Feed The Soil... 
and the Soil Will Feed You!

1. What Is Soil Made Of?
2. How Do Different Soils Affect Our Plants?
3. Soil Salad
4. Garden Journal
Feed the Soil... and the Soil Will Feed You

Unit Introduction and Teacher Vocabulary - 101-102
Linking to the Garden and Background - 102-103
State Curriculum Identifiers - 104-107
Lesson #1: What is Soil Made Of? - 108-112
Lesson #2: How do Different Soils Affect Our Plants? - 113-116
Lesson #3: Soil Salad - 117-120

Journal - 121-124

• Student Vocabulary - 123

• Soil Salad Recipe - 124

Teacher Handouts - 125-129

• What is Soil Made of? - 125-126

• Soil Shakeup Experiment - 127

• Soil Drainage Experiment - 128

• Soil Nutrients - 129
Unit Introduction:
Plants and humans require many of the same things to survive, such as air, water, and space. This unit focuses on one unique plant necessity: soil. Students will learn that soil is a complex ecosystem made up of a mixture of living and non-living components. The “Soil Shake-Up” activity will reveal the different particle sizes that are mixed together in garden soil, and a drainage experiment will show how these particles affect the movement of water and nutrients through the soil. Students are introduced to the idea that nutrients in our food originate in the soil, and that by taking care of the soil, they can help ensure that our plants grow to be healthy and nutritious. The unit includes a recipe for a healthy salad that includes ingredients to represent all of the important components of real soil!

Teacher Vocabulary:

1. What Is Soil Made Of?

Clay - the smallest particles making up the inorganic (non-living) mineral component of soil.

Ecosystem - a biological community of interacting organisms and their physical environment.

Nutrients - substances that provide nourishment needed for growth, repair, or metabolism. Plants obtain nutrients from the soil; humans obtain nutrients from their food.

Organic Matter - material that was once living that has died, decomposed, and become part of the soil.

Sand - the largest particles making up the inorganic mineral component of soil.

Silt - the mid-sized particles making up the inorganic mineral component of soil.

Soil - the outer crust of the Earth’s surface, consisting of inorganic mineral particles arising from weathered rock, and humus (decomposed organic matter), and serving as a growing medium for plants.

2. How Do Different Soils Affect Our Plants?

Drainage - the rate at which water travels through soil.

Soil Structure - a term describing how the different soil components are arranged around one another.

Soil Texture - the relative proportions of different particle sizes making up the inorganic mineral component of soil.
3. Soil Salad

**Compost** - a mixture of decaying organic matter, such as leaves or fruit and vegetable scraps, used to improve soil structure and provide nutrients.

**Decomposition** - the process by which organic matter breaks into smaller molecules that are available for use in the soil ecosystem. Decomposition is carried out by bacteria, fungi, protists, worms, and other organisms.

**Linking to the Garden:** (refer to pages 28 through 30 in the curriculum Introduction)

**Schoolyear Programs**
- **Recommended Month:** November
- **Plant:** None
- **Harvest:** Lettuce and leafy greens for “Soil Salad”; any other vegetables that may still be available in your fall garden
- **Complimentary gardening activities:** Pull out spent plants and make compost pile; cover garden soil with leaves or other mulch; sow cover crop seed

**Growing Season Programs**
- **Recommended Month:** July
- **Plant:** Transplant (late July): Broccoli, cabbage, cauliflower, collards, kale
  Direct seed (late July): Carrots
- **Harvest:** Cucumbers, peppers, tomatoes and any other available vegetables for “Soil Salad” (send surplus home with students)
- **Complimentary gardening activities:** Pull out spent plants and make compost pile; mulch; work compost into fall vegetable beds as you plant, other general garden maintenance

**Background:**

Soil is a complex ecosystem consisting of inorganic mineral particles, organic matter (plant parts, bacteria, fungi, and other invertebrate fauna that are living, dead or decomposing), air, and water. The inorganic mineral component is derived primarily from weathered rock. Organic matter is derived from the decomposition of dead plant material (roots or materials on the surface), or can be added to the soil in the form of compost or organic mulches such as leaves and straw. Understanding your soil starts with a description of two basic properties: texture and structure.

