

Background — For the Teacher

Historically, production agriculture has consisted of developing localized environments where conditions for raising food plants and animals could be established and maintained. In this way, farming has come to be one of the land uses by which people exercise their widest effects on the environment.

At the same time as it affects the environment, production agriculture also depends on the environment. Soil, light and water requirements are important and well known crop-limiting variables. However, farming also depends on organisms that affect these well known conditions in the environment without being directly cultivated.

In this activity your students are to observe the activities of a population of earthworms and draw conclusions about their effects on the soil and therefore on plant growth. As a result, they will gain an understanding of some interactions between one organism and its environment. At the same time they will see how farming, and therefore their food, depends on the activity of soil animals that are rarely given any conscious attention by farmers or food consumers.

On Task Sheet One, students record information about soil drainage of water. This information not only provides a comparison between the two subsoils, but is also important for before and after comparisons that will be made in the activity Worm Ranch II.

Procedure

Preparation

1. Obtain or build two of the soil vivariums described in Teacher Resource Sheet One.
2. Gather the other materials listed or assign their gathering to students.

Introduction

3. Review students' existing knowledge of earthworms and their effect on soil.
4. Explain that students will now be looking at earthworms from two points of view:
 - a) What do earthworms need for their surroundings?
 - b) How do earthworms affect the soil?
5. Divide the class in two equal groups, and give each group a copy of Data Sheet One.
6. Explain that each group will supervise one worm ranch project.

Activity

7. Have each group fill their worm ranch in the pattern shown on Data Sheet One.

- a) Students should record the amounts of each material used on Task Sheet One.
 - b) Students should level each layer before adding the next.
 - c) When all layers are in place, students should gently add water from the top until it begins to drain from the bottom of the frame.
8. As soon as the apparatus stops draining, students place up to 20 earthworms on the surface and observe their activity over the next five minutes. They can record their observations on Task Sheet Two.
 9. For the next five classes students should observe the worm ranch each day and record their observations on Tasks Sheets Three and Four.

Conclusion

10. Have each working group present their results from the week.
11. Lead the class in a discussion of the questions below.

Discussion Questions

1. Did the worms in the two ranches show different burrowing patterns?
2. If there were differences, what might have caused them?
3. Was there evidence of mixing between layers of soil?
4. Was there evidence of what the worms were eating?
5. If earthworms eat surface organic matter and excrete fine, mineral rich soil, what role are they playing in the food chain?
6. How does the earthworm's niche help farmers and gardeners?
7. Which type of subsoil would be better for gardening and farming? What other factors determine the answer to this question?
8. What do farmers and gardeners do that loosens and mixes the soil like earthworms?

Related Activities

1. Hold a debate on the resolution "Earthworms are the sign of a healthy soil, not the cause of a healthy soil".
2. If you use the Science Plus series as a text, you will find some simple anatomical and behavioral experiments in Chapter One of Science Plus 1.
3. To see how earthworms react to flooding in their environment, students should do the activity Worm Ranch II.

