

Let Us Enrich Soil

SUMMARY INFORMATION

Keywords

Organic farming, compost, green waste, brown waste, humus, shovel, metal fence or mesh, temperature

Topics covered

Biology, Chemistry

Target Grade(s)

7, 8

Estimated Time Required

25 hours (1 hr/day)

LESSON

Goals and Pre Requisites

Goals

- To introduce students to the concept of organic farming
- To help students come up with a practical way for managing biodegradable waste.

Pre Requisites

Knowledge of the difference between biodegradable and non-biodegradable waste.

Instructional Objectives

As a result of this activity, students would develop an understanding of:

- Importance of ecological sustainability
- Team Collaboration
- Logical Thinking

Instructional Resources

Problem Statement

In today's agricultural practices, we observe an abundant usage of chemical fertilizers and pesticides to promote growth and harvest of plants. Because of this, there occurs a major change in the soil structure leading to depletion and subsequent erosion. How can we come up with an alternative that would help in restoring the natural composition of the soil so as to improve the quality of plants?

Background

What is Organic Farming?

Organic farming (or) **Organic Agriculture** is a technique that has been practiced since the 20th century in response to rapidly changing farming practices. It relies on fertilizers of organic origin such as compost, manure, green manure and bone meal and places emphasis on techniques such as crop rotation and companion planting. Biological pest control, mixed cropping and the fostering of insect predators are also encouraged. Thus, organic standards are designed to allow the use of naturally occurring substances while strictly limiting or prohibiting synthetic substances.

Organic farming methods are internationally regulated and legally enforced by many nations, based in large part of the standards set by the International Federation and Organic Agriculture Movements (IFOAM), an international umbrella organization for organic farming organizations established in 1972.

What is Compost?

Compost is organic matter that has been decomposed and recycled as a fertilizer and soil amendment. Compost is a key ingredient in organic farming.



At the simplest level, the process of composting simply requires making a heap of wetted organic matter known as green waste (leaves, food waste)

and waiting for the materials to break down into humus after a period of weeks or months. Modern, methodical composting is a multi-step, closely monitored process with measured inputs of water, air, and carbon- and nitrogen-rich materials. The decomposition process is aided by shredding the plant matter, adding water and ensuring proper aeration by regularly turning the mixture. Worms and fungi further break up the material. Bacteria requiring oxygen to function (aerobic bacteria) and fungi manage the chemical process by converting the inputs into heat, carbon dioxide and ammonium. The ammonium (NH_4) is the form of nitrogen used by plants. When available ammonium is not used by plants it is further converted by bacteria into nitrates (NO_3) through the process of nitrification.

YES				NO			
							
Fruit Peels/ Rinds	Tea Bags	Vegetable Scraps	Plant Trimmings	Weeds with Set Seeds	Meat	Large Wood Pieces	Cat Litter
							
Dried Leaves	Egg Shells	Coffee Grinds	Shredded paper	Coal/ Ash	Fish	Dairy Products	Sawdust
							
Straw/ Small Branches	Cardboard	Animal Manure	Natural Fibres	Walnuts	Citrus Fruit Insides	Fruit Stones	Non-Biodegradable Products

Procedure

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.
3. Allow them to brainstorm with their groups, on the given **Problem Statement**.
4. Each group must come up with their unique solution to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before constructing it. Students must be able to provide justification for their choice of materials.
6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials.

- Allow students to discuss with their teams on their choice of location and materials needed to cook their compost.
- Each group must document each observation and inference during the process of preparation of their compost. Example: -

for choice of location	Materials chosen	Materials chosen	of the pile	t of water sprinkled	of pile being turned and watered	ature of pile checked every alternate day (Plot a line graph of temp vs. course of composting)	days taken by organic matter to transform into compost

- Once the process is complete, each group is requested to note down the texture, smell and composition of their compost.
 - They may now use this compost as organic manure for growing a plant of their choice.
7. Students must make sure that the design incorporated in their process would address the existing problem.
 8. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

Materials Required

Green Materials – Food scraps, Vegetable scraps, Egg shells, Coffee grounds, Grass and Plant Clippings

Brown Materials – Dry leaves, finely chopped wood and bark chips, shredded newspaper, straw, sawdust from untreated wood

Turning fork

Shovel

Metal fence or Mesh

Gloves (if necessary)

Thermometer

Procedure



Step 1: Choose a spot with soil that has good ventilation. Dig a 3ft x 3ft (1ft= 12 inches) deep pit that can be filled with your pile, for composting.

