

## DESCRIPTION

Students will review decomposition and the elements of a healthy vermiculture system, then harvest finished vermicast from their worm bin and learn how to use the vermicast to feed their garden soil and plants.

**TIME:** 60 minutes

**SUBJECTS:** Language Arts, Science

## LEARNING OBJECTIVES

After this lesson students will be able to:

- Understand that vermicomposting helps reduce waste, recycle nutrients, and nourish the garden soil and plants.
- Discuss decomposition and recognize the role that decomposers play in creating compost.
- Harvest finished vermicast from a worm bin and utilize it to improve the health of their garden soil and plants.



## ACADEMIC STANDARDS\*

**CCSS, Language Arts:** 3.RF.3, 3.W.1, 3.W.2, 3.W.10, 3.SL.1 **NGSS:** 3-LS4-3, LS4.C, Influence of Science, Engineering and Technology on Society and the Natural World, Patterns, Systems and System Models **Lesson Extensions:** 3.W.1, 3.W.2, 3.W.7, 3.OA.3, Obtaining, Evaluating, and Communicating Information

\*A detailed list of the Academic Standards can be found in the Unit Overview document.

## LESSON OUTLINE

- I. Introduction (20 minutes)
  1. Vermicomposting Review
  2. Group Activities Overview
- II. Group Activities (30 minutes)
  1. Vermicast Harvest (20 minutes)
  2. Garden Care (10 minutes)
- III. Closing (10 minutes)

## KEY TERMS AND CONCEPTS

**Aerobic** - Refers to the presence of air (oxygen) in the system

**Decomposers** - Organisms that break down dead or decaying material and carry out decomposition, e.g., fungi, bacteria, worms

**Decomposition** - The process by which a material is broken down into simpler forms of matter

**Leachate** - Liquid that comes out of the drain of a worm bin; pour back into the bin or dilute with water and add to soil around trees; do not use on edible plant parts (e.g., lettuce leaves)

**Mindful** - Conscious or aware of something; to focus attention on the present moment

**Vermicast/Vermicompost** - Also known as worm castings or worm poop; used as a nutrient-rich, living fertilizer; contains water-soluble nutrients that are relatively easy for plants to absorb; contributes to microbial life and nutrient cycling in the soil

**Vermicomposting/Vermiculture** - A system that uses composting worms to convert organic matter into vermicompost/vermicast

**Worm Tea/Vermicast Tea** - The liquid concentrate of vermicast, containing microbes, fine particulate organic matter, and soluble nutrients; aerobically brewed by steeping or mixing finished vermicast in water and aerating for 12 to 24 hours

## LESSON MATERIALS

### Community Supplies:

- 4 plastic dish tubs (1 per sorting station)
- Sample of finished, sorted vermicast
- Optional: Hanging scale (to weigh compost ingredients and/or finished vermicast)

### Lesson Supplies:

- Nutrient Cycle Sign
- Garden Agreements Sign
- Compost Map Answer Cards:  
Decomposers (F.B.I.); L.A.W.;  
Composting Worms; Shredded  
Paper; Fruit & Vegetable Scraps;  
Dairy; Meat, Bones, Processed  
Foods; Cooking Oil; Garlic and  
Onion; Papaya Seeds; Citrus Fruit;  
Aerobic; Composting Worms
- Tarp
- Spray bottle with water
- Worm bin with active vermiculture and finished vermicast (unharvested)
- Student Workbook
- Class Data Workbook



Compost Map  
Answer Cards

### Teaching Team to Provide:

- Stack of newspaper
- Food waste: Fruit and vegetable scraps (no papaya seeds, minimal citrus rinds)

### School to Provide:

- Compost/Garden/Science Journals (1 per student)
- 8 sorting containers (2 per sorting station; e.g., large yogurt containers)
- 5-gallon bucket (1 or more)



## ACCOMPANYING DOCUMENTS

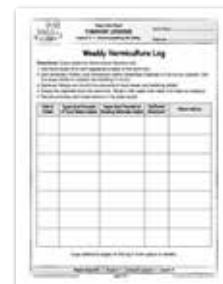
- Resource Sheet: How To Create a Vermicomposting System
- Guided Notes
- Class Data Sheet: Weekly Vermiculture Log