Inorganic mineral particles, the portion of the soil from broken down rock, make up the biggest proportion of the soil. Soil texture refers to the relative proportion of different particle sizes making up the inorganic mineral component. These particles are classified as sand (the largest particles), silt (medium-sized particles), and clay (very fine particles). Soil texture affects how well water and nutrients are retained in the soil. Soil with large amounts of sand drains well but does not retain moisture or nutrients. On the other hand, soil with large amounts of clay holds moisture and nutrients, but can prevent moisture from penetrating deep into the soil, and can suffocate roots when rain water is not able to drain away. Heavy clay soils are also very difficult for plant roots to penetrate. The ideal soil texture is one that has a balanced mixture of sand, silt, and clay; this mixture is referred to as loam.
Soil structure refers to how all of the components of soil (mineral particles, organic matter, air and water) are arranged around one another. For example, if you have very little space between the solid components of the soil for water and air to move through, your soil structure would be described as compacted. You can improve soil structure by adding organic matter. However, it is very difficult to change soil texture.

Plants remove nutrients from the soil as they grow. If they are not replaced, the soil becomes infertile, and the garden will eventually stop yielding. Adding organic matter (compost, mulch, tree leaves, etc.) will replace these nutrients better than adding fertilizer. Synthetic fertilizers are formulated to provide the major nutrients plants need (nitrogen, phosphorous, and potassium), but organic matter, which is derived from decomposed plant material, contains all of the minor or trace nutrients that were originally taken up by the plants that were composted. Adding organic matter also improves soil structure and drainage, while synthetic fertilizers do not.
Feed the Soil… and the Soil Will Feed You

Standard 2.0 Comprehension of Informational Text
A.1. a. Make inferences based on the text.
A.1. b. Use details to support the main idea and major points.
A.1. c. Demonstrate understanding by retelling, asking questions, and relating prior knowledge.
A.1. d. Follow a set of multi-step directions.
A.1. e. Listen carefully to expand and enrich vocabulary.
A.1. f. Make judgments based on information from the speaker.
A.2. a. Make inferences based on the text.
A.2. b. Use details to support the main idea and major points.
A.2. c. Demonstrate understanding by retelling, asking questions, and relating prior knowledge.
A.2. e. Listen carefully to expand and enrich vocabulary.
A.2. f. Make judgments based on information from the speaker.

Standard 4.0 Writing
A.1. a. Attend to the speaker.
A.2. b. Respond appropriately to clarify and understand.
A.2. c. Contribute relevant comments.
A.2. d. Relate prior knowledge.
A.2. e. Listen carefully to expand and enrich vocabulary.
A.2. f. Make judgments based on information from the speaker.

Standard 6.0 Listening
A.1. a. Attend to the speaker.
A.1. b. Respond appropriately to clarify and understand.
A.1. c. Contribute relevant comments.
A.1. d. Relate prior knowledge.
A.1. e. Listen carefully to expand and enrich vocabulary.
A.1. f. Make judgments based on information from the speaker.

Curriculum Identifiers - Feed the Soil - Reading/English Language Arts Standards
<table>
<thead>
<tr>
<th>Lesson</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>Identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Standard 3.0 Measurement</td>
</tr>
</tbody>
</table>

- State Curriculum Identifiers - Feed the Soil - Math Standards

105 Feed the Soil... and the Soil Will Feed You

Healthy habits

Measure length of objects and pictures of objects using a ruler or tape measure to the nearest inch, centimeter, and foot.
<table>
<thead>
<tr>
<th>Lesson</th>
<th>1.0 Skills and Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>1.8</td>
<td>1.8</td>
</tr>
</tbody>
</table>

State Curriculum Identifiers - Feed the Soil - Science Standards
<table>
<thead>
<tr>
<th>Lesson</th>
<th>#</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **State Curriculum Identifiers**

<table>
<thead>
<tr>
<th>Lesson</th>
<th>#</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Identifiers**

- **Feed the Soil, and the Soil Will Feed You**

- **Life Science**

- **C.1.c.** Given pictures of stages in the life cycle of a plant or an animal, describe the sequence of the stages in the life cycle.

- **E.1.** Describe what happens to food in plants and animals:
  - Contributes to growth
  - Supports repair
  - Provides energy
  - Maintains homeostasis
  - Is eliminated when they die

- **E.1.b.** Identify the things that are essential for plants to grow and survive:
  - Basic needs in habitats that provide their basic needs
  - Ask and develop possible answers to questions about what happens to the materials that living things are made of:
  - Contributes to growth
  - Food in plants and animals

- **E.1.d.** Ask and develop possible answers to questions about what happens to the materials that living things are made of when they die:
  - Cycle of the stages in the life cycle of a plant or an animal
Lesson #1: What is Soil Made of?

