “butterfly,” “coneflower,” “milkweed,” “pollination,” “pollen,” “host plant,” and “nectar” on cards or sheets of paper. Have students volunteer to be a butterfly, milkweed plant or purple coneflower plant. Tape the appropriate card or paper to their shirts. Give the “pollination” card or paper to the butterfly, the “host plant” card or paper to the milkweed, and the “pollen” and “nectar” cards or papers to the coneflower.

Each of our characters has a card or paper with a vocabulary word on it. That word is something that they give or do for the other. Characters hold up your cards for the rest of the class to see.

Coneflowers have pollen and nectar in their flowers.

**Who does the coneflower plant give his/her nectar and pollen cards to?**

The butterfly

**Why?**

The butterfly depends on the coneflower for its food, which is nectar. The coneflower depends on the butterfly to take its pollen to other coneflowers so it can produce seeds. The butterfly lands on the coneflower, unrolls its proboscis and sucks the nectar from deep inside the flower. At the same time, pollen from the flower rubs off on the butterfly’s body.

**Who does the butterfly give his or her pollination card to?**

The coneflower plant

**Why?**

The coneflower plant depends on insects such as butterflies to transfer pollen from plant to plant so that pollination can take place and the plants can produce fruits and seeds. The same thing can happen with the milkweed plants.

**Who does the milkweed plant give his/her host plant card to?**

The butterfly

**Why?**

The milkweed is where the butterfly lays its eggs. When the eggs hatch, the caterpillars can eat the milkweed leaves.

**Do butterflies need plants?**

Yes.

**What for?**

A place to lay their eggs, food for caterpillars, sometimes a place for a chrysalis to cling to, and food in the form of nectar for flowers.
Do plants need butterflies?
Yes.

What for?
Pollination

In every ecosystem or biome, organisms rely on each other in unique relationships that ensure each other's survival. All living things have basic needs and depend on other living things to meet those needs. We call this "interdependence." This is one example of "plant and animal interdependence."

---

**BUTTERFLY SECRET CODE**

*Distribute the Butterfly Secret Code and have the students take a look at the picture. Start with the following discussion before coloring the picture and unlocking the secret code.*

What kind of butterfly is sitting on the flower?
A monarch
Monarchs can be seen in many parts of the country, particularly in the late summer and early fall.

What color is a monarch butterfly?
Orange and black

What is the name of the flower in the picture?
The monarch on our activity sheet is sitting on a coneflower. Butterflies are attracted to flowers that have bright pink or purple blossoms such as those on a coneflower. Purple coneflowers, zinnias and cosmos are good garden plants for attracting butterflies because of their colors and because they have flat tops where butterflies can land. They also like plants with lots of little flowers.

What is the other plant in the picture called?
Milkweed

Raise your hand if you have seen milkweed plants growing in ditches or other wild areas.
Milkweed plants have big green leaves with gray pods. The flowers are typically pink, orange or yellow, depending on the type of milkweed.

Monarch butterflies lay their eggs only on milkweed plants – no other type of plant. The milkweed is the **host plant** because the leaves provide the food for the caterpillars that emerge from the eggs. Point to the monarch eggs in the picture.

---

**APPLY**

**EXPAND**

**ELABORATE IN A NEW WAY**

30 MINUTES, POSSIBLY DIVIDED BETWEEN 3 DAYS

**Life Science:**
Characteristics of organisms,
Life cycle of organisms,
Organisms and environments

**Language Arts:**
Factual understanding,
Inferring, Vocabulary

**Math:**
Number and operations,
Measurement, Data analysis, Connections,
Representation

---

**BREAKING THE BUTTERFLY SECRET CODE**

Now, it's your turn to figure out the Butterfly Secret Code. Use the code in the picture and what you already know to finish the sentences about butterflies. When you are finished, color the picture with the same colors that monarchs, coneflowers and milkweeds are in our gardens and ditches.
Because the students have already learned about the information on this evaluation tool, they should be able to fill in the blanks without even breaking the entire code for each word. If they need a hint, they may want to find the same number/letter for all the lines. For example, number 19 is for the letter “s.” They can put the letter “s” above all the 19s. After they finish the sentences and color the picture, have them put their names on the activity sheets and hand them in. When you’ve checked them, return them to the students and go over the questions.

**PLANNING AND PLANTING A BUTTERFLY GARDEN**

*Show the overhead transparency of the Butterfly Garden Plan found at the end of this lesson.*

This is an example of a butterfly garden plan.

Where should the butterfly garden be located?
Sun or shade?
Sun
Should it be in a windy or protected location?
Protected from the wind so the butterflies aren’t blown around

Where might you enjoy a butterfly garden?
Home, school, public garden, neighbor’s garden, friend or relative’s garden, etc. Notice the path through the middle of the garden for people to use while working in and enjoying the garden.

This Butterfly Garden Plan looks like a graph.

What do the coordinates or numbers across the bottom line or axis represent?
Number of feet of garden space

How wide is this butterfly garden?
10 feet *(You may want to measure 10 feet in your classroom and tape it off with masking tape.)*

What do the coordinates or numbers up the left line or axis represent?
Number of feet of garden space

How long is this butterfly garden?
15 feet *(You may want to use masking tape and tape off 15 feet in your classroom. This will look like the sides of the graph or garden plan.)*

Each square in the garden plan represents 1 square foot and the drawings and illustrations show what to plant and where to plant it. Let’s look at the special characteristics of this garden so it will attract butterflies.

1. **What brightly colored flowers with a landing pad attract butterflies at coordinate 9, 1?**
   Purple coneflowers *(You may want to color it purple.)*

2. **What flower has bright yellow clusters of flowers that butterflies like at coordinate 5, 13?**
   Yarrow *(You may want to color it yellow.)*
3. What are the coordinates for a pie pan to hold the water for the butterflies and rocks to dry their wings?
   1, 4 and 5

4. What is the name of the host plant where black swallowtails like to lay their eggs so that the caterpillars have something to eat?
   Parsley
   What are its coordinates?
   1, 3

5. Where would you plant brightly colored zinnias with landing pads?
   Between coordinates 1-3 and 12-15

We are going to start zinnias that we can plant outdoors to attract butterflies to our home or schoolyard. Zinnia flower heads are composed of many tiny flowers that form a round, flat surface for the butterflies to land and sip nectar. Let’s read the information on the seed package to learn more about zinnias.

*Follow the paper pots instructions below or decorate cups for Mother’s Day or another special event.*

**MAKING PAPER POTS**

Wrap a strip of newspaper around a juice can with about 1½ inches hanging over the bottom of the can. Fold the excess paper up around the bottom of the can to form the bottom of the pot. Press it down on the tabletop to secure. Remove the juice can. Fold over the top of the pot 1 inch to the inside to hold the pot together and form a rim.

Fill the paper pots with potting soil.

Make a depression in the center of the pot and plant a flower seed. Cover it with ½ inch of soil.

Water gently.

Place pots close together on the tray or flat.

Cover with large, clear plastic bag.

Set in a location that receives bright, indirect light.

When the seeds start to germinate, remove the plastic bag.

Set the plants where they will receive full sunlight. *(If you feel the paper pots are too difficult to make, you may want to substitute peat pots.)*

When the plants are at least 2 inches tall, you can plant the entire pot in the soil outside. Be sure that the paper is all underground so that it doesn’t act as a wick to take the water away from the plant. The paper will decompose into the soil.
VITALIZE YOUR VOCABULARY

Write the following vocabulary words on pieces of paper or 3" x 5" cards. Place them on a table with the word side down. Divide the room into four or five groups. Explain to the groups of students that this game is called Vitalize Your Vocabulary and the words on the table come from the butterfly lesson. Have group members take turns being butterflies. One butterfly from each group flies to the table and selects one word to take back to where it lives with the rest of its group. His/her group has three minutes to write the word and definition on the back of the card. Someone from each group reads the word and definition to the rest of the class. Everyone decides if the definition is accurate or not. If the definition is accurate, you may choose to give team points.

<table>
<thead>
<tr>
<th>Pollination</th>
<th>Host plant</th>
<th>Nectar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monarch</td>
<td>Chrysalis</td>
<td>Complete life cycle</td>
</tr>
<tr>
<td>Egg</td>
<td>Caterpillar</td>
<td>Pupa</td>
</tr>
<tr>
<td>Cocoon</td>
<td>Migration</td>
<td>Pollen</td>
</tr>
<tr>
<td>Butterfly</td>
<td>Moth</td>
<td>Proboscis</td>
</tr>
<tr>
<td>Sun</td>
<td>Water</td>
<td>Milkweed</td>
</tr>
<tr>
<td>Complete metamorphosis</td>
<td>Plant and animal interdependence</td>
<td></td>
</tr>
</tbody>
</table>

What other creatures go through complete metamorphosis during their life cycles?
Frogs and toads, flies
OPTIONAL ACTIVITY IDEAS

PLANT A BUTTERFLY GARDEN
Use the Plant a Butterfly Garden lesson found in the Growing in the Garden Outdoor Classrooms unit to plan and plant a butterfly garden in a place where everyone can observe and enjoy.

A CLOSER LOOK AT POLLINATION
The following activity is from Growing in the Garden: Outdoor Classrooms for Young Gardeners, Leader’s Guide. You can make the bees or turn the bee wings into butterfly wings cut from colorful napkins. After the flower and insect puppets are made, have the students stand up and put their insects on a finger of their right hands and hold their flowers in their left hands. Next, the students buzz their bee or fly their butterfly to the flower to their right, brushing their body against the stamen (pipe cleaner), getting a deposit of pollen (corn meal) on their bodies before they fly to the next flower and leave the pollen on the stigma (cotton swab). Now the flowers can produce fruit and seeds.

BEE FINGER PUPPETS
1. Cut the fingers off small, yellow cotton gloves so that they measure 1 1/2 inches from the fingertips or cut strips of yellow construction paper approximately 2" x 1 1/2". The fingers from the gloves will be the bodies of the bees. If you are using paper, the strips should fit around the students’ index fingers. Use a marker to make bee stripes and a face.

2. Using waxed paper, form wings by cutting figure eights that are 2 to 2 1/2 inches long. Make two slits (each 1/2 inch) in the body of the bee for the wings to slide through. You will have to fold one of the wings in order to slide it through the slits, then open it again.

3. Slip the bee onto a finger.

FLOWER STICK PUPPETS
1. Take one colorful, dessert napkin and cut it on the folded edge. Turn half the napkin so that you have eight points instead of four. Make a small slit in the center of the napkin pieces.

2. Put the cotton swab through the center slit.

3. Dip and roll one end of a pipe cleaner into corn meal. Fold the pipe cleaner in half. Poke the folded end of the pipe cleaner down through the center of the napkin. The pipe cleaner ends are the stamens and the cotton swab is the stigma.

4. Pinch the base of the napkin flower against the pipe cleaners and swab. Then twist the folded end of the pipe cleaner around the swab and the base of the flower to make a stem. Wrap a piece of tape around the base of the flower and stem.

5. Squeeze the top of the napkins around the pipe cleaners and swab to form the petals.
OPTIONAL ACTIVITY IDEAS CONTINUED

BOOKS ABOUT BUTTERFLIES
Read any of the butterfly books and look at the magnificent illustrations in the books listed in the Resources section.

SEE FOR YOURSELVES
Keep your eye open for a chrysalis that you can bring to your room and observe or order live chrysalises for your classroom. The students will enjoy watching the butterflies emerge. See the Resources list at the end of the lesson for information. Finding a native butterfly’s chrysalis is a better recommendation because the butterfly that emerges naturally is adapted to where you live; the purchased ones are new to your area.

TAGGING BUTTERFLIES
Contact the local conservation office and find out how to tag butterflies to follow their migration.

VISIT A BUTTERFLY HOUSE
Reiman Gardens at Iowa State University in Ames, Iowa, has a butterfly house where you can sit or stand while the butterflies hover around you in search of nectar from the beautiful plants and the handy feeders. It’s a great field trip for your group or you can go on your own. They also have an emergence window, where chrysalises and cocoons hang. You may actually see a butterfly emerge.

START A SPECIAL INTEREST CLUB
You may want to consider starting a 4-H special interest club of youth interested in learning more and doing more projects related to the environment. Contact your county ISU Extension office for more information.

REFERENCE AND RESOURCES

REFERENCE

RESOURCES
The Butterfly Celebration, Insect Lore, PO Box 1535, 123 South Beach Street, Shafter, CA. 93263. 1-800-Live-Bug. Butterfly pupae and chrysalises.

Monarch butterflies
http://www.mesc.usgs.gov/butterfly.html
http://monarchwatch.org
Activities and curriculum for kids
Butterfly Secret Code

Name
Use the code hidden in the garden to reveal the words in the sentences below.