## ADVANCE PREPARATION

- Discuss lesson preparation and presentation plans with your teaching team.
- Review the Resource Sheet: How To Create a Vermicomposting System.
- Make copies of the Weekly Vermiculture Log Class Data Sheet, one per class if not using the Class Data Workbook.
- Verify that the worm bin (one or more bins) contains finished vermicast that is ready to be harvested (all food waste is broken down completely; the finished vermicast is dark brown with no odor).
- Spread out the tarp outside in the shade and set up four sorting stations on the tarp (one plastic wash bin and two sorting containers per station).
- Discuss with teaching team a plan for worm bin care after the harvest.
- Have students ready to take notes in their Compost/Garden/Science Journals if not using Student Workbooks.



Vermicomposting  
Resource Sheet



Weekly Vermiculture Log

## INTRODUCTION

20 MINUTES

“Aloha! Today is our sixth ĀINA In Schools lesson on composting.” During the discussion, write key terms on the board and have students take notes in their journals or Student Workbooks. **Use the Compost Map Answer Cards during the discussion.**

### VERMICOMPOSTING REVIEW

Review the following key concepts with students. Students may refer to their notes from previous lessons.

“What are the main ingredients in a healthy VERMICULTURE system?” Desired answers: Organic matter (carbon: shredded newspaper or office paper, nitrogen: fruit and vegetable waste, and life), air, and water. **Workbook Question #1:** Have students fill in the main ingredients in their guided notes.

“What is DECOMPOSITION?” Desired answer: Decomposition is the process by which a material is broken down into simpler forms of matter. **Workbook Question #2:** Have students fill in DECOMPOSITION in their guided notes.

“What types of creatures live in our vermiculture system and do the work of DECOMPOSITION?” Desired answer: DECOMPOSERS such as invertebrates (composting worms and other insects) and microorganisms (e.g., bacteria). Show the Decomposers Sign.

“The L.A.W. reminds us of three things that are needed for decomposition to occur. What is the L.A.W.?” Desired answer: Life, Air, and Water.



“Are composting worms the same as the worms that we find in the garden soil?” Desired answer: No. Composting worms thrive in a very different habitat than the earthworms in our garden soil; they may not be interchanged!



“Name several ingredients that are allowed in our worm bin.” Desired answers: Pieces of raw or cooked fruit and vegetables, tea bags, paper towels, rinsed and finely crushed egg shells. Coffee grounds, citrus peels, tomatoes, breads, and grains are OK to add in small quantities.



“Name several ingredients that are NOT allowed in our worm bin.” Desired answers: What stays out: Anything spicy, salty, or vinegary, dairy products, processed/junk foods, fat/oil, fish, meat, garlic, onion, citrus fruit, and NO PAPAYA SEEDS! (which may cause the worms to become sterile and cause the colony to die out). Many items that cannot be put in a worm bin can be composted in an aerobic compost pile or with bokashi.



Decomposers Sign



“Why are there drainage holes in the worm bin?” Desired answer: Even though worms need plenty of moisture, they cannot swim and can drown if the liquid is not able to drain out.

“What is the difference between LEACHATE and WORM TEA?” Desired answer: LEACHATE is the liquid that drains out of the bottom of a worm bin. It should be added back into the bin or diluted and poured around the base of plants or trees and not on edible plant parts. It should not be brewed or stored

INTRODUCTION

CONTINUED

because it is not fully digested and may contain harmful microorganisms. WORM TEA is made by steeping or mixing finished vermicast in water and aerating for 12 to 24 hours in order to increase the population of beneficial microorganisms.

“How can we make sure that our vermiculture system remains AEROBIC?” Desired answer: By keeping the bedding (carbon materials) moist and fluffy to allow air flow, not thick and matted.



