What is soil?

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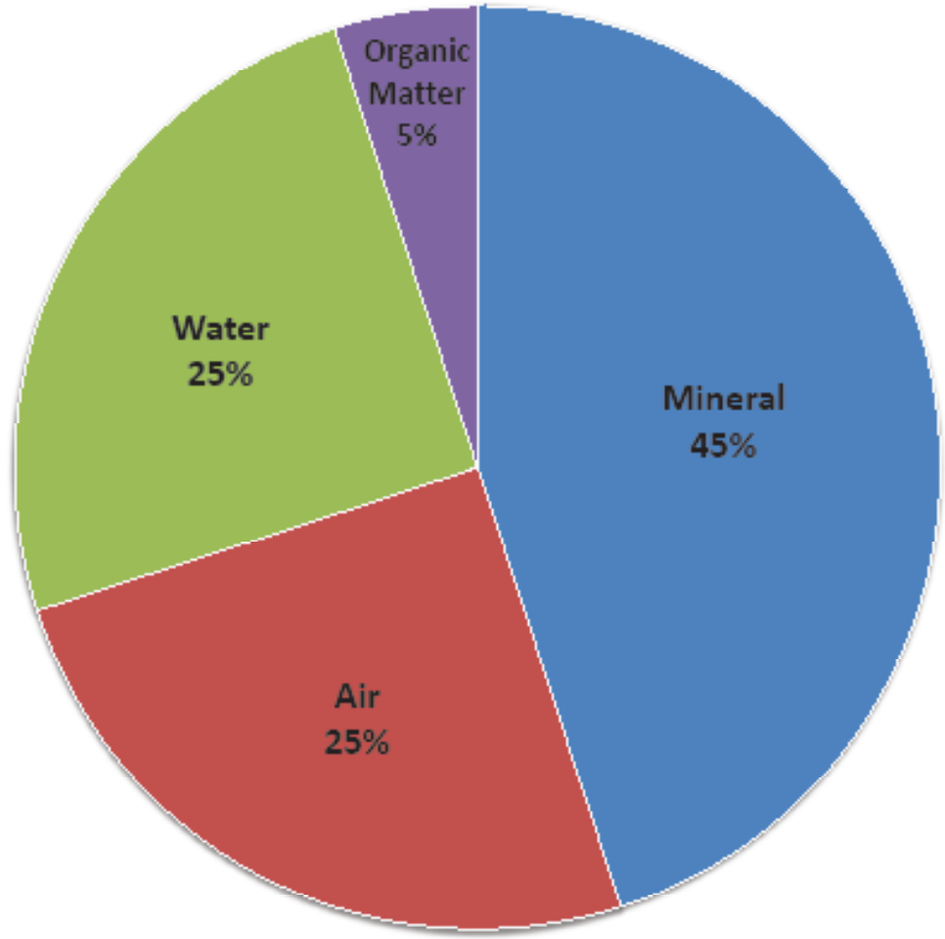

Soil…It's More Than Just Dirt

Fourth Grade Lesson

P&E Stock # 247

MICHIGAN FARM BUREAU®

Michigan Farm Bureau Ag in the Classroom - Connections to Michigan Content Standards

4th GRADE LESSON* – *"Soil…It's More Than Just Dirt"

This lesson meets the following Grade Level Content Expectations:

SCIENCE

SCIENCE PROCESSES

Inquiry Process

S.IP.E.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.

- **S.IP.04.11** Make purposeful observation of the natural world using the appropriate senses.
- **S.IP.04.12** Generate questions based on observations.
- **S.IP.04.13** Plan and conduct simple and fair investigations.

Reflection and Social Implications

S.RS.E.1 Reflecting on knowledge is the application of scientific knowledge to new and different situations. Reflecting on knowledge requires careful analysis of evidence that guides decision-making and the application of science throughout history and within society.

- **S.RS.04.11** Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.
- **S.RS.04.14** Use data/samples as evidence to separate fact from opinion.
- **S.RS.04.15** Use evidence when communicating scientific ideas.
- **S.RS.04.18** Describe the effect humans and other organisms have on the balance of the natural world.

LIFE SCIENCE

Organization of Living Things

L.OL.E.1 Life Requirements- Organisms have basic needs. Animals and plants need air, water, and food. Plants also require light. Plants and animals use food as a source of energy and as a source of building material for growth and repair.