1. Butterflies change through ___ ___ ___ ___ 13 5 20 1 13 15 18 16 8 15 19 9 19.

2. Butterflies lay tiny eggs on ___ ___ ___ ___ 8 15 19 20 16 12 1 14 20 19.

3. Monarch butterflies lay their eggs on ___ ___ ___ ___ ___ ___ 13 9 12 11 23 5 5 4 plants.

4. Little ___ ___ ___ ___ ___ ___ ___ ___ hatch from butterfly eggs. 3 1 20 5 18 16 9 12 12 1 18 19.

5. Some butterflies spend the winter in a ___ ___ ___ ___ ___ ___ 3 8 18 25 19 1 12 9 19.


7. Butterflies carry ___ ___ ___ ___ ___ ___ ___ from flower to flower. 16 15 12 12 5 14.

8. Monarch butterflies ___ ___ ___ ___ ___ ___ ___ to Mexico in the fall. 13 9 7 18 1 20 5.

9. Butterflies need ___ ___ ___ to ___ ___ ___ ___ ___ their bodies for flying. 19 21 14 23 1 18 13.

10. Butterflies need ___ ___ ___ ___ ___ to drink. 23 1 20 5 18.
Butterfly Garden
Scale: $\frac{1}{2}'' = 1'$

Notes
1. Submerge a 10-inch pie pan in the garden so the edges are level with the top of the ground.
2. Cover the edges of the pie pan with flat rocks, approximately 6'' x 8'', and put a small flat rock in the pie pan.
3. Fill the pie pan with water and keep it filled.

### Annual Garden Flowers

<table>
<thead>
<tr>
<th>Flower</th>
<th>space between plants</th>
<th>number of plants needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwarf marigold</td>
<td>8'</td>
<td>15</td>
</tr>
<tr>
<td>Tall zinnias (mixed colors)</td>
<td>8'</td>
<td>9</td>
</tr>
<tr>
<td>Dwarf ageratum (purple)</td>
<td>8'</td>
<td>9</td>
</tr>
<tr>
<td>Flowering tobacco (18'' tall, white) (Nicoliana)</td>
<td>12''</td>
<td>9</td>
</tr>
<tr>
<td>Petunias</td>
<td>8'</td>
<td>15</td>
</tr>
<tr>
<td>Parsley (biennal)</td>
<td>8'</td>
<td>3</td>
</tr>
</tbody>
</table>

### Perennial Garden Flowers

<table>
<thead>
<tr>
<th>Flower</th>
<th>space between plants</th>
<th>number of plants needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedum 'Autumn Joy'</td>
<td>18'</td>
<td>3</td>
</tr>
<tr>
<td>Gayfeather (Latris)</td>
<td>12'</td>
<td>3</td>
</tr>
<tr>
<td>Shasta daisies</td>
<td>12'</td>
<td>3</td>
</tr>
<tr>
<td>Chrysanthemums</td>
<td>16'</td>
<td>3</td>
</tr>
<tr>
<td>Purple coneflowers</td>
<td>18'</td>
<td>4</td>
</tr>
<tr>
<td>Yarrow 'Coronation Gold'</td>
<td>18'</td>
<td>3</td>
</tr>
<tr>
<td>Bee balm</td>
<td>18'</td>
<td>3</td>
</tr>
<tr>
<td>Asters (dwarf, purple)</td>
<td>18'</td>
<td>3</td>
</tr>
</tbody>
</table>
Maintaining a Healthy Garden

Lesson ten: How do you manage pests in the garden?

“WANTED: Out of My Garden” from GROWING IN THE GARDEN: OUTDOOR CLASSROOMS FOR YOUNG GARDENERS, Iowa State University Extension and Outreach

What type of mouth does an insect have – biting or sucking – and how can you tell on a plant? When is it time to take action to get insects and other critters out of the garden and what is the best way to do it? It’s time to investigate and protect your garden.

Content objectives: Identify creatures and the damage they do to garden plants; Manage harmful creatures in the garden

Life skill objectives: Critical thinking, Problem solving, Decision making, Communication, Citizenship, Leadership, Healthy living

Core and STEM concepts and skills:

Science Life science, Science as inquiry
Math Operations and algebraic thinking, Measurement and observation
Language Arts Reading, Writing, Speaking, Listening, Viewing

Healthy snack: Creative critters such as ‘Make an Insect’

Additional and supporting resources:

“Investigating Insects” from FOOD, LAND & PEOPLE: RESOURCES FOR LEARNING, Food, Land & People, from http://www.foodlandpeople.org/ordering/gardenwise/ available for $4.00 digital download. Grade Level: 3-12. Students become entomologists by observing insects in their nearby surroundings. After observing and analyzing, they learn by playing a game about how some insect interactions can be useful to people.

“Controlling Insects” and “Insects in the Garden” Science pages from GARDEN MOSAICS (Cornell University) are available for free digital download. http://communitygardennews.org/gardenmosaics/pgs/science/english/controlinsects.aspx
BEFORE THE LESSON

1. **Grade 4, Lesson 10:**
   This document contains all the curriculum items and resources you need for this lesson. All lesson downloads are located on the [www.peoplesgarden.wsu.edu](http://www.peoplesgarden.wsu.edu) Educational Toolkit.

2. Prepare ingredients for ‘Make and Insect.’

THE LESSON

1. **Wanted Out of My Garden** is a lesson that can be completed on different days. It includes a trip to the garden to look for insects and other invaders.


AFTER THE LESSON

Water and weed in the garden. Look for insects.

Continue the garden journals or records. Each time you do a lesson or go out in the garden, there is an opportunity to add something new to the Garden Journal.
Recipes

Ants on A Log

Celery sticks
Low-fat cream cheese, nut or seed butter (such as almond, peanut, sunflower)
Raisins

1. Wash the celery and cut it into pieces (about 5 inches long).
2. Spread cream cheese or nut/seed butter in u-shaped part of celery, from one end to the other.
3. Press raisins into cream cheese or nut/seed butter.
4. Enjoy your ants on a log!

Butterflies

Celery stick
Nut/seed butter (such as almond, peanut, sunflower)
4 mini pretzels
2 small pretzel pieces for antennae
1 raisin

1. Spread nut/seed butter on celery.
2. Place pretzels in center of celery stick to make wings.
3. Place raisin at top of celery
4. Use small broken pieces of pretzel for antennae.
Banana Caterpillar

Makes 1 serving
1 banana
Chow Mein noodles or pretzel sticks
2 raisins
Apple or pineapple rings, cut in half

1. Cut through the banana, spacing cuts 1 inch apart.
2. Place ½ an apple ring (peel side up) or pineapple ring in each of the cuts.
3. For the eyes, gently press raisins into one end of the banana for eyes.
4. Place Chow Mein noodles or pretzel sticks on both sides of the banana for legs.

Recipe and photo from University of Nebraska Lincoln 4H. 
http://food.unl.edu/documents/Banana%20Caterpillar.pdf
WANTED ... out of my garden!

CONTENT OBJECTIVES
Identify creatures that are pests in the garden and learn how to manage them.

LIFE SKILL OBJECTIVES
Critical thinking, problem-solving, decision-making, communication, responsibility

INDICATORS EVALUATIONS
Correctly identify creatures found in the garden, take measures to reduce damage caused by harmful creatures

MATERIALS
Apple
Glass of water
Drinking straw
Colored pencils or crayons (red, green, gray, black, brown, orange, and yellow)
Paper
Pencils
WANTED … out of my garden! activity sheet (copy or display on screen, found at the end of the lesson)
Key for Wanted … out of my garden! (found in the Reflect section of this lesson)
There are lots of creatures and critters in the garden that like to eat your vegetable plants as much as you.

**Can you think of what might eat garden plants?**
Insects, rabbits, deer, raccoon, birds, mice, slugs, etc.

**Do you think that they can do serious damage?**
Yes.
**How?**
They can eat the leaves, stems, or roots and destroy the plants. They can eat the fruits and vegetables before they are fully ripe or before you get a chance to harvest them.

**If you go out to the garden and see that something was eating crops, how can you tell what caused the damage without seeing who or what did it?**
You can look at the type of damage on the plant and you can look for other clues on or around the plant.

**What do you think does the most damage, animals or insects?**
Both can do a lot of damage, but since animals are larger they can eat more at one time.

We call the animals and insects that feed on our garden “pests.”
**What would be a good definition of a pest?**
Something that bothers you and you don’t want around.

**Can you think of some other kind of pests?**
Mosquitoes, box elder bugs, mice, rats, ground squirrels, etc. Sometimes good critters can be pests if they are in the wrong place.

**Can you think of any of these types of critters?**
Bats, snakes, spiders, lady bugs, birds, and others.

We are going to learn about the ways and types of pests that damage garden plants.

**Ask for two volunteers to pretend to be pests. Introduce them as “Pest A” and Pest B”. They are going to demonstrate how insects eat their food. Show the class an apple and a glass of water. Tell the students that both of these items represent their garden crops. The glass of water represents a leaf and the apple represents a fruit on a plant. Give the glass of water and a straw to Pest A and the apple to Pest B. Have them turn their backs to the group and drink a lot of the water using the straw or take a big bite from the apple. Have them turn back around and show the class the glass of water and the apple.**

**Do you see anything different?**
Yes, some of the water is missing and the apple has a bite taken out of it.

**How did Pest A damage the crop?**
He/she sucked the water from it.
**Have Pest A demonstrate.**
How did Pest B damage the crop?
He/She took a bite from it.
*Have Pest B demonstrate.*

Both Pest A and Pest B damaged the plant. It is obvious with Pest B because there is a piece missing. It is not so obvious with Pest A.

Pest A and Pest B showed us the two basic types of mouthparts that insects have – piercing/sucking and chewing.

Insects that have piercing/sucking mouthparts suck the water and juices from the plants with a long, tiny needle-like proboscis.

**What are Pest A’s sucking mouthparts?**
His/her lips made it possible to suck up the water using a straw, which represents a proboscis.
*Have everyone pretend that they are sucking through a straw or proboscis.*

Insects that have chewing mouthparts chew or bite holes in the leaves, fruits, and stems of plants.

**What are Pest B’s chewing mouthparts?**
His/her teeth and jaws chewed a hole in the apples.
*Have everyone pretend to be biting and chewing.*

*Pest A and Pest B can return to their seats. They can take their props with them to enjoy if they wish.*

**Can you think of a pest that sucks its food instead of bites it?**
A mosquito. Although we call it a “mosquito bite”, they don’t actually bite. They stick their long proboscis mouthpart into your skin to suck your blood. They leave you with a bump that itches.

**What kind of damage do you think is cause by insects that suck the juices from the leaves and fruits of plants?**
The leaves turn yellow or mottled in color and may eventually shrivel and dry up.

**If we use our teeth and jaws to chew, what do insects and animals use to chew?**
Most of them have teeth and jaws.

**What kind of animals bite things, but don’t have teeth?**
Birds and some fish

You can sometimes tell what kind of animal fed on our crops by the way they bit the stems. Rabbits bite the stems cleanly at an angle, deer bite stems across or tear them.

You can also tell by the crops that are damaged and the kind of fruit or vegetable they are eating. Some animals have a preference, some don’t. For example, a raccoon will eat ears of sweet corn right before they are ready to pick. They will either pull the ear from the stalk or eat it right on the stalk. Another example is mice damage on muskmelon and watermelon. Mice will chew holes in the sides of ripening fruit in the garden.
IDENTIFY THE GARDEN OUTLAWS

Distribute or display on an interactive board or screen the “Wanted...out of my garden” activity sheets found at the end of this lesson. Have the students use colored pencils or crayons or whatever you use to work on interactive boards to color the critters according to the descriptions you or the students will read. This will be a guide to identify “outlaws” in your garden.

What are “WANTED” posters all about?
They identify outlaws or criminals that have done some sort of damage to people, places, or things. Often times there is a reward for capturing them. You can find WANTED posters in public places such as the post office. You may have seen WANTED posters in movies or television programs about the “old west”.

What do these “WANTED” posters have to do with our gardens?
We are going to use the posters to find “outlaws” that have damaged our garden crops.

What kind of award will you get if you find these garden outlaws and get rid of them?
You will get tasty fruits and vegetables because the plants will have a chance to survive.

I am going to read some descriptions or characteristics of garden outlaws. Your jobs as the protectors of our garden are to listen, find the critter on the WANTED posters, color it according to the description, and put an “X” in the box next to the type of mouthpart that was used to damage the crop.

Read descriptions for each pest on the Key for “Wanted ... out of my garden!” Pause between each pest, giving enough time for the students to identify and fill in the appropriate color and mouth part. You may choose to have the students take turns reading the descriptions.

You will continue to use these activity sheets for the next activity. When you are done, be sure to save these activity sheets for future reference as your garden grows.