Time required: 40 minutes (classroom activities: 40 minutes)

Lesson Overview:
1. Students will begin to explore the very special role that soil plays in plant growth. They will conduct an experiment that will reveal that their garden or schoolyard soil is made up of different types of particles.
2. Students will use a graphic organizer to understand the components of soil.

Students will learn that:
• Soil provides plants with nutrients, support, and water.
• Soil contains mineral particles, organic matter, and living organisms.
• Different types of soil contain mineral particles of various sizes, organic matter, and organisms in different proportions.

Gather
• Hand trowel or shovel
• Clear glass jar with lid
• Clock or watch with a second hand
• Dry-erase marker or grease pencil

Setup:
• Retrieve a scoop of soil from the garden or schoolyard (remove grass, weeds, rocks, and other debris); enough to fill the glass jar halfway with soil.
  NOTE: The activity in this lesson requires that you use “real” soil (from the ground), not potting soil.
• Make copies of the following handouts for each student:
  • “What is Soil Made of?”
  • “Soil Shakeup Experiment”
• Draw the diagram from the “What is Soil Made of?” handout on the board.
• If you don’t have a sink in your classroom, fill a container with water (enough to fill the glass jar).

Process:

Introduction (5 minutes)
1. Ask students to list what plants need in order to grow, such as sunlight, soil, water, space, and air.
2. Explain that plants need many of the same things that people do. However, soil is the one special thing that plants need that humans do not.
Engagement (10 minutes)

Discussion Questions

1. What is soil?
2. Why do plants need soil?
3. What is soil made of?
4. Is soil living or non-living?
5. Is all soil the same?

Key Points

1. Soil covers the Earth’s surface and provides a place for plants to grow. Soil is the scientific word for dirt.
2. Soil keeps plants anchored and upright, and provides moisture and nutrients to the roots.
3. Soil is a mixture of many different ingredients, both living and non-living.
4. There are many different types of soil, but all soils in Maryland have the same basic ingredients.

Activity (25 minutes)

SUMMARY OF ACTIVITIES

1. The class will complete an activity that will reveal that their garden soil is made up of a mixture of different particle sizes. You will shake up a jar of soil and water and allow the soil to settle out. The particles settle at different speeds, depending on their size. Once all the soil has settled, they can observe the layers of sand, silt, and clay that were previously mixed together in the soil.

2. The students will work with the teacher to complete the “What is Soil Made of?” handout. This graphic organizer will help the students visualize the different components that make up soil. The students will learn that soils from different places all have the same ingredients, but they differ in the proportion of those ingredients.

Activity Process #1 (10 minutes) “Soil Shake Up Experiment”

1. Display the jar containing the soil and tell students where it came from.

2. Tell students that soil is made from many different ingredients mixed together, and this experiment will help us separate those ingredients so we can see them.

3. Explain that you will fill the jar with water, shake it up, and observe what happens when the soil is allowed to settle.
4. Pass out the “Soil Shakeup Experiment” handout.

5. Ask students to predict what will happen. Have them record their hypotheses on the handout.

6. Remind students that a hypothesis is an educated guess about what will occur with our experiment. Have students record their hypothesis. You may need to guide students in coming up with some possible hypotheses, such as:
   - The soil will settle and look the same as before it was shaken.
   - The soil will not settle and will remain mixed with the water.
   - The soil will settle and look different than before it was shaken.

7. Remind students that an observation is a record of what happened in the experiment, and a conclusion indicates whether or not the hypothesis was correct. They will make observations and draw conclusions after the soil has settled overnight.

8. Leave the jar undisturbed to continue settling while you move on to the next activity.

**NOTE:** The soil will settle out in layers because it is made up of different “ingredients” that sink at different speeds. They will learn what these ingredients are during the next activity.

**Activity Process #2 (15 minutes) “What is Soil Made Of?” handout**

1. Pass out the “What is Soil Made Of?” handout.

2. Explain that this diagram will help us understand what soil is made of. Soil is made of both living and non-living things.