“What would make a worm bin smell bad and what could you do about it?” Desired answer: A worm bin may smell bad if there is too much food waste (nitrogen) in the bin. Garlic, onion, and citrus may also cause the worm bin to smell bad. Avoid adding too much food by only feeding the worms when almost all of the previously added food waste has been digested.

“Have you been taking good care of your composting worms?” Invite students to share about their experience.

“Have you noticed what happens to the food scraps? How long does it take for them to disappear? How does the bin look or smell? What else have you noticed?” Accept a few student answers.



Many schools recycle food waste from their cafeteria in high-capacity “pipeline” worm bin systems, often complemented by aerobic compost and bokashi composting systems.

GROUP ACTIVITIES OVERVIEW

Show students the sample of finished vermicast. “This is what the worms produce! Do you remember what it is called?” Desired answers: VERMICAST, VERMICOMPOST, or worm poop. **Workbook Question #3:** Have students fill in VERMICAST in their guided notes.

“It is a favorite food for plants because it contains nutrients that they are able to use, and beneficial microorganisms that contribute to the recycling of nutrients in the soil.”



Nutrient Cycle Sign

Show the Nutrient Cycle Sign to remind students of this important and life-giving process.

“Today we will work in groups to harvest finished vermicast from our worm bin by gently removing bits of finished vermicast from the top and sides of small piles, allowing the worms to move away from the light toward the center/bottom of the pile. Please remember to be MINDFUL when handling the worms by being conscious their needs and treating them with kindness and respect. We will put the worms back into the bin (or start a new bin), then dissolve the sorted, finished vermicast in water and add it to our garden soil.”

Garden Agreements

Have students take a deep breath, then repeat and discuss the Garden Agreements as listed on the Garden Agreements Sign:



- I will be SAFE
- I will be KIND
- I will have an OPEN MIND
- I will use my TIME WELL

Divide the students into four groups before going outside.

**GROUP ACTIVITIES**

**30 MINUTES**

**VERMICAST HARVEST (20 minutes)**

1. Have each group gather around a sorting station on the tarp (one plastic wash bin and two sorting containers per station).
2. Remind students to be mindful and handle the worms very gently. Spray their hands with water (worms should not be handled with dry hands).
3. Place one or more large handfuls of unsorted, finished vermicast from the class' worm bin into each group's plastic wash bin.
4. Have students slowly and carefully remove pieces of finished vermicast from the top and sides of their pile, allowing the worms to move away from the light toward the center/bottom of the pile. Finished vermicast and composting worms should be placed carefully into separate sorting containers.
5. Any undigested materials (e.g., avocado peels) should be removed and returned to the worm bin or transferred to the aerobic compost pile.
6. After they are finished have one student from each group carefully place the worms back into the class' worm bin. Optional: Use these worms to start a new worm bin (see Lesson 2 for complete instructions).
7. Have another student from each group collect all of the sorted, finished vermicast into a container (clean plastic wash bin or other container).
8. Optional: Weigh the sorted, finished vermicast.



**GARDEN CARE (10 minutes)**

All of the sorted, finished vermicast may be applied to the gardens during this lesson, or it may be stored for later use, with a small amount used during the lesson for demonstration. Harvested vermicast is best stored in a plastic container with holes in the lid for ventilation, and kept in a cool location out of direct sunlight. As the vermicast dries over several days and weeks, be sure to crumble it into small pieces so that it will be easy to apply to garden or potting soil. Beneficial microorganisms remain alive but dormant in vermicast that has dried.

**To Apply Moist Vermicast to the Garden Soil:**

1. Fill one or more 5-gallon buckets with water.
2. Dissolve a large handful of sorted, finished vermicast in each bucket.
3. Have students take turns using cups (e.g., large yogurt containers) to apply the nutrient-rich water to the garden soil. Be sure to water the soil (not the leaves), and water slowly, allowing the soil to "sip and swallow" before more liquid is applied (avoid creating puddles).
4. Alternatively, small handfuls of vermicast may be directly applied and mixed into to the soil around the base of plants if the vermicast is not too moist (and therefore easier to handle).
5. Remind students that the beneficial microorganisms from the vermicast help to build healthy soil by boosting the soil's ability to cycle nutrients.