GATHER MORE EVIDENCE

Similar to all the investigation shows on television, you need to gather more evidence to figure out what happened and what to do about it.

We are going to continue to use the WANTED posters as we hear evidence and try to solve cases about the WANTED critters that can cause damage to garden crops. Then you can try to draw or describe the damage on your WANTED poster. This time we will be working with the plant drawings.

Read the CASE FILES one by one and have the students identify the potential garden outlaw from their WANTED posters. You may choose to have students take turns reading the evidence in the case files. Then have them try to draw or write what to look for on the plant by the insect.

Save the completed activity sheets as guides to identify damage and outlaws in your garden.
**WANTED ... out of my garden!**

**CHARACTERISTICS OF GARDEN OUTLAWS**

- **The squash bug** is a big, gray bug that sucks plant juices out of squash, pumpkin, zucchini, and gourds. Squash bugs make the leaves of these plants turn yellow and dry out. Squash bugs lay red eggs the size of pinheads on the undersides of leaves. The small squash bugs that hatch are bright green with black legs.

- **The squash vine borer** is a fat, white caterpillar without legs that hatches out of an egg and chews a hole in the stem near the bottom of pumpkin, squash, zucchini, and gourd plants. It chews its way inside the stem or vine. If a squash vine borer is in the stem, you can see what looks like sawdust coming out of a hole in the stem. Plants with squash vine borers in their stems wilt because they can’t get water through their damaged stems to the leaves.

- **Aphids** are small and white, green, red or orange bugs, depending on what kind of aphid it is. Different aphids feed on different plants by sucking the juice from the leaves. The leaves turn yellow and brown. There are rarely just one or two aphids on a plant. You usually find hundreds on one plant.

- **Tomato hornworms** are large, bright green caterpillars with black and white stripes on their sides. Each tomato hornworm has a horn on its rear end. It eats entire leaves off tomato and tomatillo plants. One tomato hornworm can eat nearly all of the leaves from a plant. Tomato hornworms will take large bites out of green and red tomatoes.

- **Bean leaf beetles** are small oval-shaped beetles. They are yellowish green with four black spots and a black triangle at the top of its wing covers. The adult beetles chew small round holes in the leaves of snap beans.

- **Cucumber beetles** are yellow with black spots or stripes. They chew holes in the leaves of cucumbers, squash, and melons. They also carry a disease that causes these plants to die. They infect the plants when they chew on the leaves.

- **Corn earworms** are light brown caterpillars that chew through the husk of corn to eat the kernels. Corn earworms are also called tomato fruitworms because they also chew holes in tomatoes and peppers.

- **There are two types of cabbageworms.** Both are green and eat cabbage, cauliflower, broccoli, Brussels sprouts, kale and kohlrabi. One is fuzzy and fat. The other is bright green, skinny, and walks in a looping fashion. They can be found chewing holes on the top or underside of leaves.

**BIRDS and ANIMALS** Several kinds of animals visit the garden. They are fun to look at, but they can damage and destroy garden crops. What are some ways they destroy our crops? They can eat parts or entire plants, dig up plants, and flatten plants as they walk or lay on them. What color are the rabbits we see in our gardens? What do they eat? What do raccoons look like? What do they eat? What does a crow look like? What do they eat?

What are some other animals that are pests when they are in our gardens? Possible answers include deer, moles, and ground squirrels.
CASE FILES

WANTED . . . out of my garden!

Evidence for CASE #1
A. There are no holes in the leaves but the leaves are yellow, mottled or dull in color, or shriveled.
B. There is a sap feeding insect found on the underside of the leaves or in the center of the new growth.
C. If the evidence is found on a squash plant, which garden outlaw is guilty of damaging the plant?
   Find the outlaw on the WANTED poster and color the leaf as described.
D. If the evidence is found on a pepper or another plant, which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and color the leaf as described.

Evidence for CASE #2
A. There are holes where something has chewed into the leaves.
B. The holes are irregularly shaped, which could mean it is some type of caterpillar or beetle.
C. If the evidence is found on a cabbage plant, which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and show the damage on the leaf.
D. If the evidence is found on a cucumber plant, which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and show the damage on the leaf.

Evidence for CASE #3
A. The garden was recently planted. There are holes poked in the ground and seeds or young seedlings are gone.
B. There are tracks on the ground but they don’t lead in and out of the edges of the garden.
C. The same garden outlaw can return to the garden to steel berries and corn kernels
D. Find the outlaw on the WANTED poster and draw evidence of the crime near the picture.

Evidence for CASE #4
A. There are holes where something has chewed into the leaves.
B. The holes are circular which indicates it is a bean leaf beetle or a flea beetle.
C. If the evidence is found on a bean plant, which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and show the damage on the leaf.

Evidence for CASE #5
A. Entire plant parts are missing, such as the top leaves of the plants.
B. Plant stems are bit off at an angle and some of the plant parts may or may not be missing.
C. There are tracks and marble-shaped droppings in the garden.
D. Which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and draw or write about a piece of evidence near the picture.
CASE FILES

WANTED . . . out of my garden!

Evidence for CASE #6
A. Holes have been chewed in the stems and there is something that looks like sawdust near the hole.
B. The evidence is found on stems of a zucchini, squash, or pumpkin plant.
C. Which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and you will see the evidence already drawn on the picture.

Evidence for CASE #7
A. There are holes in the corn ears.
B. Which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and you will see the evidence already drawn on the picture.

Evidence for CASE #8
A. An entire ear of corn is missing or damaged.
B. The tracks look like tiny hand prints with claws. There are seedy-looking droppings near the garden.
C. Which garden outlaw could be found guilty of this crime?
   Hint: This masked bandit already has part of a striped jail outfit on his tail.
   Find the outlaw on the WANTED poster and draw or write about the crime evidence near the picture.

Evidence for CASE #9
A. The edges of the leaves are eaten but there are no holes.
B. The evidence is found on a tomato plant.
C. Which garden outlaw could be found guilty of this crime?
   Find the outlaw on the WANTED poster and draw a leaf with the edges chewed up.
D. The edges of the leaves are eaten up on several of the garden plants and the green or brown culprits are hopping everywhere.
   This garden outlaw is not on the WANTED poster but you don’t have to watch A Bug’s Life® to figure out what it is.

Evidence for CASE #10
A. The plant stems are bitten off straight across the stem.
B. Plant parts are missing.
C. There are hoof tracks going in and out of the garden and some plants look trampled.
D. This garden outlaw is not on the WANTED poster because it is much larger than any of the other critters and much harder to stop. Who is the most likely suspect?
   You may want to draw a new WANTED poster of this outlaw or another one in the last blank poster on the activity sheet.
What are some other potential garden outlaws and what kind of damage do you think they can cause?

Moles, ground squirrels, and snakes dig tunnels through the ground and ruin the root system causing the plants to fall over. Large holes chewed in melons or tomatoes could be from mice. Small holes chewed in tomatoes or peppers could be fruit worms. Pets and livestock can trample the plants in the garden.

Maybe you noticed in the evidence that the kind of garden outlaw you find in the garden depends on the plants you are growing.

What are some other factors that have an influence regarding what kind of critters you might find in your garden?

Location: Where is the garden located in the United States or around the world? Is it located in a city or in the country? Where is it located on a lot? What is located near it such bird houses, pet areas, trees, farm fields, etc.

Climate and weather conditions: Is it cool, hot, humid, lack of rain, too much rain, wind, etc.? Pest management strategies: What has been done to prevent garden pests? Are there fences, pesticides, companion plants, etc?

Use the WANTED…out of my garden! activity sheet and work together as teams of detectives to gather evidence and identify outlaws in the your garden. Remind the students that not all critters are bad outlaws. Look for evidence of the good guys and what they do in a garden. If plants are producing flowers then fruits, that is evidence of pollination by critters or the wind. Frogs, bats, snakes, and beneficial insects can eat the outlaws. A good example is lady beetles (lady bugs) eating aphids.

If you find some UNWANTED garden outlaws, gather evidence and decide what the best management strategy would be. Use the Key to Protecting Plants from Garden Outlaws key found on the following page to help you determine the right course of action.

What can you do to prevent damage by animals and birds?
Put large fencing around the garden. Make a scarecrow.
## KEY TO PROTECTING PLANTS FROM GARDEN OUTLAWS

<table>
<thead>
<tr>
<th>Plant Pests</th>
<th>Prevention/Control Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squash bugs</td>
<td>Pick off the leaves that have clusters of red eggs on the undersides. Pick off the gray adults. Toads, turtles, and birds such as wrens are heroes that eat squash bugs.</td>
</tr>
<tr>
<td>Squash vine borer</td>
<td>Carefully slice open the vine where you see sawdust coming out of borer’s the hole. Dig out the borer, bury the cut stem in soil, and water well. Cover the plants with a thin floating row cover from late May through mid-June to keep the adult moth from laying eggs on the vines.</td>
</tr>
<tr>
<td>Aphids</td>
<td>Wash the aphids off with a strong spray of water from the hose. Mix insecticide soap (5 tablespoons of liquid dish detergent in a gallon of water) and spray on the aphids. Lady beetles or ladybugs are heroes because they eat aphids.</td>
</tr>
<tr>
<td>Tomato hornworms</td>
<td>Use your hands to pick them off the plants.</td>
</tr>
<tr>
<td>Bean leaf beetles</td>
<td>Cover small plants with a floating row cover and remove it later in the season as the plants begin to flower and set fruit. Use an insecticide containing carbaryl, rotenone, or pyrethrum. A garden spider is a hero when it catches bean leaf beetles in its web and eats them.</td>
</tr>
<tr>
<td>Cucumber beetles</td>
<td>Cover the plants with a floating row cover. Remove it when the plants begin to flower. Use an insecticide containing carbaryl, rotenone, or pyrethrum.</td>
</tr>
<tr>
<td>Corn earworms</td>
<td>Use your hands to pick them off the plants or cut off the portion of the ear that the insect was feeding on.</td>
</tr>
<tr>
<td>Cabbageworms</td>
<td>Use your hands to pick them off the plants. Use a safe, organic insecticide containing bacillus thuringiensis.</td>
</tr>
<tr>
<td>Rabbits</td>
<td>Build a fence around the garden. Make sure the fence is high enough that the rabbits can’t easily jump over it and that it goes all the way down to the ground so that they can’t get under it. Either step over the fence to get into it or make sure that the gaps around the gate aren’t big enough for the rabbits to gain easy access to your garden.</td>
</tr>
<tr>
<td>Deer</td>
<td>This requires a very tall fence.</td>
</tr>
<tr>
<td>Birds</td>
<td>Scarecrows are fun to make and may help a little by being a distraction. It is a good idea to not put birdhouses near the garden because they draw more birds. Birds are good in the garden when they eat garden outlaws. They are not so good when they eat seeds, seedlings, and fruits or vegetables and when they use your garden as a bathroom. Covering strawberry plants with a floating row cover will help.</td>
</tr>
</tbody>
</table>

Please check with your local University Extension Service, garden outlets, and other gardening experts to find the best solution for protecting your plants from garden outlaws.

Regularly check your garden for outlaws. Determine what needs to be done to protect the plants. Extension Master Gardeners or garden store managers can help you decide the best course of action.

Encourage students to keep their eyes open for outlaws in other gardens and alert the gardeners if they find evidence.

There are several books, websites, and movies about insects and garden critters that would be a fun addition to this lesson.
WANTED ... out of my garden!

Name

Instructions:
Color the creatures with their true colors as the leader reads the descriptions aloud.

Put an “X” in the box in the lower corner of the picture that best describes how that creature would eat plants in the garden. Listen closely for clues as the leader reads aloud.

Use these WANTED posters to identify the “outlaws” in your garden.

WANTED Squash Bug

WANTED Bean Leaf Beetle

WANTED Squash Vine Borer

WANTED Aphid

WANTED Cucumber Beetle

WANTED Corn Earworm
WANTED ... 
OUT OF MY GARDEN!

CONTINUED

WANTED

Tomato Hornworm

WANTED

Cabbageworm

WANTED

Crow

WANTED

Raccoon

WANTED

Rabbit

WANTED

???
INSECTS IN THE GARDEN Teaching Tips

LEARNING OBJECTIVES

Youth will be able to:
* Differentiate between insects and other arthropods.
* Compare and contrast complete and incomplete metamorphosis.
* Describe how insects over-winter.
* Describe what and how insects eat, and how mouthparts are adapted for biting, chewing, or sucking.

HOW TO USE THE INSECTS IN THE GARDEN SCIENCE PAGE

Introduce the Science Page by asking youth to list some words that come to mind when they think of the word “insect.” Many youth may feel that all insects are creepy, or a nuisance, or mostly harmful rather than helpful. Explain that insects make up three-quarters of all the animals that exist, and they play a very important role in the world of living things. Point out that the majority of insects that visit a garden are helpful, rather than harmful.