3. Ask students if they know another word that is sometimes used for soil.

4. Explain that the word “dirt” can be used to describe the non-living part of the soil. Scientists call this the inorganic mineral component of the soil. This is the “main ingredient” in soil: little particles that have been formed from rocks that have broken down into tiny pieces.

5. Write the word “dirt” in the bubble in the bottom center of the diagram on the board, and have the students do the same on their handouts.

6. Explain that “dirt” is non-living, but soil also contains living things. Ask students what the living portion of the soil is made of.

7. Tell students that earthworms, bacteria, insects, and fungi are living things that are part of the soil ecosystem. Share with students that there are 1 billion microorganisms in an amount of soil equal to the size of your fingertip.

8. Fill in one of the bubbles to the left or right of the central line with the word “critters” or “animals”.
9. Explain that animals aren’t the only living things in the soil. Roots, leaves, and other parts of plants are left behind in the soil when they die. These plant parts break down, or decompose, and become part of the soil. The term “organic matter” refers to things that were once living that decompose and become part of the soil. Organic matter provides nutrients to plants.

10. Write “organic matter” in one of the remaining bubbles.

11. Point out that there are two bubbles remaining. In between the dirt, critters, and organic matter in the soil are spaces. These spaces are important because they make room for two things that plant roots need.

12. Students are to guess what the last two components are.

13. Write “air” and “water” in the remaining bubbles.

14. SAY:

These bubbles represent the five main ingredients of soil. However, we can further break-down the category of “dirt.” Remember that the “dirt” component of soil is made from rocks that have broken down into tiny pieces. However, not all of these pieces are the same size. Soil scientists classify these particles into three main categories based on their size. Sand particles are the largest particles, clay particles are the smallest, and silt particles are medium-sized.

15. Write these three words (sand, silt, and clay) under the corresponding particle sizes.

16. Direct the students’ attention to the jar. Remind them that this experiment was to help us see the different ingredients that are mixed together in soil, because different sized particles sink at different speeds.

17. Ask students to guess, which one of the three particles just named makes up the bottom layer of soil that settled out quickly. Have them explain their guess.

18. SAY:

The sand particles settled to the bottom the fastest because they are the largest. Silt will sink at a medium speed, and clay will take the longest to settle. Because of this, we should be able to see the different layers of particles once everything settles.

19. SAY:

We have just learned that soil is made of a mixture of different ingredients. If I gave each of you the same set of ingredients needed to make bread, would everyone’s bread turn out the same? What else would you need to know?

20. Guide students in coming to the conclusion that the amount of different ingredients is important to the recipe.
21. SAY:

Just like different breads have different amounts of the same ingredients, different soils have different amounts of the ingredients shown on our diagram. The proportion of the different “ingredients” present in a soil sample determines what type of soil we have. This affects how our plants grow.

22. Explain that once all of the soil settles in the jar, they will be able to see the proportions of sand, silt, and clay in the soil. The sand will have already settled, but the silt and clay are smaller particles and therefore settle more slowly.

23. Have students record their initial observations on their Soil Shakeup Experiment handout. Collect and save handouts for use in the next lesson.

24. Leave the jar undisturbed over night to allow the experiment to finish.

Reserve a time to revisit the results of this activity as part of lesson #2.
Lesson #2: How Do Different Soils Affect Our Plants?

Time required: 30 minutes (classroom activities: 30 minutes)

Lesson Overview:

1. Students will draw conclusions from the “Soil Shakeup Experiment” started in Lesson #1 of this unit to understand the texture of their soil.

2. Students will conduct an experiment to determine how soil texture affects how water moves through soil.

Students will learn that:

• Soil provides plants with nutrients, support, and water.
• Different types of soil contain different amounts of sand, silt, clay, and organic matter.
• The amount of these different soil “ingredients” affects how quickly water and nutrients move through soil.

Gather

• The incomplete “Soil Shakeup Experiment” handouts from Lesson #1
• 4 one-quart-sized plastic containers (such as yogurt containers)
• Dried kidney beans (about 1 1/2 cups)
• Flour (about 1 1/2 cups)
• Sink or large plastic bin for catching water during experiment

Setup:

• Make copies of the “Soil Drainage Experiment” handout.
• Punch holes in the bottoms of two of the plastic containers using scissors or a pointed knife.
• Fill the plastic containers without holes with water.

