








George Washington Carver: From Slavery to Agricultural Scientist

Overview:



Students will learn about the life of George Washington Carver (1860-1943) and his groundbreaking work to prevent soil depletion in agriculture. Students will participate in one of three activities and either: (1) learn how to test the pH level of garden soil; (2) learn about soil nutrients, and how to increase them when necessary, using worm tea; or (3) learn how to make homemade peanut butter.

Objectives:








At the end of the lesson, students will be able to:

-  **Explain** the difference between monoculture (when the same crop is planted on the same land every year) and permaculture (when different crops are rotated on the same land each year).
-  **Describe** why permaculture is more desirable than monoculture for environmental reasons.
-  **Demonstrate** how to test the pH level in garden soil.
-  **Create** a worm bin in the garden in order to make “worm tea” as a natural, organic fertilizer for plants.
-  **Make** homemade peanut butter.


Preparation:


-  Write the vocabulary words on the board.
-  For Handout 1: “How to Check pH Level of Soil” obtain litmus papers and a color comparison chart for one group of

Materials:













-  Visual Aid: “George Washington Carver”
-  Handout 1: “How to Check pH Level of Soil”
-  Handout 2: “Making Worm Tea”
-  Handout 3: “How to Make Homemade Peanut Butter”
-  For Handout 1:
 - Litmus paper
 - pH comparison chart
-  For Handout 2:
 - Two plastic bins that fit inside each other
 - A tight lid for the top bin
 - Hammer
 - Nails
 - Dried leaves, grass, or crumpled up newspaper
 - Kitchen scraps (fruits and vegetables)
 - A handful or two of garden soil
 - A cup or so of water
 - Many red wiggly worms (you can buy these at a nursery or online)
 - Dead plant materials or crumpled up newspaper
-  For Handout 3:
 - 15 ounces shelled and skinned roasted peanuts
 - 1 tsp kosher salt
 - 1 ½ tsp honey

students to do pH tests of the soil in four corners of the garden (or in four pots/containers with soil from different locations, if there is no established school garden).

 Obtain materials for Handout 2: “Making Worm Tea.” Read the directions on the Handout for how to make an inexpensive worm bin out of two plastic boxes with a tight fitting cover.

 Obtain the materials and equipment for Handout 3: “How to Make Homemade Peanut Butter” using the recipe on the Handout.

Vocabulary:

 botanist	 monoculture
 crop rotation	 permaculture
 bio-diverse	 groundbreaking
 ecosystem	 micronutrients
 food chain	 industrial farming
 deplete, depletion	 worm castings (manure)


Learning Activities:

- I. Presentation (15 min.)
 - A. Use the Visual Aid: “George Washington Carver” to project the image of GWC onto the board.
 - B. Tell the students that today they are going to learn about GWC who was born into slavery (1860-1943), but went on to become a famous agricultural scientist and did groundbreaking work to prevent soil depletion in agriculture.
 - Carver was born into slavery in Missouri just before the Civil War, but was raised by a German American immigrant family who taught him how to read and write.
 - With extraordinary perseverance he attended a series of schools and universities and eventually became a botanist. Carver was one of the first agricultural scientists to promote crop rotation for small scale cotton farming to improve unhealthy soil caused by repeated plantings of only one kind of crop (monoculture).


Materials Continued...

- 1 ½ tbsp peanut oil
- Food processor
- Rubber spatula
- Bowl for serving
- Crackers or vegetables


On the board:

-  Vocabulary words
-  Image of George Washington Carver

Suggested Snack:

-  Homemade peanut butter with crackers and/or vegetables

Other Resources:

-  *A Weed is a Flower: The Life of George Washington Carver*, written and illustrated by Aliko Brandenburg, Aladdin Paperbacks, 1988.

- He recommended to African-Americans, who owned small farms after the Civil War in the south, that they rotate crops— such as cotton— planted on the same land year after year with other crops they could eat (such as sweet potatoes and peanuts).
 - Crop rotation results in a strong, diverse ecosystem with many kinds of healthy microorganisms and bacteria.
 - If crop rotation doesn't occur, then synthetic materials such as herbicides, insecticides, and fertilizers are put on the fields and these toxins can get into the water system and the food chain.
 - He was sometimes called the "Peanut Man" because of the 300 peanut products he created (e.g., peanut soup, peanut bread, peanut cake, but not peanut butter!)
 - Emphasize that Carver was an early leader in promoting environmentalism in agriculture. One of his most important contributions to agricultural science was the importance of keeping soils healthy so plants could grow well, and the most important way to do this was/is to rotate crops.
- C. Explain any vocabulary words as needed.
2. Garden/Cooking Activities (30 min.)
- A. Tell students they will now break up into three groups and each group will be assigned one of the following tasks:
- (1) check how acidic or basic the soil in the garden is to see if it's ready for planting,
 - (2) make an organic fertilizer for plants which is called "Worm Tea," or
 - (3) make peanut butter.
- B. Divide the class into three groups and give each person the appropriate Handout that describes their task.
- C. Give students 15 minutes to complete their tasks and then reconvene them as a whole to present/discuss their findings.
- For the **pH Level Activity**: ask the students which soil site would be best for growing plants and why (**pH level that is about 6-6.5 is ideal**). If the pH level is above this then it's too basic, so vinegar will need to be added to the soil (or green pine needles) to make it more acidic. If it's too acidic, ground limestone can be added to make more basic.
 - For the **Worm Tea Activity**: ask students why they think we do not put dairy, oil, fish, or meat scraps in the worm bin? (**They will attract rodents that like to eat these items.**)
 - For the **How to Make Peanut Butter Activity** ask the students why do they think it is necessary to add oil to the recipe? (**To keep it moist and easy to spread.**)

3. **Snack:** Serve homemade peanut butter with crackers and/or vegetables (5 min.)
4. Have students answer the Reflection Questions in their garden journals. (5 min.)