Not only are insects important to our survival, but they are also fascinating creatures to observe. They are easy to find, they generally do not move very far from one spot, and they usually allow you to get up rather close. What youth will discover is that the more they learn about and observe insects, the less hostile towards insects and more fascinated with them they will become.

Give youth some time to read the front of the Science Page, which includes information on how you can distinguish insects from other animals, how an insect grows, and what and how an insect eats. Then ask: How do you distinguish an insect from all other animals? (Answer: Adult insects have two distinguishing traits:

1. They have three major divisions to their bodies, called head, thorax and abdomen.
2. They have three pairs of legs, all attached to the thorax. Many insects also have one or two pairs of wings, also attached to the thorax. Spiders have only two body divisions and eight pairs of legs.)

Explain that the word metamorphosis comes from the roots meta, meaning change, and morphe, meaning form. Emphasize that some insects, such as beetles, flies, butterflies, moths, and bees, undergo complete metamorphosis. These insects change a great deal during their lives, and look entirely different in the four different stages of their development. When an egg hatches, the larva, which looks like a small worm, sheds its skin from time to time as it grows. Then the outer skin hardens into a tough casing to form the pupa. During the pupal stage, the insect undergoes a radical change in form, and then emerges as an adult, which is able to reproduce.

Insects that undergo gradual metamorphosis, including true bugs, aphids, and grasshoppers, emerge from the egg as a nymph, which looks like a miniature adult, except it lacks fully developed wings. With each shedding of their “skin” or exoskeleton, they look more like the adult.

Youth may wish to capture immature insects and keep them in captivity to watch how they grow and change. A large, wide-mouthed jar with a mesh cover can be used for a cage. In order to keep them alive, you must meet the basic needs of insects in captivity, including food, water, and the correct temperature. Many insects only eat specific plants, so you must observe what the insect is feeding on, and provide it with a daily fresh supply of the same plants. A damp sponge will provide sufficient water for most insects. As an alternative to capturing insects outside, youth could purchase crickets or mealworms, which have less specific food requirements, from a pet supply store.

Ask: Do insects grow faster in warmer weather? (Answer: Yes, because they are cold-blooded. When their surroundings are warmer, their body temperatures are also warmer. So their body processes speed up, and they grow faster. That is why the number of generations for some insects can vary, depending in large part on the weather.) Ask: Where do insects in a garden come from? Do they just appear out of nowhere each spring? (Answer: Insects can over-winter in and around the garden, and begin growing and reproducing again when the weather warms up.)

Point out that it is possible to infer what an insect eats just by looking at its mouthparts. Encourage youth to use a magnifying lens to watch how different kinds of insect mouthparts are used. For example, they can watch how butterflies and moths uncurl their long proboscis to reach deep into flowers to suck up nectar.

PUZZLE

Challenge youth to figure out which mouthparts are used for each type of food, and then check their answers by following the lines.

Answers: A. The curled proboscis is used to suck nectar; B. the needle-like stylet is used to suck plant juices; and C. the chewing mandibles are used to eat aphids.

TRY THIS

The information about the shake-it box was taken from: Cayuga Nature Center. 1988. Curriculum Guide in Environmental

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
Before going to the garden, have youth construct the shake-it box. Also gather other materials they will need, such as plastic jars with lids, magnifying lenses, and insect identification books. Use field guides with lots of illustrations, available at bookstores or the library. There are also several websites developed by agricultural universities which feature full-color photographs of common garden insect pests, for example, check out: <http://entweb.clemson.edu/cuentres/cesheets> and <http://www.entm.purdue.edu/entomology/vegisite/homeowners/insect1.html>.

Before using the shake-it box, have students sit still in the garden for about 5 minutes, and look closely at the plants around them. They will soon see insects crawling on leaves, flying about, or even landing on themselves. Then have them search more actively for insects, under leaves, around flowers and stems, and close to the ground. CAUTION: Tell youth to stay far away from stinging insects, such as bees and wasps. They can use a magnifying lens to look at the details of insect structure. Move around among youth, asking questions to help direct their observations. For example, ask: What do different insects eat? How do they obtain their food? Do they have chewing or sucking mouthparts? A jar with a lid works well for watching insects up close.

After youth have made their observations, they should return surviving helpful insects to where they were found. Allow some time for youth to discuss and share their observations with each other.

SPOTLIGHT ON RESEARCH
Many different kinds of insects visit a garden. Some can be harmful, but most are helpful.

### How can you tell an insect from other animals?

All insects have 3 pairs of legs and 3 body parts (head, thorax, and abdomen). A hard outer covering protects the insect’s body. This covering is called an exoskeleton.

Spiders, sow bugs, and millipedes are not insects. Can you see some differences?

### How does an insect grow?

An insect begins life as an egg and changes shape as it grows. This is called metamorphosis.

Insects are cold-blooded animals, so the rate at which they grow depends on the temperature. Cooler temperatures slow down their growth, and warmer temperatures speed up their growth.

Some insects have only one generation per year. Others have up to 12 generations per year, depending upon the temperature.

### What does an insect eat?

Lots of insects come to a garden to eat. Some come to suck nectar and eat pollen. Others chew on leaves, stems, and fruits. Some are predators and prey on insects and other small creatures.

Mouthparts of most insects are specialized for a particular kind of food. Some mouthparts are adapted for biting or chewing. Others are adapted for sucking up blood, nectar, or other fluids.

Insects do not grow in cold weather. They over-winter at different stages of metamorphosis:

- **Egg**
- **Larva**
- **Nymph**
- **Pupa**
- **Adult**

### Mouthparts

- **Mandibles**: A chewing insect has jaws called mandibles that move together when the insect is eating.
- **Proboscis**: The proboscis of a moth or butterfly curls up when the insect is not feeding.
- **Proboscis of a moth or butterfly**: The proboscis is a long tube used for sucking nectar.
- **Aphids**: Have needle-like mouthparts, which they use to make a hole in the plant stem and then suck up plant juices.
- **Colorado potato beetle**: (up to 3 generations/year)
- **Striped cucumber beetle**: (1 generation/year)
- **Mexican bean beetle**: (as an adult)
- **Praying mantid**: (as an egg)
- **Japanese beetle**: (as an adult)
- **Aphids**: (up to 12 generations/year)
- **Cabbage butterfly**: (as a pupa)
- **Colorado potato beetle**: (as an adult)
- **Japanese beetle**: (as a larva)

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
PUZZLE

Follow the line from each insect mouthpart to find out what food the mouthpart is able to obtain.

A.  
B.  
C.  

TRY THIS
OBSERVING INSECTS IN THE GARDEN

What you need
- shallow cardboard box, about 25 cm by 30 cm
- white paper to line the box if it is not already white
- plastic bag to fit over the end of the box
- tape
- plastic jar with lid
- paper and pencil
- magnifying lens, if available
- insect field guide, if available

What to do
1. To make a shake-it box, cut off one side of the box. If the inside of the box is not white, line it with white paper, taping the paper in place.
2. Tape the plastic bag to the bottom and two sides of the box (see picture).
3. To use the shake-it box, hold the box under a plant in the garden and gently shake the box and the plant. Insects on the leaves and stems will drop into the box.
4. You can observe the insects in the box. You can also transfer the insects to a jar, where they are less likely to escape. To do this, untape the bag from the box and close the bag so the insects don’t get out. Hold the plastic bag over the jar and shake the insects down.
5. Observe the insects you have collected with the naked eye and with a magnifying lens. How many different kinds of insects did you collect? If possible, use an insect field guide to identify the insects that you collect.

SPOTLIGHT ON RESEARCH

Using Green Lacewings in Biological Control

Imagine a creature that looks like a tiny green-gray alligator with ice tongs for a mouth. It seizes and punctures its prey, injects it with poison, and sucks out the body fluids. Sounds like science fiction? This creature, called an aphidlion, actually exists. It is the larva of the green lacewing. Its prey is the aphid, a garden pest. The adult lacewing is light green, with long slender antennae, golden eyes, and large, thin, “lace-like” wings. (An intricate pattern of veins in the wings creates the lacy effect.) Because of what it looks like, and the fact that it flies around at night feeding on nectar and pollen, some people mistake a lacewing for a fairy!

Although not as pretty as the adult lacewing, the aphidlion is extremely effective at controlling aphids. One aphidlion feeds on up to 200 aphids a week. Worldwide they rank as one of the most commonly used biological controls. However, it is very expensive to produce lots of aphidlions. Scientists are trying to find better ways to mass-rear aphidlions, so that they can be made available at a lower cost to growers of vegetables, fruits, nuts, and flowers. One reason why aphidlions are costly to rear is that they eat each other when other food is not available!

Scientists have developed a new diet for aphidlions that is cheap and does not spoil quickly. When it becomes available to lacewing growers, scientists believe that the cost of rearing will be reduced from $0.35 to $0.00025 per insect. Engineers and biologists are also working together on ways to harvest, package, and ship the insects. When a mechanized way of doing all these things is fully developed, the cost of this natural insect control should be cut drastically.


RIDDLE

Why do bees hum?

Answer: Because they forgot the words!
**INTERPLANTING FOR PEST CONTROL Teaching Tips**

**LEARNING OBJECTIVES**

Youth will be able to:

* Explain what interplanting is and how it can help protect crops from insect pests.
* Identify flowers and herbs that attract and shelter helpful insects.
* Identify flowers and herbs that are interplanted with crops to confuse or repel insect pests.

**HOW TO USE THE INTERPLANTING FOR PEST CONTROL SCIENCE PAGE**

Give youth some time to read the front of the Interplanting for Pest Control Science Page. Show youth samples of flowers in the Aster family (marigolds, daisies, sunflowers, zinnias, cosmos, calendula, coreopsis, and tansy) and the Umbelliferae family (dill, parsley, Queen Anne’s lace, and coriander). Have students locate where the pollen and nectar are in these flowers, and discuss how insects with short, chewing mouth parts can easily land on these flowers and reach the pollen and nectar. Compare these flowers to those that have nectar that can only be reached by butterflies and moths, which have a long tube for sucking the nectar up. For more information on mouth parts, see Science Page entitled Insects in the Garden.

Explain to youth that interplanting is a way to create a more balanced garden ecosystem. Most insect pests only attack certain kinds of crops. For example, the Colorado potato beetle attacks only crops in the Solanaceae family (tomatoes, potatoes, peppers, and eggplant). Interplanting a large area with only Solanaceae crops will attract Colorado potato beetles, and other insect pests of the Solanaceae family, to the garden. Because these insect pests would have an abundant food supply, their populations could increase very rapidly. Interplanting mimics natural ecosystems, which generally have a diversity of plants. Small areas or rows are mixed with other unrelated crops, so it is not so easy for pests to spread and cause damage.

Explain that natural enemies of insect pests include predators, such as lady beetles and lacewings, which hunt down and kill insect pests. Another type of natural enemy is parasites, which live within the bodies of insect pests. The immature stages of many wasps and flies are insect parasites. The adults are free living and often visit flowers for nectar and pollen. The Science Page entitled Controlling Insect Pests has more information on predators and parasites of insect pests. Planting flowers that insect predators and parasites can eat is another way to create a more balanced garden ecosystem. While crops will attract insect pests, the flowers will attract their predators and parasites.

Point out that planting herbs and flowers with strong scents among crop plants may help to repel or confuse insects. This practice, sometimes called companion planting, has been used by gardeners for centuries. Many insect pests probably find their food source by smell, so they may be confused or repelled by strong-smelling herbs and flowers. However, there has not been a lot of scientific research to prove that these interplanting practices actually work. Nevertheless, traditional practices, when put to the test, often can be scientifically proven to be effective. Designing an experiment to test the effectiveness of interplanting to confuse or repel insect pests might be an interesting challenge for youth. They could try combinations that gardener say are effective. They should make careful observations and write down combinations that seem to work for pest control. They should also try to replicate their observations, and have others try the same combinations.

**CROSSWORD PUZZLE**

Answers

Across: 1. lacewings; 2. interplant; 3. basil; 4. marigolds; 5. nasturtiums; 6. aster; 7. herbs.

Down: 2. interplant; 3. basil; 5. nasturtiums; 7. aster; 8. herbs.

**TRY THIS**

Encourage youth to be patient when observing insects up close. Here are some examples of insects they might find: syrphid and tachinid flies, assassin bugs, lacewings, and parasitic wasps on parsley, dill, cilantro, and fennel; and soldier beetles, flower beetles, and lady beetles feeding on the pollen of flowers in the Aster family. Move around among youth, asking questions to help direct their observations. For example, ask, “What are the insects eating? How do they obtain their food? Do they have chewing mouth parts?” A jar with a lid works well for watching insects up close. Caution: Warn youth to stay far away from stinging insects such as bees and wasps. After youth have made their observations, they should return surviving helpful insects to where they were found. Allow some time for youth to discuss and share their findings with each other.