Process:

Introduction (5 minutes)

1. Review the “ingredients” of soil: “dirt,” organic matter, critters, air, and water.

2. Review the fact that although all soils have the same basic ingredients, soils differ because they contain different amounts of the soil “ingredients.”
Engagement (5 minutes)

Discussion Questions

1. What part of the plant grows in the soil?
2. What is the role of the roots?

Key Points

1. Roots are the part of the plant that grows down into the soil.
2. Roots absorb water and nutrients from the soil, which are essential for plant growth.
3. Roots anchor the plant into the ground so it doesn't fall over.

Activity (20 minutes)

SUMMARY OF ACTIVITIES

1. Students will observe the jar from the “Soil Shakeup Experiment” that has settled overnight to determine the texture of the garden soil. This will prepare them to consider how soil affects plant growth.

2. You will use different sized food items to represent different sized particles that make up the mineral component of the soil. By pouring water over these particles, students will notice the differences in drainage time between the varying sized particles. The largest particles will allow water to drain through the fastest, and the smallest particles will drain the slowest.

Activity Process #1 (10 minutes) “Soil Shakeup Experiment” Conclusions

1. Ask the students to review the steps of the experiment from Lesson #1. Remind them of the various parts of the scientific method.

2. Ask students to describe the purpose of the experiment. What questions are they trying to answer with the experiment?

3. Call students’ attention to the jar from the previous lesson’s experiment. The water should be clear.

4. Without disturbing the jar, mark the top two layers that have formed in the soil. Ask students to recall what makes up each layer, and explain why they settle in those layers.

5. Students should recall that the bottom layer is sand (the largest particles). The middle layer is silt, and the top layer is clay. The layers form because larger particles settle faster than smaller particles.
6. Discuss the relative proportions of particle sizes in your soil. Have students record their observations on their experiment handout.

7. Remind students that the conclusion to the experiment is when the scientist decides whether their hypothesis was correct or not, and why.

8. Have students record their conclusions on the experiment handout.

9. SAY:

Our jar experiment showed us the layers of sand, silt, and clay in our soil. But remember that soil also includes other ingredients. The stuff floating on the top of the water is organic matter. Organic matter is the part of the soil that comes from living things that have died, decomposed, and turned back into soil. Soil that contains a lot of organic matter has a soft texture, dark color, and provides nutrients to plants. Plant roots can easily grow through it, and air and water can reach the roots. This is why we think of dark soil as being healthy.

10. If desired, use a ruler to measure the depths of each layer and the total depth of the soil. Use this information to calculate the percent composition of each soil component (divide the depth of each layer by the total depth of all layers combined, then multiply by 100). For example, if the sand layer is 2 inches thick, the silt layer, 1 inch, and the clay, 1/2 inch, the total of all layers is 3.5 inches. The sand layer, therefore, is (2 divided by 3.5 = .57). Multiply by .57 by 100 = 57. Sand is 57% of the total solid depth.

Activity Process #2 (10 minutes) “Soil Drainage Experiment”

1. Explain that the class will complete another experiment that will show how different soil types affect how well roots are able to do their job of absorbing water and nutrients from the soil.

2. Display the kidney beans and the flour. Explain that these two things will represent different particle sizes in the soil. Ask students what they think the flour and the beans represent.

3. Explain that the kidney beans will represent sand, which are the largest soil particles, and the flour will represent clay, which are the smallest soil particles.

4. Show students the containers that have holes in the bottom. Explain that you will be placing a layer of each of the two different “soil particles” (beans and flour) in the two containers and pouring water over them to observe the speed at which water drains through.

5. (Pass out “Soil Drainage Experiment” handouts.) Remind students that a hypothesis is an educated guess about what will occur with our experiment. Have students record their hypothesis. You may need to guide students in coming up with some possible hypotheses, such as:

- The water will drain through the flour faster than through the beans.
- The water will drain through the beans faster than through the flour.
- The water will drain through the beans and flour at the same speed.
6. Conduct experiment:
   - Fill one of the containers that has holes in the bottom with about 1 1/2 cups of kidney beans. Put 1 1/2 cups of flour in the other container.
   - Select students to assist in the experiment: one student to hold each of the drainage containers over the bin or sink; and one student to pour water into each of the drainage containers.
   - Emphasize that this is an experiment, so we will pour the same amount of water over each type of “soil”, and try to pour it at the same speed.
   - Instruct the students to rapidly pour the water over the two drainage containers while they are held over the sink or plastic bin.