Student Reflection Questions:

1. What went well for your team during the activity? What went not so well and why?
2. What additional information did you need to make this activity easier for your team?

Assessment Questions:

1. Why do you think small southern farmers in the 1800's planted only cotton (a monocrop) each year?
 - A. They had no interest in growing food.
 - B. They did not know that rotating crops each year would improve the health of their soil.**
 - C. They loved to grow and pick cotton.
2. Why is it better to use organic fertilizer like "Worm Tea" on plants rather than synthetic fertilizer?
 - A. Organic fertilizer is natural and does not contaminate soil, water, or food.**
 - B. Industrial farmers use organic fertilizer because it is cheaper than synthetic fertilizer.

Standards:

Common Core State Standards

- CCSS.ELA-Literacy.SL.8.1.B

Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.

Next Generation Science Standards

- MS-ESS3-4: Human Impacts on Earth Systems

Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless activities and technologies involved are engineered otherwise.



From: <https://historicmissourians.shsmo.org/historicmissourians/name/c/carver/>



How to Check pH Level of Soil

Name: _____

Teacher: _____

Date: _____

*Your team's task is to find out how acidic (like lemon juice) or how basic (like bananas) the soil is in four places in your garden. To do this you will be checking the pH level of soil in **four sites**.*

You will need:

- a garden trowel
- 4 litmus papers strips
- a color comparison chart to compare each strip with the chart

Procedure to follow at each site:

1. Put a small amount (about a teaspoonful) of soil on your trowel and add a tablespoon or more of water in order to make a solution of soil and water.
2. Stick one of your litmus papers into the solution; wait at least two minutes.
3. Note what color the litmus paper turns and then compare that with the color comparison chart to determine its number (whether it is acidic [red, less than 7 pH] or basic [blue, greater than 7 pH]). Write the number on the chart below, and then go to the next site to take a sample.

List the locations of your four soil test sites:

(1) _____

(2) _____

(3) _____

(4) _____

Write the pH color & number for each sample below:

Sample #1: color _____ number _____

Sample #2: color _____ number _____

Sample #3: color _____ number _____

Sample #4: color _____ number: _____



Making “Worm Tea”

Name: _____

Teacher: _____

Date: _____

In this activity, you will build a “worm bin” that, over the span of several months, will create an organic fertilizer that you can use in the garden.

“Worm tea” is an organic fertilizer made of the “castings” (liquid manure) of worms. This kind of fertilizer is much better for the environment than synthetic fertilizers made by large corporations. Why do you think this is so?

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Today, follow steps 1-2 to create a worm bin that will produce organic fertilizer:

1. Using two plastic bins that fit inside each other, create holes in the sides and bottoms of the smaller bin so that liquid can seep through it (you can make the holes with a large nail and a hammer). Be sure there is a tight fitting cover on the large bin so that no predators (rats, squirrels, etc.) can get in to eat the food scraps you will be putting into the small bin.
2. Fit the small bin into the large bin and then fill the small bin in this order:
 1. dried leaves, grass or crumpled up newspaper,
 2. kitchen scraps (fruits and vegetables),
 3. a handful or two of garden soil,
 4. a cup or so of water,
 5. many red wiggly worms, and on the top of all this,
 6. more dead plant materials or crumpled up newspaper to block any odors that the rotting food might make.

Later on...

3. To keep the bin healthy, add kitchen scraps to the small bin every two-three weeks.
4. Within a month or two there will be “worm tea” in the bottom of the large bin. When this is mixed with water (about $\frac{1}{4}$ cup of worm castings to a gallon of water) you can add this solution to the soil under an ill plant and then water thoroughly with a hose for a 5-10 seconds.



How to Make Peanut Butter

Name: _____

Teacher: _____

Date: _____

Follow the recipe below to make your own peanut butter!

Ingredients:

- 15 ounces shelled and skinned roasted peanuts
- 1 teaspoon kosher salt
- 1 ½ teaspoons honey
- 1 ½ tablespoons peanut oil



Directions:

1. Place the peanuts, salt, and honey into the bowl of a food processor. Process for 1 minute.
2. Scrape down the sides of the bowl.
3. Place the lid back on and continue to process while slowly drizzling in the oil and process until the mixture is smooth, 1 ½ to 2 minutes.
4. Place the peanut butter into a bowl and serve to your classmates with crackers.
5. Any leftovers can be placed in an airtight container and stored in the refrigerator for up to two months.