**SPOTLIGHT ON RESEARCH**


---

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
INTERPLANTING FOR PEST CONTROL

Interplanting is growing one kind of plant alongside a different kind of plant. Some plants attract helpful insects. Other plants confuse or repel insect pests. When these plants are interplanted, they can help protect your crops from insect pests.

INTERPLANT TO ATTRACT AND SHELTER HELPFUL INSECTS

Most insects that eat insect pests also eat nectar and pollen from flowers. They have short mouth parts for chewing, rather than long tubes for sipping, so they need flowers with easy-to-reach nectar and pollen.

Flowers in the Aster family, such as marigolds and sunflowers, have wide, open flowers, so they are an excellent choice for attracting helpful insects.

Herbs like parsley, dill, and coriander have flat-topped clusters of small flowers. They also have strong fragrances that attract beneficial insects.

HOW TO CONFUSE OR REPEL INSECT PESTS

Many insect pests attack only certain kinds of crops. They spread more quickly if a large area is planted with only the kind of crop they eat. If you interplant crops, it’s not as easy for insect pests to spread and cause damage.

A large cabbage patch presents a big target for cabbage white butterflies flying by. Also, lots of cabbages in one spot make it easier for the cabbage white butterflies to move from one cabbage to the next. The same number of cabbages scattered among other crops over a larger area is a much less obvious target.

Many gardeners interplant with herbs and flowers that have strong scents, which may confuse or repel insect pests looking for crops to feed on. Here are some combinations that many gardeners use.
CROSSWORD PUZZLE

Across
1. Flowers of dill and parsley attract these insects, which feed on insect pests.
5. Try planting these among squash.
7. Flowers in this family attract helpful insects.
8. Plant these to confuse or repel insect pests and attract helpful insects.

Down
2. Do this instead of planting a large area with only one kind of plant.
3. Try growing these plants among tomatoes.
4. Try planting these among eggplants.
6. Helpful insects often eat _____ from flowers.

TRY THIS
CHECK ON INTERPLANTING FOR INSECT CONTROL IN THE GARDEN

What you need
* Paper and pencil
* Magnifying lens, if available
* Insect field guide, if available

What to do
1. Go to a garden to look for examples of interplanting for pest control. For example, try to find these flowers and herbs interplanted among crops: marigolds, zinnias, tansy, or other flowers in the Aster family; strong smelling herbs such as basil or dill; nasturtiums; and chives and garlic.
2. Look for insects around the interplanted flowers or herbs. Spend at least 5 to 10 minutes observing insects that you find. Use a magnifying lens to observe them more closely. Do they have mouth parts for sucking or chewing? Are they feeding on the nectar and pollen of the interplanted flowers?
3. Try to identify the insects that you see. If possible, look them up in an insect field guide. Find out if they eat any insect pests.
4. Share your observations with other youth and adults.

SPOTLIGHT ON RESEARCH

How do you know what crops to combine when interplanting?

Researchers at Cornell University in Ithaca, New York, tested a method for selecting vegetables suitable for interplanting. They listed all the vegetables commonly grown in New York State, and then listed all the pests common to each vegetable. They reasoned that interplanting vegetables that have different insect pests would make it harder for insect pests to find their food. They also thought that plots planted with a variety of vegetables would attract a greater variety of beneficial insects.

They planted five different kinds of plots:
A. Only squash;
B. Plants with different ways of growing and different pests (beets, broccoli, sweet corn, squash);
C. Plants with different ways of growing but with similar pests (sunflowers, cucumbers and squash);
D. Plants with similar ways of growing but different pests (eggplant, snap beans, squash);
E. Plants with similar ways of growing and similar pests (peppers, watermelon, squash, cucumbers).

The scientists sampled the insects by vacuuming each plot for one minute. They repeated this on five different days during the summer. Then they calculated the average number of beneficial and pest insects for each plot.

So far, their results show that interplanting of any vegetables increases the variety of beneficial insects. They will continue their research to test their hypothesis that combining crops having different pests and different growth habits will attract greater numbers and a greater variety of beneficial insects.


RIDDLE

What is the difference between a fly and a lacewing?

A lacewing can fly but a fly can’t lace wing.

Answer:

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
Harvesting Healthy Garden Produce

For SPRING HARVEST – FINAL HGHY LESSON FOR 2011-12 SCHOOL YEAR, GRADE 4

Lesson eleven: Harvest a Garden Salad Party

“Garden Celebration“ from EATING FROM THE GARDEN, University of Missouri Extension

How do you know when crops are at their peak for flavor and texture? What is the best way to harvest them and keep their flavor? It’s time to harvest cool-season crops and plan a Salad Party. Invite families to enjoy tasting salads from your garden as they hear and see what the children have learned. Play Nutrition and Gardening Jeopardy.

Content objectives: Apply harvesting, cleaning, and salad mixing strategies for salad crops; Plan and implement a Salad Party

Life Skill objectives: Critical thinking, Decision making, Communication, Citizenship, Leadership, Healthy living

Core and STEM concepts and skills:
Science Earth and space, Life science
Math Operations and algebraic thinking, Measurement and data
Language Arts Viewing, Speaking, Listening, (depends on what you do for the Salad Party)
Social Studies Behavioral, Economic

Healthy snack: Tossed salads or wraps

Additional and supporting resources: Present plays, projects, songs, and a tour of the garden during the Salad Party. Plant seeds or transplants for late-summer, early-fall harvest.

Depending on climate and who is taking care of the garden over the summer, salad crops can be planted 30 to 60 days before school starts again so that students can harvest them along with the late summer or fall harvest crops. Extension Master Gardeners are great resources.
BEFORE THE LESSON

1. **Grade 4, Lesson 11**: This document contains all the curriculum items and resources you need for this lesson except for the Jeopardy Game. Those documents are in a separate file. All lesson downloads are located on the [www.peoplesgarden.wsu.edu](http://www.peoplesgarden.wsu.edu) Educational Toolkit.

2. Plan the garden harvesting. Decide if you are inviting parents to the harvest or tasting. Prepare ingredients for harvest tasting. You may not have enough produce from the garden for a tasting. Supplement with purchased products as needed.

3. Set up Nutrition and Gardening Jeopardy.

THE LESSON

1. **Garden Celebration** is a lesson that can be taught over several days. It includes a Jeopardy Game to review nutrition and gardening concepts.

2. **Nutrition and Gardening Jeopardy** can be used with the lesson or at a later date.

AFTER THE LESSON

Complete Garden Journals. Student can record the amount of vegetables harvested, stories about the garden or drawings of the harvested produce.

*Note: If garden will not be tended over the summer, decide how to dispose of rest of produce, clean out garden area, and “put it to bed” until fall.* Divide the class into groups. Have groups assigned to the different jobs (soil prep, spreading compost, incorporating compost, weeding, harvesting, washing). Pull out the rest of the plants and weeds. Cover with leaves and turn into the soil. Rotate students into different jobs.
Harvesting is one of the nicest chores of the season. If you follow a few important, but easy tips, you will get the most of your crops. Some crops (e.g. carrots) only provide one harvest, while other crops (e.g. lettuce) can provide multiple harvests. If possible, harvest early in the morning, after the dew dries, but before the heat of the day.

**LEAFY GREENS – Lettuce & the Brassica Family (including Spinach, Kale, Chard, Collards, Asian Greens, Mustards)**

To harvest at peak flavor and freshness, harvest young greens when they are just a few inches long. At this stage all greens are tender and delicious eaten raw in a salad. These are called “baby greens”. Pick the largest, outside, leaves first while leaving the smaller and younger inside leaves for harvesting in a week or two. If possible, eat your greens the same day you pick them. Larger leaves, 6-12” long, are less tender and are best for cooking. Remember that greens cook down; plan about 6 cups of greens for 4 usual servings. Always wash garden greens carefully before eating or cooking to remove dirt and small insects.

*Tip*: Snip (with scissors or skilled fingers) the greens about ½-1” above the base of the plant to encourage new growth. Harvesting this way will allow you to get 3-5 cuttings of lettuce and spinach and even more from kale, chard and other hardier greens.

*Note on Lettuce*: If you planted head lettuce and prefer to harvest an entire head, wait until the entire lettuce plant is about softball - melon size and looks like the shape of head lettuce, as you know it. Don’t wait too long though - Growing head lettuce rather than harvesting baby greens often allows more time for pests and diseases to attack the crop.

### Simple Greens Recipe

- Wash and dry greens and cut larger leaves into pieces about 3 inches long.
- Heat a bit of olive oil in pan with a clove of chopped garlic or a few tablespoons of chopped onion. Cook 2-3 minutes.
- Add greens and a dash of water. You may keep the greens plain or drizzle with a dash of soy sauce or balsamic vinegar.
- Cook 3-4 minutes until softened.
- Remove from heat, place into bowl. Sprinkle with slivered almonds, sunflowers seeds and dried cranberries, or chives chopped chives from your garden.
- Serve cold or warm.

**LEGUMES – Peas, Snow Peas, Beans**

Harvest peas with 2 hands, holding the vine with one hand while snipping the entire pod off the vine with your other hand. Harvest when fully mature, about 2” long for peas and 4” long for beans, depending on the variety planted. Harvesting encourages new growth, so be sure to pick off over-ripe pods you may have missed earlier on. Continue to harvest from the same vines as the legume ripens.
Peas and young beans can be eaten raw, added to salads, or lightly steamed or sautéed.

**CUCUMBERS & SQUASH (CUCURBIT FAMILY)**
Harvest cucumbers as they ripen to the desired size. For pickling, fruits should be 4 to 5 inches long, for eating fresh; most varieties grow to 7-8 inches long. Cucumbers will develop a bitter taste if they are allowed to over-ripen. (Note: Some varieties such as European or Dutch cucumbers can grow much longer. This is another reason why clear labeling of the plants in the ground is useful.)

To ensure cucumber vines continue to produce heavily all season long, it’s best to harvest daily to prevent them from becoming overgrown.

Even though huge zucchini squash are impressive, they will be more flavorful if they are picked when they are smaller.

**Tip:** Use a sharp knife or pair of scissors when harvesting, and leave a short length of stem on each fruit.

**ROOTS—Carrot, Beets, Radish, Potato**
It can be difficult to determine if root crops are full grown and ready to harvest because they grow underneath the soil. You may recall, most seed packets will tell you how many “Days to Harvest”. This is the number of days it takes from planting to harvesting. If you can keep track of when you planted the seeds (maybe you wrote it down in the garden journal or it’s listed on the label that next to the plant in the ground), you’ll know about when they are ready. That said visual clues are always helpful. Roots start to lift themselves up out of the ground a bit as they develop. You’ll see radishes, beets and carrots creep a bit (< 1/4 inch) above the soil giving you a clue about how wide they are getting.

**Tip:** Radishes and beets are easy to pull out of the ground whole. Carrots often break off, leaving half of that sweet orange snack for the worms. To harvest them whole, use a digging fork to loosen the soil around the root and pull it out at the base of the greens. For radishes and beets, grab the plant right at the base of the stem, loosen the root a bit by rocking it back and forth, and then pull. If the whole thing does not come up, gently use a digging fork as you would for carrots.

For potatoes, you can start gently digging for new potatoes once the plants start to bloom. Wash and cook new potatoes immediately, as they do not store well at all. If you are planning to harvest potatoes to store for a while, wait until the tops of the plants start to yellow and die back. Then gently dig around the perimeter of the plant and dig up the tubers. If you are
planning on storing them, don't wash them! Let them sit out in a cool place for a few days to cure, then gently rub off any dirt, and store in a cool, dark place.

**FRUITS – Strawberries, Tomatoes, Peppers, Eggplant**

Similar to cucurbits, fruits like to be harvested when ripe and harvesting regularly encourages new production. Use a scissors or be very careful to snip eggplant and peppers from the stem without damaging the fruit. Leaving a small stem on the harvested fruit will help keep it ripe and ensure you don’t bruise it when harvested. Carefully pick tomatoes from the plant. For strawberries, grasp the stem just above the berry between the forefinger and the thumbnail and pull with a slight twisting motion. Carefully place the fruit into your containers.