7. Have students record their observations on the “Soil Drainage Experiment” handout.

8. Ask several students to explain the results they observed and whether their hypothesis was correct. Make sure students are given the opportunity to explain their own conclusions about how particle size affects soil drainage based on their own observations.

9. Explain that the kidney beans allowed the water to drain through the quickest because the large particles also leave large spaces between them, allowing water to drain through. The small particles in the flour lay right on top of one another and don’t allow water in between them. Remind students that the kidney beans represent sand, and flour represents clay. Ask students which type of soil particles allow water to drain through soil the fastest. Have them write their conclusions on their handouts stating whether their hypothesis was correct and explaining what they observed.

10. Remind students that soils contain different amounts of sand, silt, and clay. Ask them which particle type (sand, silt, or clay) they think is the best to have the most of. Have them explain their answers.

11. Explain that the best soil contains a mix of sand, silt, and clay. Ask the students to verbally brainstorm reasons for why this is. Discuss the following points:

12. SAY:

Sand allows water to drain down deep to the roots, and clay holds on to water and nutrients and keeps the roots moist when the weather is dry. Silt fills in between the sand and clay. Too much sand causes soil to dry out quickly; too much clay doesn’t allow water to penetrate to plant roots. A mix of all three is just right.

13. SAY:

Organic matter (things that were once living) is another important ingredient in soil. Ideal soil contains lots of organic matter because it provides nutrients to plant roots. Furthermore, it makes the soil loose and soft so that water can drain through it, but it also absorbs water like a sponge and stores it for when the weather is dry. No matter what kind of soil you have, adding organic matter to soil will help plants grow better.
Lesson #3: Soil Salad

Time required: 35 minutes (classroom activity: 20 minutes; food demo: 15 minutes)

Lesson Overview:

1. Students will discuss soil nutrients: their sources, their path from soil to plants to our bodies, and the importance of replenishing them.

2. Students will prepare a snack that will help them remember the different ingredients in soil.

Students will learn that:

• As they grow, fruits and vegetables use up nutrients from the soil.
• The vitamins and minerals in foods can be traced to minerals and nutrients in the soil.
• Growing and harvesting vegetables removes these minerals and nutrients from the soil.
• We can replace nutrients in the soil by adding organic matter, such as compost.

Gather:

• Ingredients for “Soil Salad” recipe
• Equipment for “Soil Salad” recipe

Setup:

• Cook and chill brown rice.
• Draw the diagram from “What is Soil Made of?” handout (lesson #1) on the board, with bubbles filled in with names of soil components
• Make copies of the following handouts for each student:
  • “Soil Nutrients: Where did they come from? Where did they go?”
  • “Soil Salad” recipe.
• Harvest (or purchase), wash, and chop all vegetables for “Soil Salad,” reserving scraps for compost pile, if applicable.

Process:

Introduction (5 minutes)

1. Remind students that different-sized soil particles affect how quickly water drains through soil. Larger soil particles, such as sand, allow water to drain through more quickly than small particles, such as clay. Water that drains through the soil is soaked up by plant roots. Describe the feel of sand as gritty and rough, silt as smooth, and clay as sticky.
Engagement (5 minutes)

Discussion Questions

1. Besides water, what else does the soil provide that plant roots must absorb?

2. Why do plants need nutrients from the soil?

3. What part of the soil provides nutrients to plants?

Key Points

1. Plant roots absorb nutrients from the soil.

2. Plants need nutrients so they can grow and be healthy, just like our bodies need nutrients to grow and be healthy.

3. Organic matter is the best source of nutrients in the soil. Organic matter is made up of things that were once living that have decomposed to become part of the soil again. Nutrients contained in organic matter are released slowly into the soil over the growing season.

Activity (25 minutes)

SUMMARY OF ACTIVITIES

1. Students will use the “Soil Nutrients: Where did they come from? Where did they go?” handout to understand how nutrients move from the soil, into the plants, and finally, into our bodies. They will learn that soil nutrients must be replaced in order to have continued yields from the garden. Methods for replacing soil nutrients will be discussed.

2. The class will prepare a “Soil Salad” with healthy ingredients that represent all of the different components found in soil.

Activity Process #1 (10 minutes) “Soil Nutrients: Where did they come from? Where did they go?” handout.

1. Pass out “Soil Nutrients: Where did they come from? Where did they go?” handout. Direct students to the graphic at the top of the page.