- **L.OL.04.15** Determine that plants require air, water, light, and a source of energy and building material for growth and repair.

"Soil…It's More Than Just Dirt"

Fourth Grade Lesson
Presented by: Michigan Farm Bureau Members

(2 minutes) **We are _____ and _____ from the Michigan Farm Bureau. (Continue to introduce what you do on your farm.)**

(10 minutes) **Today we are going to talk to you about soil and the role soil plays in agriculture. First, who can tell me what soil is?** (layer of Earth where plants grow) **What color do you find soil to be?** (black, dark brown, light brown) **Are there different kinds of soil?** (yes) **How do the kinds of soil differ?** (In texture, color, what they do, how much water they allow, what they are used for) **Why do plants need soil?** (To have something for roots to hold onto, take nutrients, protect the growing seed)

Have students cover desks with newspaper. Pass out various soil particles.

Soil Comparison Activity
(10 minutes)

I am going to give you all a few soil samples to look at and compare. We are going to compare these samples as a dry sample and then again as a wet sample. (Pass out the soil samples)

Pass out lab sheet #1

Allow the students time to make observations of the dry sample. (see lab sheet) Encourage them to use their senses during this observation. Then, have the students split their samples in half. Use eyedropper to wet half of the soil sample as instructed to each student. Observe soils dry, then wet soils with an eyedropper of water. Walk around asking students about the sample they are experiencing. **How do the soils differ in color? Do they feel different when they are dry? What other materials do they feel like?** (sugar, flour, powder, etc.) **Can you make a ball with the soil when it is wet? Which soils hold together best? Record what you observe on to lab sheet #1.**

Hold up soil composition diagram

Soils are made up of many things. The soil you handled contains organic matter (living and once-living materials), minerals, water, and air. The more closely the particles can be packed together, the denser the material is. Smaller particles pack closer to each other and allow less space for air and water. Glaciers melted, leaving

Have students split into groups of 5 or 6.

Give each group of students 2 pieces of screen (1 with larger holes & 1 with smaller holes) and 3 pieces of white paper

Pass out a mixed soil sample (1/4 cup) in cups

Soil Texture Activity
(10 minutes)

rocks and soil particles behind. The lighter particles were left on top leaving a well-drained soil. You may now clean up the soil samples.

Now that we have been able to experience different soils, we know that there are many differences between them. Different soils are composed of different mixtures of soil particles which are of various sizes. In this activity, we will examine the different size particles that make up a soil.

Each of your groups has two pieces of screen and 3 sheets of white paper. Put the screen with the bigger holes on top of a piece of paper.

Carefully pour your dry soil sample on the screen with the biggest holes. Shake it gently. Watch how some particles pass through and others don't. Set the screen aside (on a piece of paper), with the particles on it. Now, do the same thing with the 2nd screen with the smaller holes, letting the smallest particles fall on the paper. (Allow students to do this.)

Now make 3 piles on your paper with the soil from each screen and the soil that went through both. Do you see any differences? (Talk through differences).

Hold up softball, tennis ball, and ping pong ball when needed.

The largest particles are coarse sand. We will represent these particles with a softball. (Hold up softball for students to see.) **The medium particles are silt particles. We will represent these particles with a tennis ball.** (Hold up tennis ball for students to see.) **The smallest materials are clay particles. We will represent these particles with a ping pong ball.** (Hold up ping pong ball for students to see.) **The amount of each of these particles in a soil tells us what kind of soil it is and determines what crops will grow best in it.** (Review what each particle size represents for students to understand visually the particle sizes.)

Soil Density and Permeability
(10 minutes)

The size of the soil particle and the pore size (air between the soil particles) determine the permeability of the soil. Permeability means the ability of liquid to move through the soil. Because water is important for crops to grow, the permeability of the soil determines

Use food coloring to dye water

- **Pour water into profile tube with gravel and time.**
- **Pour water into profile tube with sand and time**
- **Write the actual times on the chalkboard/white board.**

what kinds of crops can grow. We have 2 profile tubes, one with gravel and the second with sand.

Use lab sheet #1 to predict how long it will take for the water to reach the bottom of the profile tube with Gravel and the profile tube with Sand and rank them. (1st = the most permeable – water runs through the fastest)

Does everyone have their prediction completed? (Wait if more time is needed.)