Step 2: Your pile would require 2 mandates: **Green Materials** (food scraps, Vegetable scraps, Egg shells, Coffee grounds, Grass and Plant clippings) and **Brown Materials** (Dry leaves, finely chopped wood and bark chips, shredded newspaper, straw, sawdust from untreated wood). Alternate your pit with 4-8-inch deep layers of green and brown materials. Green materials are Nitrogen rich whereas Brown materials are Carbon rich.

Step 3: Sprinkle water over the pile regularly so that it has consistency of a damp sponge. Do not add too much water otherwise the microorganisms in your pit will become waterlogged and drown. If this happens, your pile will rot instead of compost.

Step 4: Check to see if your pile is decomposing by monitoring temperature. Check the temperature of the pile with a thermometer or by simply placing your hand in the middle of the pile. The ideal temperature must be 55-65 degree Celsius.

Step 5: During the growing season, you should provide the pile with oxygen by turning it once a week with a garden fork. The best time to turn the compost is when the centre of the pile feels warm. Stirring helps the pile cook faster and prevents material from becoming matted down and developing a bad odour.

Step 6: When the compost no longer gives off heat and becomes dry, brown and crumbly, it's fully cooked and ready to feed to the garden!

Conclusion

Organic composting, which is a widely practiced alternative to inorganic farming, is a low cost and highly efficient method in restoring the fertility of the soil. Due to this, the vegetables and fruits produced have a higher nutritional composition.

Extension

1. Students can report the quality of the plant(s) grown out of their prepared compost. Compare the differences in physiology, texture and quality of plants growing from the prepared Organic fertilizer to that of Chemical fertilizers.
2. Make your own Vermicompost.



Assessment and Rubrics

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

- University of Illinois Extension

<http://web.extension.illinois.edu/homecompost/science.html>

- How to Compost – Better Homes and Gardens:

<http://www.bhg.com/gardening/yard/compost/how-to-compost/>

- Deep Green Permaculture:

<https://deepgreenpermaculture.com/>

<https://deepgreenpermaculture.com/diy-instructions/hot-compost-composting-in-18-days/>

- Rodale's Organic Life:

<http://www.rodaleorganiclife.com/garden/how-compost>

- Composting 101:

http://eartheasy.com/grow_compost.html

- Paull, John & Henning, Benjamin(2016)

http://www.academia.edu/25648267/Atlas_of_Organics_Four_maps_of_the_world_of_organic_agriculture

- USDA Blog

<http://blogs.usda.gov/2012/01/25/organic-101-allowed-and-prohibited-substances/>

- Paull, John (2011)

Nanomaterials in food and agriculture: The big issue of small matter for organic food and farming

- Arsenault, Chris.

"Only 60 Years of Farming Left If Soil Degradation Continues"

- Coleman, Eliot (1995), the New Organic Grower: A Master's Manual of Tools and Techniques for the Home and Market Gardener (2nd Ed.).
- Gold, Mary <http://www.nal.usda.gov/afsic/pubs/ofp/ofp.shtml>
- <http://cdn.healthy-holistic-living.com/wp-content/uploads/2015/02/compost-gardening.jpg>
- <http://www.see-change.org.au/compost-workshop/>
- <http://reallygroup.com.au/latest-news/benefits-of-composting/>
- <http://www.thehindu.com/sci-tech/agriculture/vermicompost-a-down-to-earth-solution-to-cut-input-costs/article4902079.ece>