**HERBS – Basil, parsley, mint, cilantro, oregano, rosemary, tarragon, sage, chives, lavender, thyme & more.**

Herbs are grown for their leaves, flower, roots or seed. Most commonly, culinary herbs are grown for their leaves and should be harvested before they flower. Flowering can cause the foliage to develop a bitter flavor. For example, while chives are quite attractive in bloom – and their flowers are edible and delicious – the stems tend to become tough and woody after bloom. Some general guidelines for harvesting herbs:

- Begin harvesting the herb when the plant has steadily been producing new growth. Harvesting generates the plant to continue to produce. Just be sure to leave enough leaves so the plant can continue to photosynthesize. Don’t be afraid to harvest. Up to 75% of the current season's growth can be harvested at one time!
- Harvest herbs before flowering, otherwise, leaf production declines because the plant will put its energy towards flowering and producing seed to reproduce. **Tip:** Pick off flowers buds as you notice them develop.
- ‘Annual’ herbs (basil, cilantro, chives) will have to be planted each year. They have soft stems and can be harvested until frost. Perennial herbs (rosemary, lavender) have somewhat woody stems and can be clipped until about one month before the frost date.
"Healthy Gardens, Healthy Youth"
People’s Garden School Pilot Project

The Extension Partnership including:
Washington State University Extension
Cornell University Cooperative Extension
Iowa State University Extension and Outreach
University of Arkansas Extension

This project has been funded at least in part with Federal funds from the U.S. Department of Agriculture. The contents of this publication do not necessarily reflect the view or policies of the U.S. Department of Agriculture, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.
Food Safety Tips for School Gardens

Growing and Harvesting Produce
A school garden provides an opportunity for children and volunteers to learn about how to handle food safely. The following are some food safety tips to follow when growing and harvesting produce.

- Ensure that all persons, including staff, students, and volunteers receive basic food and gardening safety training instructions according to local health regulations. The following topics are recommended:
  - Handwashing and personal hygiene
  - Cleaning and sanitizing garden equipment and containers used to hold produce
  - Handling produce during harvest, washing, and transportation
  - Glove use
- Ensure that volunteers are covered by the school district insurance policy in the event of accident or injury.
- Require signed permission slips for all student gardeners. Permission slips should list potential hazards of working in a school garden and identify any allergies the child may have.
- Do not allow anyone to work in the garden while sick, or until 24 hours after symptoms, such as vomiting or diarrhea, have subsided.
- Ensure that all harvesters wash hands thoroughly in warm, soapy water for at least 10 to 15 seconds, and then rinse with potable water. Ensure that all open cuts or wounds on hands, arms, or legs are properly covered prior to participating in the harvest.
- Require harvesters to wear closed-toed shoes to prevent cuts, stings, or other injuries.
- Consider using single-use disposable gloves when harvesting, or handling, fresh produce as an extra precaution.
- Harvest the garden regularly and remove any rotten produce.

Excerpted From Food Safety Tips for School Gardens
• Use cleaned and sanitized food grade containers, such as plastic bins or buckets, to hold harvested produce. Do not use garbage bags, garbage cans, and any container that originally held chemicals. These types of containers are made from materials that are not intended for food use.

• Clean harvesting tools, such as knives, scissors, etc., with soap and potable water immediately before and after each gardening session.

Using School Garden Produce in your School Meal Program
• Check with your local health department to ensure that local regulations permit food from gardens to be served as part of school meals.

• If the harvest from the school garden will be used in the school meals program, the school garden coordinator should work cooperatively with the school nutrition director to plan and implement the garden.

• Discuss food safety practices in the garden with school garden coordinators. Consider asking gardeners to document their practices. Use the information in this document as a guide to identify appropriate practices.

• Accept produce harvested from school gardens only when school nutrition staff is present to receive it. All produce dropped off or left when staff is not present should not be used in the school meal programs.

• See Best Practices: Handling Fresh Produce in Schools for guidelines on receiving, storage, preparation, and service of fresh produce in schools.

• Reject produce that does not meet school nutrition program standards.

• Receive and inspect produce harvested from school gardens according to the same procedures used to inspect produce from the district's distributors.

• Do not use any produce that has been noticeably contaminated by animals or insects.

• Refrigerate garden produce immediately, unless the particular item is normally held at room temperature.

• Store, prepare, and serve school garden produce separately from other sources of produce to maintain traceability.

• Document service of school garden produce on the menu management/food production record. See Ensuring Traceability of Fresh Produce for more information.

• Ensure that liability for a potential foodborne illness caused by produce grown in school gardens is covered by your school district.
Eating from the Garden

Garden Celebration

Knowledge Objectives:
• Students will review the importance of eating fruits and vegetables
• They will review where the fruits and vegetables are grown, the plant and which season to plant them.
• They will recognize when plants are ready for harvest.

Behavioral Objectives:
• Students will choose a wider variety of fruits and vegetables
• They will harvest ripe fresh fruits and vegetables
• They will prepare the garden for fall planting.

Doing the lesson:

Nutrition Activities:

NOTE: You may want to do gardening activities first and do nutrition activities while vegetables are cooking.

1. Explain that today we are going to harvest our garden since we are near the end of school. We will be preparing some of the foods for tasting. Have the students share some of the things they learned this past year about nutrition and gardening.

2. Core Activity: Eating from the Garden Jeopardy
• Divide the students into two groups for a classroom of less than 20 students. Bigger classrooms can have more than two teams. Give each team a bell and instruct them to ring the bell if they know the answer. Each group should work together to come up with a category that they would like to start with. Remind your students that each answer must be given in the form of a question.

Supplies needed:
To Pick or Not to Pick (4-4)
Eating from the Garden Jeopardy game (13-2 or computer version) – SEPARATE FILE
Examples of produce from garden to show maturity
Gardening equipment
Ingredients and equipment for recipe preparation

Core activities:
Eating from the Garden Jeopardy (13-2)
Harvesting
Preparation of garden vegetables

Student handouts:
To Pick or Not to Pick (6-2)

Teacher references:
Vegetable Harvest and Storage-MU Guide
Putting Garden to Bed tip sheet
Eating from the Garden Jeopardy (13-2)

Advance Preparation:
Prepare cards and board for Jeopardy game or download electronic version from Eating from the Garden website: http://missourifamilies.org/eattromgarden/
Gather materials and garden supplies.
• Have teams roll dice to see which one goes first. The first team chooses a category, and if applicable, an amount. Read the question that they have chosen. Allow them 30 seconds to consult for an answer. They should guess the answer in terms of a question. If they get it correct, they get the points, and if not, the other team gets a chance to "steal" the same amount of points if it guesses the right answer. Keep a tally on the chalkboard of team points.

• If desired, place the “Double Jeopardy” card behind one of the questions and let the team discuss their wager before reading the question to them.

• Allow each team a few minutes to discuss their wagers for "Final Jeopardy." Have them hand in their wagers so that no one can change it later. Give each team a few minutes to discuss their answers to the "Final Jeopardy" question and instruct them to write their answers down. When the time is up, the students share their answers and a winner is determined.

Gardening Activities:

Core Activity: Harvesting

1. Discussion: Do you remember why it is important to know when to harvest produce? We like to grow the biggest sized vegetables but don't want to sacrifice the taste. The quality of vegetables deteriorates when they are left in the garden too long. Vegetables picked too late can be tough, mushy, rotten, or lack taste. Garden produce picked too early lacks flavor or tastes "green" or unripe.

2. What are three important things to remember during harvest to ensure you have great tasting vegetables?
   a. Harvest your produce at the right stage of maturity.
   b. Handle vegetables gently.
   c. Store your vegetables in a cool place soon after harvest.

3. The time for harvesting depends on the climate, the variety, and the vegetable involved. For instance, tomatoes can be left on the vine until fully ripened or harvested when partially mature. They will continue to change color. Other crops such as winter squash and watermelon are not ready for harvest until after they are fully developed on the vine in the garden.

4. What does the phrase "days to maturity" mean and where can you find this for the vegetables you are growing? "Days to maturity" tells how many days it will take from planting the seed until harvest. This number can be found on the back of seed packets, in our Vegetable Planting Guide, in gardening books, and seed catalogs. But these numbers should be used only as an estimate of when to harvest because of varying weather conditions. (Show examples)

5. Determining when vegetables have reached peak quality is not easy.
   a. Keep a record of the varieties used and when they were planted.
   b. Know what your fruits and vegetables should look like when they mature. Review To Pick or Not to Pick (handout 4-4) and use reference Vegetable Harvest and Storage-MU Guide
c. Look for damage. Some vegetables are more susceptible to damage during harvesting than others, but avoiding bruises and cuts in handling is important with all your vegetables. Never eat any portion of a vegetable that is decayed or rotted.

d. Check your garden frequently during harvest time, for ripe produce. When harvesting, be very gentle with the produce to avoid bruising or damaging it. Many vegetables are very perishable and have a short storage life once they are harvested.

6. Use vegetables harvested from the garden to show examples of ripe, under-ripe and over-ripe vegetables or too large vegetables. Discuss different ways they could prepare the vegetables they grew.

7. There is something else we did after we harvested our vegetables last fall. Do you remember what we did? “Put our garden to bed”. You would not normally put a garden to bed this time of year because most people grow their garden all summer. But school is ending and no one will be tending the garden during the summer, what will happen to it? It will dry out, weeds will grow, insects will attack, produce will grow and no one will pick it. So we need to put our garden to bed this spring so that it will be ready for the new school year. We need to pull out all the plants and weeds. We need to rake up any fallen fruits or vegetables. We can add all these materials to our compost pile (if you have one.) Spread fallen leaves over the garden to a depth of 2 to 3 inches. Turn the leaves into the soil with a spading fork, and smooth the soil out some. Then we have put our “garden to bed.” for the summer and we will ready for next fall’s garden.

8. Core Activity: Preparation of garden vegetables
   Go out to garden and harvest enough vegetables that were grown for preparation and point out signs the vegetables are ready to pick. Prepare salad, Skillet Pizzas, Veggie Pillows, or lettuce wraps using julienned or finely chopped fresh vegetables from the garden and others if needed. Eat.

9. Getting the Garden Ready for the Summer
   a. Decide what to do with additional produce grown. Options would be prepare them a different way another day, give to cafeteria to use in lunch program, donate to a food bank, etc.

   b. Note: If garden will not be tended over the summer, decide how to dispose of rest of produce, clean out garden area and “put to bed” until fall. (Use Putting Garden to Bed tip sheet). Pull out the rest of the plants and weeds. Cover with leaves and turn into the soil. Divide the class into groups. Have groups assigned to the different jobs (soil prep, spreading compost, incorporating compost, weeding, harvesting, washing). Rotate students into different jobs.
Eating From the Garden
A nutrition and gardening program

Vegetable Harvest and Storage

Denny Schrock
Department of Horticulture

Timely harvest and proper storage help maintain the quality and freshness of garden vegetables. This publication gives information on how and when to harvest vegetables, special harvest preparations, storage requirements, and appropriate length and kinds of storage.

The following terms are used in this publication:

- Light freeze: 28 to 32 degrees F
- Moderate freeze: 24 to 28 degrees F
- Severe freeze: Less than 24 degrees F

You should recognize that ideal storage conditions for many vegetables are not attainable around the average home or farm. It is important, therefore, to recognize the limitations of the best storage available.

Refrigerators can be used for storage. If two refrigerators are available, one can be kept at a cold temperature (32 to 40 degrees) and the other at a cool temperature (45 to 50 degrees). If there is only one refrigerator with the control set for normal operation, the temperature in the center storage section is usually between 38 and 42 degrees. Check the setting of the temperature control by placing a thermometer in different places in the refrigerator. Remember: Opening the refrigerator door frequently raises the temperature inside.

Basements are also possible storage places. Temperatures in most heated or air-conditioned basements will usually be 65 degrees or warmer in summer and 60 degrees or cooler in winter. Separate sections can be partitioned to vary the temperature and humidity. You can use outdoor air, dirt floors or wetted sacks to vary the temperature and humidity needs. Unheated basements, if well ventilated, can provide good storage conditions for some vegetables.

Different vegetables require different temperature and humidity levels for proper storage.

Cold, moist storage
32 to 40 degrees F
90 to 95 percent relative humidity

Root crops

- Beets
  Begin harvest when beet is 1 inch in diameter or smaller for baby beets. Main harvest is when beets are 2 to 3 inches. Tender tops make excellent greens regardless of the size of the root ball. Harvest spring-planted beets before hot weather. Harvest fall beets before the first moderate freeze. For storage, wash roots, trim tops to \( \frac{1}{2} \) inch, place in perforated plastic bags and store in refrigerator, cold moist cellar or pit. Storage life is two to four months.

- Carrots
  Harvest spring carrots before hot weather. Baby carrots may be harvested when roots are 3 inches long. Fall-planted carrots should be harvested before the first moderate freeze. For storage, wash roots, trim tops to \( \frac{1}{2} \) inch, place in perforated plastic bags and store in refrigerator, cold moist cellar or pit. Storage life is two to four months. With a heavy layer of mulch, carrots may also be overwintered outdoors in the ground.

- Horseradish
  Harvest after several severe freezes. Store in the ground all winter. Mulch with straw or leaves and dig, when needed.