Now we will pour the water into profile tube with gravel. Make sure to pay attention to what happens so that you can compare it to the sand. (Have students record the actual time on to their lab sheet #1.)

Now we will pour the water into the profile tube with sand. (Have students record the actual time on to their lab sheet #1.) **Record on your lab sheet which soil the water moved through the fastest.**

What does this mean for plants that are grown in these soils? (Take a few suggestions from the students.) **Which soil is the most permeable?** (Complete lab sheet #1 by answering the questions together.)

Show soil composition diagram

Soil Composition Diagram
(5 minutes)

We just discussed the differences in the soil and the permeability that they have. Now we will discuss what soil is made of. What do plants need to be able to grow? (air, water, and soil)

The ideal soil contains ½ mineral and organic particles, ¼ air and ¼ water. More or less of any of these limits the growth of the plants. (Take the time to ask if any of the students have questions about this information. Make sure that the students have understood what has occurred so far before moving ahead.)

Pass out lab sheet #2

Soil Conservation "Pie"
(10 minutes)

Who has driven past a field on a windy summer day and has seen soil blowing away in the wind? What is that called? (Erosion) **What are a few ways that soil leaves the field?** (Through erosion, wind and water.)

Farmers need the top layer of soil (topsoil) to grow crops. This layer has the most organic materials and nutrients (food for plants). There are many ways that farmers use to keep the soil in their fields. Today, we will demonstrate some of the ways this happens. We will have a field and a pond. We are only small farmers so our fields aren't very big. This cake pan is our field and this collecting jar is our pond or ditch. It has been dry so your pond has no water. We have a sprinkler can full of rain.

Today we will compare two different methods of keeping soil in the fields. The methods are cover crops and conservation tillage (no-till). Cover crops are crops which are planted on a field to keep the soil in place over a period of time and to add nutrients to the soil. Conservation tillage, also referred to as no-till, is when the plant stalks from last year's crops remain in the field and without turning over the soil, the farmers plant the new crop right in with last year's stalks. This reduces soil erosion and runoff. All of these methods are used to keep the soil from eroding, or being moved by wind, water and other things. We are going to use these methods in our experiment. We will also leave one plain field.

Show the pictures of cover crops, conservation tillage and no-till.

For the plain soil - we'll simply pat the soil into the pan and leave it smooth.

This represents a field that was plowed or tilled in the spring or the previous fall after last year's crop was harvested. This method is still needed for certain types of soils. The residue from last year's crop is plowed under and decomposes to nurture the soil.

For the conservation tillage field – we'll take grass or leaves and lay them on top of the soil. In conservation tillage, also referred to as no-till, the plant stalks from last year's crops remains in the field and the farmers plant the new crop right in with last year's stalks.

For the cover crop field – we'll use this pan with rye planted on it. Farmers use grass, wheat or alfalfa as a cover crop. They are planted to protect the field from erosion and then plowed under before a new crop is planted. Sometimes the crop is planted in

strips on the edge or by a ditch to catch the soil as the wind blows. This also provides vegetation and shelter for wildlife.

Now, predict what will happen – use your lab sheet #2.

Now it will rain on our field. We will take water and pour it on the top of our hill. (Pour water on "fields". Tip the pie pan up with the bottom edge at the pond.) **We are collecting the "runoff" in our pond or ditch. Let's compare the water from each pan.**

What method kept the most soil in the field? Which pan absorbed the most water? What do these results mean to us? (If we keep material on our fields or slow down the water as it moves across, we lose less soil).

Hold up Soil Conservation Map

Michigan soil is very different throughout the State
(3 minutes)

As we look at this map, we can see by the color-coded areas the different types of soil that exists. Different crops need different soil types to grow. Cherries grow well by Traverse City, dry beans grow well in the Saginaw Valley, and fruit is plentiful in the western part of the state. Crops like corn and soybeans can grow well in many soil types so they are seen throughout the state.

Because certain crops can grow only on specific kinds of soil, it is important to keep good agricultural soils available for farming.