**All students must wash their hands thoroughly with soap and water after working with the vermiculture system.**



## CLOSING

10 MINUTES

Gather all the students in the garden/compost area. Ask them to share about their experience.

Discuss with students:

- What types of DECOMPOSERS did you observe today?
- Do you remember what types of ORGANIC MATTER have been added to the worm bin, and were you able to recognize any of them today?
- How does VERMICAST contribute to healthy soil?

Remind students of their weekly tasks, including feeding the worms (review do's and don'ts of what to feed them), adding fluffed, moist bedding as needed, and emptying the leachate (to be diluted and poured into to the soil around trees around campus).

"Today you saw what happens when you take good care of composting worms. Did it seem easy to make beautiful, finished vermicompost that will benefit our gardens? Remember to thank the worms for their hard work!"

"As you help your family to prepare foods at home, think about what kinds of waste you can feed to your worms. How many of you will continue to bring in kitchen waste for your worm bin? And will you continue to take good care of your worms?"



## FOLLOW UP VERMICULTURE CARE

**Follow Up Vermiculture Care is the responsibility of the classroom teacher and students.**

- Assign two to four **Vermiculture Monitors** per week to feed the worms, add properly prepared, moist bedding, spray additional water as needed, and empty the leachate (diluting it and applying it to the soil around trees on campus). Have Vermiculture Monitors complete the Weekly Vermiculture Log.
- Optional: Have students weigh and record the amount of food waste that they add to the bin(s) each week.
- Refer to the How To Create A Vermicomposting System Resource Sheet for additional tips and troubleshooting.
- Students must wash their hands thoroughly with soap and water after working with the vermiculture system.

## FOLLOW UP ACTIVITIES

**Follow Up Activities are the responsibility of the classroom teacher.**

- Have students keep a journal about the composting experience including notes, opinions, drawings, poems, stories, etc.
- Continue to have students care for the aerobic compost pile(s) as described in the Follow Up section of Lesson 5.



## LESSON EXTENSIONS

### It Piles Up - Composting To The Rescue (3.OA.3)

1. Have students gather data and solve this math problem to gain a better understanding of the value and importance of composting!
2. Collect and weigh all of the compostable waste produced at your school in one day: Newspaper, office paper, all food waste and yard waste. Optional: Do this for one week and calculate the average amount of waste produced per day.
3. Multiply the number of pounds per day by the number of days per school year to calculate an estimate of how many pounds of compostable waste enter the waste stream and are sent to the landfill or incinerator by your school in one year!
4. Find comparisons for this figure; for example, how many pickup trucks or elephants weigh the same amount as your school's yearly compostable waste?
5. How many adults and students are part of your school community? Divide the total pounds of compostable waste per year by the total number of people to discover the average number of pounds of compostable waste per person produced at your school in one year.
6. Find out how many total students and school staff there are on your island. Multiply your school's average number of pounds of compostable waste per person per year by the total number of people to discover an estimate of how many pounds of compostable waste are produced each year by all the schools on the island!
7. Now, discuss the fact that if all schools on this island composted all of their compostable waste, how much trash would be saved from entering the waste stream and how much compost would be produced!

### Waste Stream

(3.W.1, 3.W.2, 3.W.7, Obtaining, Evaluating, and Communicating Information)

1. Have students explore their local waste stream in order to find out what really happens to "waste" after we throw it "away" and it is collected:
  - Who collects the waste? Meet and interview those involved.
  - Where does the waste go? Tour a landfill, incinerator, and/or recycling center (green waste, mixed materials, etc.).
  - What is a landfill? Find out more about O'ahu's main landfill here: <http://www.keepinghawaii-clean.com/waimanalo.htm>.
  - Explore the history of how humans have dealt with waste up to the present day. What are some ideas for the future?
  - Why is it important to reduce, reuse, and recycle?
  - How does composting play a role in reducing waste and taking responsibility for what we produce?
  - Does nature create any waste?
2. Have students write informational and opinion pieces about their research results and in-person experiences.