- Parsnips
  Harvest in late fall after several moderate freezes. Exposure to cold develops the sweet flavor. For storage requirements, see carrots.

- Potato, Irish
  Harvest in July when the tops have yellowed or died. Do not leave in ground exposed to high...
soil temperatures from sun. Wash potatoes and remove the diseased or damaged ones. Cure for about a week in a shaded, well-ventilated place (open barn, shed, garage). Avoid exposing tubers to light. Store in as cool a place as possible at this time of year. You are not likely to find ideal storage conditions (40 degrees, 85 to 90 percent relative humidity) at this time of year other than commercial cold storage. Cool basements are probably the best storage available. Keep humidity high and provide good ventilation. Storage time is two to four months.

- **Radish**
  Harvest when ½ to 1 inch in diameter. Wash roots, trim both taproot, and tops and store in plastic bags in a refrigerator for up to a month. Winter or black radishes are stored the same as carrots.

- **Salsify**
  See parsnips for harvest and storage.

- **Turnip**
  Turnips can be harvested from the time they are 1 inch in diameter. They are best as a fall crop and can withstand several light freezes. Store the same as carrots. Turnip greens may be harvested and used the same as beet greens.

**Cole crops (cabbage group)**

- **Broccoli**
  Harvest terminal head while florets are still tight and have a good green color. Smaller side heads will develop. Store in perforated plastic bags for up to one week in the refrigerator. Freeze any surplus. Best quality will be found in shoots that are harvested during cool weather.

- **Brussels sprouts**
  Harvest the sprouts (small heads) when they are firm — begin from the bottom of the plant. Sprouts can stand several moderate freezes. Harvest all sprouts before the first severe freeze and store in the refrigerator in perforated bags for up to three weeks. Freeze any surplus.

- **Cabbage**
  Harvest when heads are solid. Remove loose outer leaves. Store cabbage in refrigerator, cold cellar or outdoor pit in plastic bags for up to two months.

- **Cauliflower**
  Tie outer leaves above the head when curds are about 1 to 2 inches in diameter (except colored types). Heads will be ready for harvest in about two weeks. Cauliflower may be stored in perforated plastic bags in the refrigerator for up to two weeks. Freeze any surplus.

- **Chinese cabbage**
  Grows best in the fall, although varieties that mature in less than 55 days can be planted in early spring. Harvest head after the first moderate frost in the fall and store in perforated plastic bags in the refrigerator, cold cellar or outdoor pit. Chinese cabbage will keep for up to two months. Harvest spring cabbage when heads solidify, but before a seed stalk forms.

- **Kohlrabi**
  For standard types, harvest when the swollen stems are 2 to 3 inches in diameter. Stems become woody if left too long before harvest or if grown under poor conditions. Giant, heirloom types may reach 1 foot in diameter and still retain high quality. Cut off root and leaf stems, and store in plastic bags as indicated for carrots. Storage life is two to four weeks.

**Greens**

- **Swiss chard**
  This is a summer green that is harvested continuously. Merely break off the outer leaves. Swiss chard is a beet relative developed for its top. A spring planting will provide greens from early summer to the first moderate freeze. Store in plastic bags up to two weeks in the refrigerator.

- **Collards (kale, mustard, spinach)**
  Harvest the leaves and leaf stems of greens when they reach suitable size. Either harvest the whole plant or the outer, larger leaves. Greens do not store well, but may be kept in plastic bags in the refrigerator for up to two weeks. Freeze any surplus.

**Salads**

- **Endive (Escarole)**
  Harvest whole plant. Wash thoroughly to remove soil and sand. Gather leaves together and tie with rubber band. Store in plastic bags in refrigerator for up to three weeks.
• **Lettuce**
  Head, semi-head and leaf lettuce can be stored for up to two weeks in perforated plastic bags in the refrigerator. Individual leaves may be harvested at any stage of development before the plants bolt (go to seed). For best quality, successive plantings at two-week intervals are suggested.

• **Parsley**
  Parsley will overwinter if planted in a protected place like a cold frame. If planted in the open, it can be carefully lifted with a ball of soil just before the soil freezes, potted and taken into the house in a cool, sunny room and harvested for several weeks. Parsley leaves will keep in plastic bags in the refrigerator for about one week.

**Legumes**

• **Lima beans**
  Harvest when pods have filled. Harvest tender limas when a bit immature and harvest meaty limas when mature. Shelled limas can be stored in perforated plastic bags in the refrigerator for about a week. Surplus limas can be canned or frozen.

• **Garden peas**
  Harvest when pods have filled. Harvest tender peas when a bit immature and harvest meaty peas when mature. Unshelled peas can be kept in a perforated plastic bag in the refrigerator for about a week. Surplus peas can be stored in the refrigerator for several days.

• **Southern peas (Crowder, Purple Hull, etc.)**
  For fresh use, freezing or canning, harvest when seeds are large and plump, but moist. Either shelled or unshelled peas may be stored in the refrigerator for several days.

**Other vegetables**

• **Asparagus**
  Harvest by snapping 6- to 12-inch spears off at ground level, but before the top begins to fern out. Store in plastic bag in refrigerator for up to one week. Freeze or can any surplus.

• **Onions, green**
  Harvest green onions when they attain sufficient size. Cut off roots and remove top, leaving 1 inch of green. Place in plastic bag and store in refrigerator for up to two weeks.

• **Rhubarb**
  Harvest leaf stalks when ½ to 1 inch in diameter. Do not use leaves. Rhubarb can be stored in perforated plastic bags for up to three weeks in the refrigerator. Surplus rhubarb can be frozen.

• **Sweet corn**
  Harvest sweet corn when kernels are plump and tender. Silks will be dry and kernels filled. To check a few ears for maturity: Open top of ear and press a few kernels with thumbnail. If milky juice exudes, it is ready for harvest. Harvest at peak of quality, husk to conserve space and store in plastic bags for no more than two days in the refrigerator. The new super sweet varieties will store for a week or more. Freeze or can surplus corn. Baby corn may be harvested just as silks emerge, before the ear is 3 inches long.

  **Cool, moist storage**
  
  45 to 50 degrees F
  80 to 90 percent relative humidity

**Vine crops**

• **Cantaloupe (muskmelon)**
  Harvest when the stem slips easily from the fruit. Lift the melon — if ripe it should separate easily from the vine. Store ripe melons in the refrigerator in a plastic bag for up to 10 days. Try a few boxes of frozen melon balls.

• **Squash, summer**
  Harvest when fruit is young and tender. Skin should be easily penetrated with the thumbnail. Store for up to a week in a perforated plastic bag in the refrigerator.

• **Cucumber**
  Harvest cucumbers before seeds become half-size. This will vary with variety. Most varieties will be 1½ to 2½ inches in diameter and 5 to 8 inches long. Pickling cucumbers will be a bit more blocky and not as long as slicers. Store slicing cucumbers in the warmest part of the refrigerator (45 to 50 degrees). Place in plastic bag. Storage life is about one week. Pickling cucumbers should be cooled.
quickly in ice water and can be kept up to two days in a plastic bag in the refrigerator.

- **Watermelon**
  Harvest when underside of fruit turns from whitish to yellowish. The tendril at the juncture of the fruit stem and the vine usually dies when the fruit is mature. Thumping an immature melon gives a ringing metallic sound, while a mature melon gives a dull thud. Watermelons will store at room temperature for about a week and at a temperature of 45 to 50 degrees for two or three weeks.

**Other vegetables**

- **Eggplant**
  Harvest when fruits are nearly full grown, but color is still bright. Eggplants are not adapted to long storage. Keep in warmest part of refrigerator (45 to 50 degrees) for about a week.

- **Beans, green**
  Bean pods will be most tender when the small seed inside is one-fourth normal size. The pods become more fibrous as the beans mature. Harvest before pods begin to swell because of the developing bean seeds inside. Store green beans up to one week in perforated plastic bags in the warmest part of the refrigerator. Can or freeze surplus.

- **Okra**
  Harvest okra pods when they are 2 to 3 inches long. Over-mature pods are woody. Store in plastic bags in the warmest part of the refrigerator for about one week. Freeze surplus.

- **Peppers, sweet**
  Harvest when fruits are firm and full size. If red, yellow or other colored fruits are desired, leave on plant until mature color develops. Sweet peppers can be stored for two to three weeks in the warmest part of the refrigerator in plastic bags.

**Cool, dry storage**

32 to 55 degrees F
50 to 60 percent relative humidity

- **Onions, dry**
  Harvest onions when the tops have fallen over and the necks have shrivelled. Remove tops, place in shallow boxes or mesh bags and cure in open garage or barn for three to four weeks. Store in mesh bags in as cool a place as can be found in midsummer (32 to 35 degrees). During humid (muggy) weather, keep ventilated.

- **Peppers, hot**
  Pull plants late in the season and hang to dry in sun or a warm place. Store in a dry, cool place (usually a basement).

**Warm, dry storage**

55 to 60 degrees F
60 to 70 percent relative humidity

- **Pumpkins, winter squash**
  Harvest pumpkins and winter squash when the skin is hard and the colors darken. Both should be harvested before frost. Remove the fruit from the vine with a portion of the stem attached. Store on shelves in a single layer, so air can circulate around them.

**Warm, moist storage**

55 to 60 degrees F
80 to 85 percent relative humidity

- **Sweet potatoes**
  Harvest in fall before frosts and freezing temperature. Handle carefully in the digging process. Cure for one week at temperature of 80 to 85 degrees. Ideal storage is at 55 degrees and 85 percent relative humidity. (This might be accomplished in a basement with ventilated boxes covered with periodically moistened burlap sacks.)

- **Tomato**
  Ripe tomatoes will keep for a week at 55 to 60 degrees. Green, mature tomatoes, harvested before frost, should be kept at a temperature between 55 and 70 degrees. For faster ripening, raise temperature to 65 to 70 degrees. Mature green tomatoes should approach normal size and have a whitish, green skin color. Keep mature green tomatoes for three to five weeks by wrapping each tomato in newspaper and inspecting for ripeness each week. Do not store tomatoes in the refrigerator.

This handout is an adapted version of University of Missouri Horticulture Guide G6226.
# To Pick or Not to Pick

<table>
<thead>
<tr>
<th>Crop</th>
<th>Harvest these crops when:</th>
</tr>
</thead>
</table>
| **Beans**        | • Pods are firm, crisp and not wrinkled.  
|                  | • Seeds are not bulging.  
|                  | • Snaps when you break the pod in half.                                                                       |
| **Beets and turnips** | • Roots are at least 1 inch in diameter – up to 2 to 4 inches.  
|                  | • Trim tops to ½ inch.  
|                  | • Greens may also be harvested while tender.                                                                   |
| **Corn**         | • Ears of corn are well-filled with dark green husks and brown silks.  
|                  | • Kernels have milky fluid when punctured with a fingernail.                                                  |
| **Cucumbers**    | • Any stage before they turn yellow.  
|                  | • Small cucumbers are generally used for pickles.  
|                  | • Larger ones (less than 8 inches) are for slicing.                                                           |
| **Honeydew/Cantaloupe** | • Shake the honeydew — you should hear the seeds rattle.  
|                  | • Strong cantaloupe smell.                                                                                    |
| **Lettuce**      | • Choose leaves at desired size any time before it goes to seed.  
|                  | • Snap or cut leaves or harvest whole heads.                                                                  |
|                  | • Leave 2 inches for plant to reproduce.                                                                     |
| **Okra**         | • Pods are 2 to 3 inches long.  
|                  | • Okra gets tough and woody quickly.  
|                  | • Short hairs on the pods can irritate bare skin.                                                             |
|                  | • A knife is useful to cut the pods off the plant.                                                             |
| **Onions**       | • Green onions are ready for harvest at any size.                                                              |
|                  | • Bulb onions are harvested when the tops fall over and are yellowish.                                         |
|                  | • After digging bulb onions, leave them out in the sun to dry for a few days to toughen the skin.             |
| **Peppers**      | • Any size while they are firm, crisp and unwrinkled.                                                         |
|                  | • Leave them on the plant to mature and develop a color.                                                      |
|                  | • Use rubber gloves when harvesting hot peppers to protect skin from irritation.                               |
| **Radishes**     | • Select ½ to 1 inch in diameter.  
|                  | • Trim taproot and tops.                                                                                       |
| **Snap peas**    | • Pods are full-size, but peas inside have not swollen.                                                         |
To Pick or Not to Pick *(continued)*

<table>
<thead>
<tr>
<th>Crop</th>
<th>Harvest these crops when:</th>
</tr>
</thead>
</table>
| **Summer squash** | • Squash is 6 to 8 inches long.  
                     | • Pick often, as they grow quickly in hot weather.                                                            |
|                 | • If squash gets too big, it will be tough and seedy, but can be grated for baked breads.                  |
| **Tomatoes**    | • Fruit are firm with some color.                                                                             |
|                 | • They have the best flavor when they fully develop color on the plant.                                       |
| **Watermelon**  | • Makes a thud sound when you thump it.                                                                       |
Putting the Garden to Bed

- After harvesting, remove debris from garden.
- Remember to remove the entire root so plants do not grow back.
- Incorporate compost (if available).
Setting up the game

- Set up the game before the students arrive. In Jeopardy, the questions in the game are statements called “clues,” and the answers are given in the form of a question. Create a board with the topics listed across the top. Place the game cards on the game board under the proper categories and with the money-side up in ascending order ($100 at the top to $500 at the bottom).