This is why farmers have tried to their best to stop the soil from eroding. Farmers have implemented conservation practices to stop erosion. What practices did we discuss today? (No-till, cover crops, etc.) **Since there are so many people in the world and there is only so much farm land to grow crops and feed all the people.**

Have you heard of Farmland Preservation? It is an awareness message and offers ways to keep land available to farmers. Farmland preservation is an issue farmers are very interested in, and you should be, too. This demonstration will help you understand why preserving farmland is important.

Apple-Land Use Demonstration (5 minutes)	Use the attached form to do the apple demonstration. Allow time for the students to fully understand the concept.
Summarizing (1 minute)	**Today we have shown you several different types of soils and how they differ. We have watched water move through different soils and practiced protecting soil from erosion. We've also demonstrated how little useable soil we have. Can anyone tell me what makes up soil?** (Air, mineral, oxygen, organic matter) **What are the largest particles of soil?** (Sand) **What are the three particles of soil?** (Sand, silt particles, and clay particles.) **What are a few ways that farmers can preserve the soil onto the land?** (No-till, cover crops, etc.) **We hope that you now have a better understanding of soils and why they are important to all of us. Thank you for letting us spend time with you.**

Name_____

SOIL…IT'S MORE THAN JUST DIRT!

4th Grade

Lab Sheet #1

Soil Samples/Permeability

1. Obtain samples of the three types of soil. Using your senses, respond to the following questions and record your observations on the chart below:

	WHAT DOES IT LOOK LIKE?	WHAT DOES IT FEEL LIKE? (WHEN DRY)	WHAT DOES IT FEEL LIKE? (WHEN WET)
Sand			
Silt			
Clay			

2. For the soil permeability activity, record your data below.

MATERIAL	PREDICTED TIME	PREDICTED RANK	ACTUAL TIME	ACTUAL RANK

3. Why is soil texture/permeability important? _____

_____

4. How does soil texture help the soil hold water? _____

_____

_____

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Name_____

SOIL…IT'S MORE THAN JUST DIRT
4th Grade
Lab Sheet #2
Conservation Pie

1. Which option kept the most soil in the field, and the water the most clean, and why? (rank these in order with 1 being the cleanest)

Soil Type	Rank	Why?
Bare Soil		
Soil with Crop Residue (leaves/grass)		
Soil with Cover Crop		

2. Using the above results, which method would be the best to use to reduce erosion?

_____

_____

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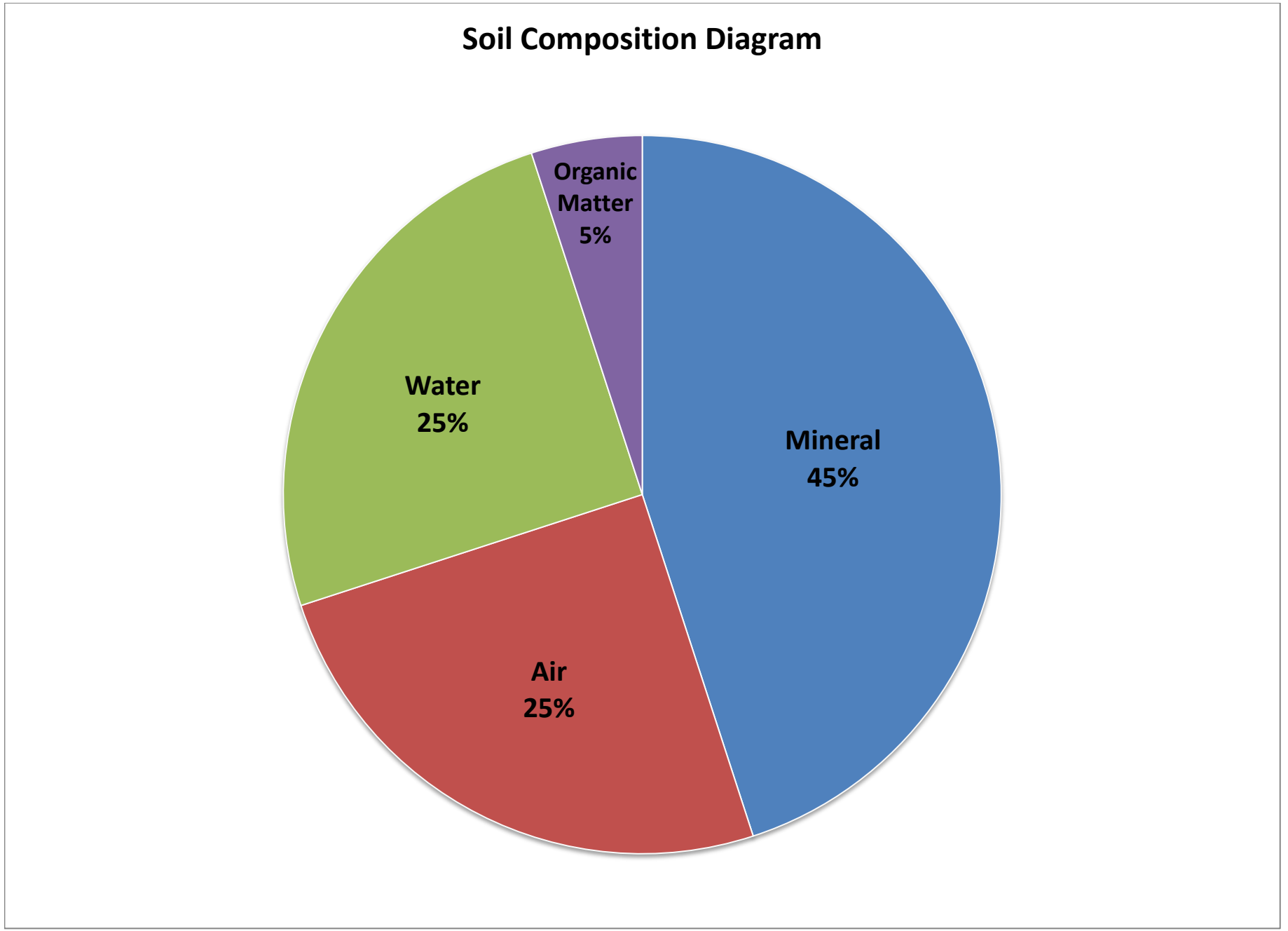
Soil Composition Diagram
Organic Matter 5%
Water 25%
Mineral 45%
Air 25%