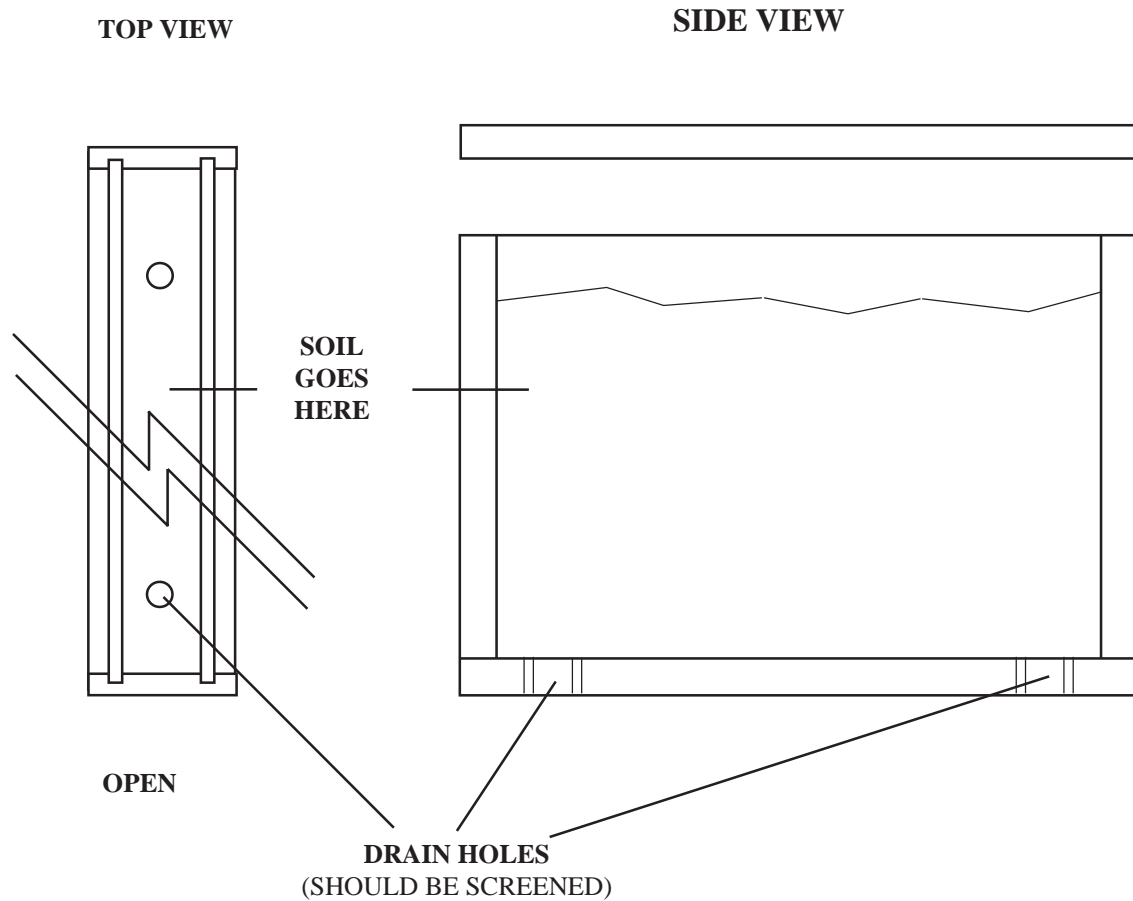
Sheet One --

Building A Worm Ranch

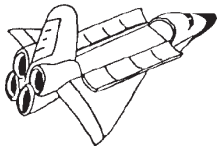


Your worm ranch is a narrow, glass-sided vivarium, commonly known as an ant farm.

It consists of glass held 3-4 cm apart by a frame, with the space between filled with soil.



It is important to have opaque covers for each side of the worm ranch. Soil organisms are all highly light sensitive and will only tunnel near the glass if it is covered between observations.

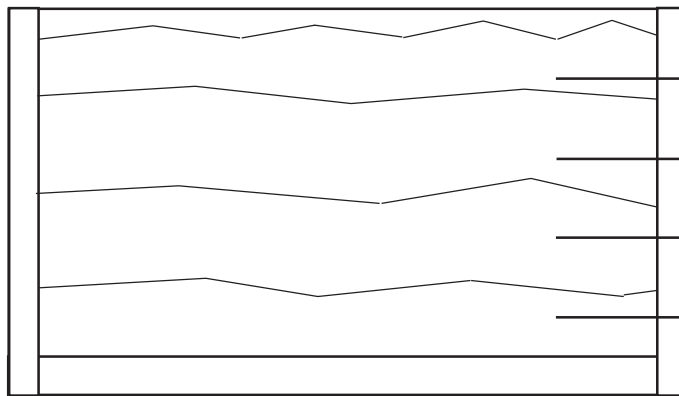


Data Sheet One --

Preparing and Stocking the Worm Ranch

For this activity and Worm Ranch II
you need to fill two soil vivariums with layers of soil as illustrated.