Game Play

- In a class of less than 20 students, divide the students into two teams. Classes with more than 20 students can have more than two teams.

- Give each team a bell and instruct them to ring the bell if they know the answer. Introduce the categories and instruct the student that their answers must be in the form of a question.

- Have each team work together to come up with a category that they would like to start with. Then have teams roll dice to see which one goes first.

- Have the first team choose a category and an amount. Read the chosen clue. Allow the team that rings their bell first to give their answer — in the form of a question. If they answer correctly, they get the points and get to choose the next clue. If they answer incorrectly, give the other team(s) the opportunity to answer. The team that answers correctly chooses the next clue. In no one answers correctly, the team that chose that clue chooses the next clue.

- Tally team points on the chalkboard. Continue play in the above manner until all the clues have been read.

- If desired, place the Daily Double card behind one of the clues. Let the team that chooses that clue decide on their wager before you read the clue. Then read the chosen clue, and allow the team 30 seconds to consult on an answer. If they get it correct, they get the points; if not, the other team gets a chance to “steal” the points if they give the correct answer.

- After all the clues have been read, allow each team a few minutes to decide on their wagers for Final Jeopardy. Have them hand in their wagers so they cannot change them later. Read the Final Jeopardy clue, and give the teams a few minutes to discuss and write down their answers. When the time is up, the students share their answers, points are tallied, and a winner is determined.

Variations

- Have teams take turns answering questions.

- Make the game noncompetitive by having students work as a group to complete the game.
Eating From the Garden Jeopardy

Category cards

Nutrition

Food Safety

Physical Activity

Planting

Garden Care

Plant Science
# Eating From the Garden Jeopardy

## Clue cards

<table>
<thead>
<tr>
<th>Fruits, vegetables, grains, protein and dairy</th>
<th>Half of my plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water, food and air</td>
<td>Nutrients we want to see less of on food labels</td>
</tr>
<tr>
<td>Nutrient that gives us energy</td>
<td>What you should do just before eating</td>
</tr>
</tbody>
</table>

**Nutrition**

**Food Safety**
Eating From the Garden Jeopardy

Clue cards

$200  $100

$400  $300

$100  $500
# Eating From the Garden Jeopardy

## Clue cards

<table>
<thead>
<tr>
<th>What we should use to wash fresh fruits and vegetables before we eat them</th>
<th>We remove these when we wash fresh fruits and vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Safety</strong></td>
<td><strong>Food Safety</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items we should use to clean counters and cutting boards</th>
<th>A method of keeping fruits and vegetables fresh longer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Safety</strong></td>
<td><strong>Food Safety</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A physical activity that burns calories and encourages you to eat healthfully</th>
<th>Forms of active play</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Activity</strong></td>
<td><strong>Physical Activity</strong></td>
</tr>
</tbody>
</table>
Eating From the Garden Jeopardy

Clue cards

$300  $200

$500  $400

$200  $100
## Eating From the Garden Jeopardy

### Clue cards

<table>
<thead>
<tr>
<th>Being active helps you achieve this</th>
<th>The number of times your heart beats in a minute</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Activity</strong></td>
<td><strong>Physical Activity</strong></td>
</tr>
<tr>
<td>The amount of time you should spend in active play every day</td>
<td>Plants that are good for a school garden</td>
</tr>
<tr>
<td><strong>Physical Activity</strong></td>
<td><strong>Planting</strong></td>
</tr>
<tr>
<td>Tools used to prepare soil for planting</td>
<td>This grows into a new plant when placed in the right environment</td>
</tr>
<tr>
<td><strong>Planting</strong></td>
<td><strong>Planting</strong></td>
</tr>
</tbody>
</table>
Eating From the Garden Jeopardy

Clue cards

$400

$300

$100

$500

$300

$200
# Eating From the Garden Jeopardy

## Clue cards

<table>
<thead>
<tr>
<th>Planting seeds indoors under “grow lights” and later moving the seedlings inside</th>
<th>Root vegetables that are planted from seedlings in the spring and harvested in the fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jobs to do after a garden is planted</td>
<td>Decayed dried leaves, fruit and vegetable scraps, other organic matter and water</td>
</tr>
<tr>
<td>A plant that is growing where it is not wanted</td>
<td>Removing small seedlings from a garden to make room for others to grow</td>
</tr>
</tbody>
</table>

---

**University of Missouri Extension, Eating from the Garden, 2010**
Eating From the Garden Jeopardy

Clue cards

$500  $400

$200  $100

$400  $300
### Eating From the Garden Jeopardy

#### Clue cards

<table>
<thead>
<tr>
<th>Garden Care</th>
<th>Plant Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removing plants from a garden and working in leaves or compost</td>
<td>The part of a plant that absorbs water and nutrients from the soil</td>
</tr>
<tr>
<td>The process by which plants make their own food from air, water and sunlight</td>
<td>The process by which a seed takes in water and swells, and the embryo starts to grow</td>
</tr>
<tr>
<td>The process by which plants use colors and smells to attract insects and animals to produce the fruit of the plant</td>
<td>Animal that helps break down nutrients in the soil</td>
</tr>
</tbody>
</table>

---

*University of Missouri Extension, Eating from the Garden, 2010*
Eating From the Garden Jeopardy

Clue cards

$100  $500

$300  $200

$500  $400
Eating From the Garden Jeopardy

Additional cards

DAILY DOUBLE

Colorful foods that give us lots of vitamins and minerals and very little fat, sugar or sodium

FINAL JEOPARDY CLUE
Eating From the Garden Jeopardy

Additional cards

DAILY DOUBLE

FINAL JEOPARDY ANSWER

What are fresh fruits and vegetables?
**Eating From the Garden**

A nutrition and gardening program

### Eating From the Garden

#### Jeopardy Answer Key

<table>
<thead>
<tr>
<th>Nutrition</th>
<th>Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Fruits, vegetables, grains, protein and dairy <em>(What are the food groups?)</em></td>
<td>100 A physical activity that burns calories and encourages you to eat healthfully <em>(What is gardening?)</em></td>
</tr>
<tr>
<td>200 Half of my plate <em>(How much of my plate should contain fruits and vegetables?)</em></td>
<td>200 Forms of active play <em>(What are riding a bike and playing sports?)</em></td>
</tr>
<tr>
<td>300 Water, food and air <em>(What do people and plants need for growth?)</em></td>
<td>300 Being active helps you achieve this <em>(What is a healthy weight?)</em></td>
</tr>
<tr>
<td>400 Nutrients we want to see less of on food labels <em>(What are fat, sugar and sodium?)</em></td>
<td>400 The number of times your heart beats per minute <em>(What is your pulse?)</em></td>
</tr>
<tr>
<td>500 Nutrient that gives us energy <em>(What is carbohydrate?)</em></td>
<td>500 The amount of time you should spend in active play every day <em>(What is 60 minutes?)</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food Safety</th>
<th>Planting</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 What you should do just before eating <em>(What is wash your hands?)</em></td>
<td>100 Plants that are good for a school garden <em>(What are radishes, lettuce and other cool-season crops?)</em></td>
</tr>
<tr>
<td>200 What we should use to wash fresh fruits and vegetables before we eat them <em>(What are cold water and a scrub brush?)</em></td>
<td>200 Tools used to prepare soil for planting <em>(What are shovels and rakes?)</em></td>
</tr>
<tr>
<td>300 We remove these when we wash fruits and vegetables <em>(What are dirt, insects and pesticides?)</em></td>
<td>300 This grows into a new plant when placed in the right environment <em>(What is a seed?)</em></td>
</tr>
<tr>
<td>400 Items we should use to clean counters and cutting boards <em>(What are soap, water and a sanitizing solution?)</em></td>
<td>400 Planting seeds indoors under “grow lights” and later moving the seedlings inside <em>(What is transitioning?)</em></td>
</tr>
<tr>
<td>500 A method of keeping fruits and vegetables fresh longer <em>(What is freezing?)</em></td>
<td>500 Root vegetables that are planted from seedlings in the spring and harvested in the fall <em>(What are sweet potatoes?)</em></td>
</tr>
</tbody>
</table>
# Eating From the Garden

Eating From the Garden

A nutrition and gardening program

---

## Eating From the Garden

### Jeopardy Answer Key (continued)

<table>
<thead>
<tr>
<th>Garden Care</th>
<th>Plant Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>100  Jobs to do after a garden is planted <em>(What are watering and weeding?)</em></td>
<td>100  The part of a plant that absorbs water and nutrients from the soil <em>(What are roots?)</em></td>
</tr>
<tr>
<td>200  Decayed dried leaves, fruit and vegetable scraps, other organic matter and water <em>(What is compost?)</em></td>
<td>200  The process by which plants make their own food from air, water and sunlight <em>(What is photosynthesis?)</em></td>
</tr>
<tr>
<td>300  A plant that is growing where it is not wanted <em>(What is a weed?)</em></td>
<td>300  The process by which a seed takes in water and swells, and the embryo starts to grow <em>(What is germination?)</em></td>
</tr>
<tr>
<td>400  Removing small seedlings from a garden to make room for others to grow <em>(What is thinning?)</em></td>
<td>400  The process by which plants use colors and smells to attract insects and animals to produce the fruit of the plant <em>(What is pollination?)</em></td>
</tr>
<tr>
<td>500  Removing plants from a garden and working in leaves or compost <em>(What is “putting the garden to bed”?)</em></td>
<td>500  Animal that helps break down nutrients in the soil <em>(What is a worm?)</em></td>
</tr>
</tbody>
</table>

---

### Final Jeopardy

Colorful foods that give us lots of vitamins and minerals and very little fat, sugar or sodium *(What are fruits and vegetables?)*
Nutrition & Gardening Jeopardy
Nutrition
Food Safety
Physical Activity
Planting
Garden Care
Plant Science
Guides for healthy eating.
What are the food groups?
Half the Plate.
How much fruits and vegetables should we eat?
Water, food, and air
What people and plants need for growth

$300
Nutrient that gives us energy
What is carbohydrate?
Nutrients we want to see less of on the food label
What are fat, sugar, and sodium?
The first thing you should do before eating.
What is washing your hands?
What we should use to wash fresh fruits and vegetables before we eat them.
What are cold water and a scrub brush?
We remove these when we wash fresh fruits and vegetables.
What are dirt, insects, and pesticides?
We should use these to clean counters and cutting boards.
What are soap, water, and a sanitizing solution?
Method to keep fresh fruits and vegetables longer.
What is freezing?
A physical activity that burns calories and encourages you to eat healthy.
What is gardening?
This is a form of active play.
What is riding your bike or playing sports?

$200
Being active helps you to achieve this.
What is a healthy weight?
The number of times your heart beats in a minute.
What is your pulse?
Amount of time you should spend in active play every day.
What is 60 minutes?
Plants that are good for a school garden.
What are radishes and lettuce and other cool season crops?
Tools used to prepare the soil for planting.
What are shovels and rakes?
Grows into a new plant when placed in the right environment.
What is a seed?
Planting seeds indoors under “grow lights” and moving them outside.
What is transplanting?

$400
Root vegetables that are planted from seedlings in the spring and harvested in the fall.
What are sweet potatoes?
Jobs to do after the garden, is planted.
What are watering and weeding?
Decayed dried leaves, fruits and vegetable scraps, water, and other organic matter.
What is compost?
A plant that is not growing where it is supposed to be.
What is a weed?
Removing small seedlings from the garden to make room for others to grow.
What is thinning?
Removing plants from the garden and working in leaves or compost.
What is “putting the garden to bed”?

$500
Part of the plant that absorbs water and nutrients from the soil.
What are roots?
Process where the plants make their own food from air, water, and sunlight.
What is photosynthesis?
Process by which the seed takes in water, swells, and the embryo starts to grow.
What is germination?
Plants use colors and smells to attract insects and animals to produce the fruit of the plant.
What is pollination?
Animal that helps break down nutrients in the soil.
What is a worm?

$500
Final Category

How much you do want to wager?
Colorful foods that give us lots of vitamins and minerals and very little fat, sugar, or sodium.
What are fresh fruits and vegetables?