soil

Conservation Tillage/no-till

Cover crops

APPLE LAND USE DEMONSTRATION

Procedure:

1. Cut a large apple into four equal parts. Three-fourths of the apple represents the oceans that cover our planet. The remaining quarter piece represents the land area.

2. Next, cut the land section in half lengthwise, making two 1/8 sections. One represents the deserts, swamps, mountains, Arctic, and Antarctic regions. The remaining 1/8 section of apple symbolizes the land where people can live and may be able to grow food.

3. Cut the remaining 1/8 section into four pieces. Three of those pieces represent land that is too rocky, too wet, or too hot to grow food or that has been developed by people.

4. Finally, peel the last small piece of apple – 1/32 of the world. This tiny peel represents the soil which we all depend on for food production.

Question – Is land a resource to be managed, or a commodity to be bought and sold?

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"SOIL…IT'S MORE THAN JUST DIRT"
4th Grade Kit Packing List

Based on 30 students per class

- Sand, topsoil, and clay for observation
- 6 8"x 8" x 1 ½" aluminum cake pans (with lids or ziplock bags to cover them)
- Mixed gravel loam soil
- Sand (approx. 12 cups)
- Gravel
- 1 gallon jug full of water
- 30 Dixie cups to distribute soil to students (1 cup/2 students)
- Large apples – 1 per class
- Leaves, grass or paper towel
- Squirt bottle
- 30 copies lab sheet #1 (1 copy per student)
- 30 copies lab sheet #2 (1 copy per student)
- Sharp knife to cut apple
- 1 soil composition diagram (large version in packet)
- 1 map from Soil Conservation District (available through MSU Extension, Bulletin E-1550
- 2 plastic profile tubes
  1 filled with sandy soil (1 ½ cups)
  1 filled with course soil/part gravel (1 ½ cups)
- Newspapers to cover desks (4 per kit)
- 8 ½" x 11" sheets of white paper (2 bundles of 54 – 108 total)
- 9 pieces of small pored plastic screening
- 9 pieces of large pored plastic screening
- 4 plastic spoons
- 1 softball
- 1 tennis ball
- 1 ping pong ball
- Three pictures of soil, conservation tillage, and cover crops
- Paper towels for clean-up
- Trash bag for clean-up

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