2. ASK:

   When a plant absorbs nutrients from the soil and we eat part of that plant, are those nutrients still in the soil?

3. Guide students in coming to the conclusion that the nutrients in vegetables move out of the soil, into the plants, and into our bodies.
4. Ask students what would happen to the nutrients in the soil if we kept growing and harvesting food every year for many years without adding anything to the soil.

5. Explain that the soil would become depleted of nutrients if we did not replace them and plants would stop growing!

6. Brainstorm ideas of things that we, as gardeners, can do so that the soil does not become depleted.

7. Direct students’ attention to the graphic at the bottom of the page.

8. SAY:

   Plants remove nutrients from the soil. However, if we take plant parts, such as scraps from our kitchen or leaves from our yard, and let them breakdown, or decompose, the nutrients that those plants soaked up from the soil while they were growing can be added back into the soil. This process of recycling plant nutrients is called composting. Composting is a way of making organic matter to add to our soil, and it helps keep our garden growing.

9. Explain that this is why worms are important garden friends: worms eat dead plant parts in the soil and turn it into organic matter that provides nutrients to the soil.

**Activity Process #2 (15 minutes) “Soil Salad” Recipe**

1. Explain to the class that you are all going to prepare a “Soil Salad”. The salad will not contain any soil, but each ingredient will represent a component of the soil. Students will be asked to guess which soil component each ingredient represents. If they get it right, they can add it to the salad.

2. NOTE: Remember to review with students the importance of clean hands when preparing food. Have all students wash their hands before they begin to handle the food. The curriculum introduction has a useful description of proper hand-washing techniques.

3. Display all ingredients: kidney beans, brown rice, salt, vinaigrette, vegetables, and shredded cheese.

4. Direct their attention to the “What is Soil Made Of?” diagram on the board, and remind them of the drainage experiment.

5. Ask the students what the kidney beans represented in the soil drainage experiment. They should recall that the beans represented sand because sand is the largest particles in the soil.

6. Select a student to open the can of beans, drain and rinse them, and add them to the mixing bowl.

7. Point out that although we used flour to represent the smallest particles in our drainage experiment, we aren’t going to use flour in our recipe because that wouldn’t taste good. Instead, we will use salt. Ask students to recall what the smallest particles in soil are called. They should recall that clay is the smallest particles in the soil.
8. Explain that you will now add just a little bit of salt to the salad to represent clay. It is important to have a little bit of clay in your soil because it holds onto moisture and nutrients, but too much clay can prevent water from draining deep into the soil and reaching plant roots. Similarly, we need to have a little bit of salt in our diets, but not too much.

9. Select a student to measure a ¼ teaspoon of salt into the bowl.

10. Remind students that the medium-sized particles in soil are called silt.

11. Ask students to guess what ingredient represents silt. They should conclude that brown rice will represent silt, the medium-sized particles in the soil.

12. Select a student to add the rice to the bowl.

13. Point out that you now have three ingredients left: vegetables, cheese, and dressing. Invite students to guess which soil components these ingredients represent.

14. Continue assembling the salad. Students should conclude that the vegetables represent organic matter because they are plants that were once living that will add nutrients to the soil (and will add nutrients to the salad), the cheese represents worms, and the dressing represents water.

15. Mix the salad thoroughly and serve.

16. Encourage students to share the “Soil Salad” recipe with their family.
Journal

Time required: 20 minutes (classroom activities: 20 minutes)

Lesson Overview:

1. Students will write a creative written response to a prompt related to the content covered in the “Feed the Soil” unit.

Process:

1. Read the prompt aloud to your students. After answering any questions, allow them time to write a response in their Garden Journals.

2. Optional: Students in grades 1-3 may enjoy the book “Diary of a Worm” by Doreen Cronin as a complement to this activity. The book can be found in most libraries or book stores. Read the story after students write their journal entries.

Prompt:

In this journal activity, you will be asked to create the diary of a worm. Pretend you are an earthworm living in the garden soil. You have noticed that people seem to think that life in the soil is dark and dirty, and that you are gross and slimy. You are tired of it! In the space below, write a few paragraphs to inform people about what life in the soil is like. What goes on below the ground? What is your home like? How is the soil special? What special jobs do worms do?
Garden Journal

Name: ____________________________

Pretend you are an earthworm living in the garden soil. You have noticed that people seem to think that life in the soil is dark and dirty, and that you are gross and slimy. You are tired of it! In the space below, write a few paragraphs to inform people about what life in the soil is like. What goes on below the ground? What is your home like? How is the soil special? What special jobs do worms do?
Student Vocabulary

**Clay** - the smallest particles making up the non-living part of soil.

**Compost** - a mixture of decomposed organic matter, such as leaves or vegetable scraps, used to improve soil health and provide nutrients to plants.