SANDYBASE RANCH S B



loose organic litter

topsoil mix

sand as a subsoil

aquarium gravel



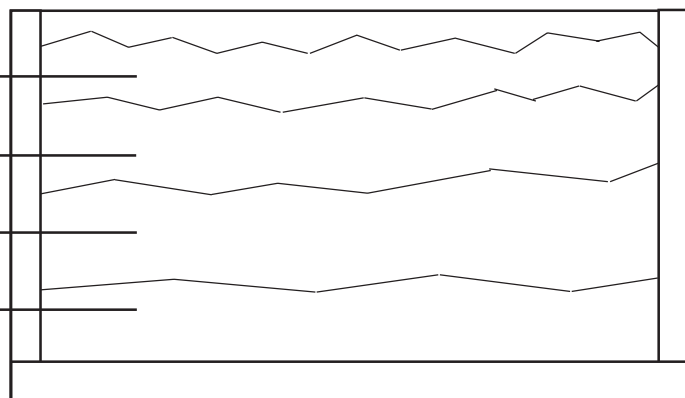
HOLDWATER RANCH

loose organic litter

topsoil mix

clay as a subsoil

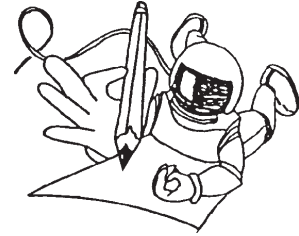
aquarium gravel



The exact depth of each layer is not critical. All layers but the sub-soil should be the same.

Each ranch can be stocked with up to 20 earthworms.

Task Sheet One -- Ready the Ranch

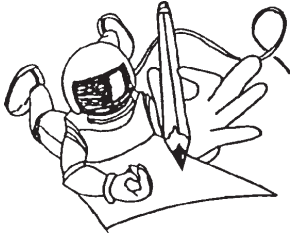


RANCH NAME: _____

Team Members:

<u>Material</u>	<u>Volume</u>	<u>Mass in Grams</u>
gravel sub-soil topsoil mix surface litter		

<p><u>WATER</u></p> <p>Volume added _____</p> <p>Volume draining _____</p> <p>_____</p>	<p>Volume held in soil _____</p> <p>Time elapsed before draining begins _____</p> <p>Time elapsed when draining is complete _____</p>
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Task Sheet Two -- Stocking the Ranch

RANCH NAME: _____

Team Members:

OBSERVATIONS

Number of worms added: _____

Time until first movements: _____

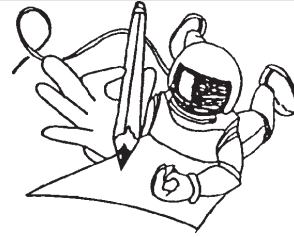
Time until digging begins: _____

Time until worms all underground: _____

GENERAL OBSERVATIONS

Possible explanations of observed behaviours.

Task Sheet Three -- Riding the Range



Ranch Name

Team Members

Viewing Day

OBSERVATIONS

Is litter changing or disappearing?

Are there castings on the soil surface?

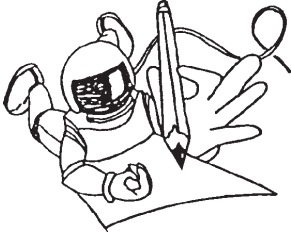
If so, how do they differ from soil and litter?

Are tunnel openings visible at the surface?

Is there any visible mixing of soil layers?

What layers are tunnels visible in?

GENERAL COMMENTS



Task Sheet Four -- Mapping the Range

1. Use the grid to make a scale diagram of the side of the worm ranch.
2. Each day mark the locations of visible tunnel sections and earth worms.