**Decomposition** - the process by which living things that have died break down into smaller and smaller pieces and become part of the soil. Bacteria, fungi, worms, and other critters in the soil help dead plants decompose.

**Drainage** - the speed at which water travels through soil.

**Nutrients** - things needed by living organisms to grow and be healthy. Plants get their nutrients from the water, soil and air; humans get nutrients from their food and water.

**Organic matter** - once living plants and animals that have died, decomposed, and become part of the soil. Organic matter provides nutrients to the soil that help plants grow.

**Sand** - the largest particles making up the non-living part of soil.

**Silt** - the mid-sized particles making up the non-living part of soil.

**Soil** - the outer layer of the Earth’s surface, made of non-living bits of rock, organic matter, air, and living things like bacteria and worms. Plants grow in soil because it provides them with water, nutrients, and support.
Soil Salad Recipe

This recipe for a healthy rice and bean salad is used to demonstrate the different components of soil. The beans and rice represent different sized soil particles (sand and silt); the vegetables represent organic matter (things that were once living); the dressing represents water; and the cheese represents worms! Healthy soils contain all of these things!

Makes 20 sample portions
Serves 6-8 as a side dish

Ingredients:
1 can kidney beans, drained and rinsed
1 cup cooked rice (preferably brown)
¼ teaspoon salt
1-2 carrots, washed, peeled, and shredded
½ can corn, drained
½ pint-sized container cherry tomatoes, washed and cut in half
½ green pepper, washed and chopped
½ tex-mex dressing
  (or store bought or homemade vinaigrette, recipe at right)
½ cup shredded low-fat cheese

You will need:
Can opener
Collander
Mixing bowl
Serving spoon
Measuring spoons

Directions:
1. Place beans, rice and vegetables in a large bowl.
2. Add dressing.
3. Mix thoroughly.
4. Top with cheese (if desired).

Cook’s note: Vary your veggies! The vegetables suggested here are only suggestions. This recipe works with just about any vegetable that you might include in a salad. Experiment and enjoy!

Tex-Mex Vinaigrette

Ingredients:
1-2 Tablespoon red wine vinegar
1 ½ teaspoons mustard
½ teaspoon ground cumin
Pinch cayenne (optional)
3 Tablespoons olive oil
Salt and pepper to taste

Directions:
1. Place vinegar, mustard, and cumin in a bowl.
2. Whisk in olive oil.
3. Season with salt and pepper.
4. Taste and adjust seasonings.
5. Use in soil salad, or other salads.
What is Soil Made Of?

SOIL

[Diagram with blank circles to be filled in by hand]

Name_______________________________ 

This material was funded by USDA's Supplemental Nutrition Assistance Program - SNAP in cooperation with Maryland's Department of Human Services and University of Maryland Extension. The University of Maryland Extension will not discriminate against any person because of race, age, sex, color, sexual orientation, physical or mental disability, religion, ancestry or national origin, marital status, genetic information, political affiliation, and gender identity or expression.
What is Soil Made Of?

SOIL

Critters

Organic Matter

Air

Water

“Dirt”

Clay

Silt

Sand
Soil Shakeup Experiment
The Scientific Method

Today’s Date ________________

My Name ________________

Hypothesis:

Observations:

Conclusion:
Soil Drainage Experiment
The Scientific Method

Today’s Date __________________

My Name __________________

Hypothesis:

Observations:

Conclusion:
Soil Nutrients: Where did they come from? Where do they go?

Nutrients in the soil will eventually run out!

Compost replaces organic matter and nutrients.

This institution is an equal opportunity provider.
This material was funded by USDA’s Supplemental Nutrition Assistance Program - SNAP in cooperation with Maryland’s Department of Human Services and University of Maryland Extension. The University of Maryland Extension will not discriminate against any person because of race, age, sex, color, sexual orientation, physical or mental disability, religion, ancestry or national origin, marital status, genetic information, political affiliation, and gender identity or expression.