

Activity 5

Temperature of Vermiculture

Rationale: The temperature of the Habitat is crucial to its success. A data collection system needs to be used to collect data on a continuous basis. The easiest method is to use the system that interfaces with the Texas Instruments graphing calculator TI 83/84. The temperature and changes in temperature will affect the success of all of these activities. A constant ($22 \pm 3^{\circ}\text{C}$) temperature is optimum.

Objectives

- 1) Set up a system for collected temperature data.
- 2) Determine the optimum intervals.
- 3) Compare the temperature of the Habitat with the ambient temperature.
- 4) Determine if any insulation is necessary to maintain a constant temperature.
- 5) Learn how to use the DataMate application.

PDE Standards

Science and Technology

3.1.7. A,B,C

3.2.7. A,B,C,D,E,F

3.6.7. A,B

3.7.7. A,B,C,D

Environment and Ecology

4.1.7. A,B,C

4.2.7. A,C

4.6.7. A,B,C

Math

2.1.8. A,B,D,G

2.2.8. A,B,F

2.3.8. A,B,D

2.4.8. A,B,D,F

2.5.8. A,B,C,D

2.6.8. A,B,C,E,F

2.7.8. B,C,D

2.8.8. F,G,H,I,J

2.11.8. A,B

Materials

Class Habitat

Temperature sensor

Graphing calculator

Computer

Graphical Analysis

Introduction

The rate of metabolism is controlled by the temperature of the worms. To some extent this metabolic process produces excess heat energy as well as the composting/decomposition reactions that are also taking place in the Habitat. The ambient temperature of the room affects the rate at which the Habitat loses or gains heat. Too low of a temperature -- the metabolic reactions proceed too slowly; too high of a temperature - - the reactions proceed very fast. To an extent, large variations in temperature may cause the worms to not metabolize correctly, breed and not reproduce, or die. Most worms used for vermiculture metabolize best between 15°C and 25 °C. Most do best at 22°C +/- 3 °C. The Habitat should not sit on a table that gets direct sunlight or in the stream of cool air from an AC vent.

Strategies

Help the students decide on the number of temperature readings to record each day and the interval between the readings. With the CBL2 system, TI 83/84, and temperature sensor, readings can be taken every few minutes for a week at a time. However, the temperature readings will probably only change significantly when the lid is open, worms are counted, at night when the school temperature is lower, the AC turns off and on, and over weekends. To have these readings and to be able to compare them to the changes in worm mass will help determine the optimum temperature. If the optimum temperature cannot be maintained, the Habitat can be put inside a larger box or a larger bin with shredded paper between all sides, bottom, and the top of the worm bin. Too much humidity and/or too much moisture in the vermicompost will also cause large fluctuations in temperature.

Procedure

- 1) Set up the DataMate application to collect data with the appropriate temperature sensors.
- 2) Students should decide on the number of data points (temperature readings) collected per 24 hours, diurnal. 24 or 48 are good starting values. Every ½ hour or every hour for 7 days will be a total of 168 and 336, respectively.
- 3) Set up the CBL2 with three appropriate temperature sensors. One sensor is on the outside of the Habitat and the other two should be placed in the vermicompost at places decided upon by the students.
- 4) Collect the data for a week. Download the data to a computer via Graphical Analysis. Complete a 1-Var Stat on the data for the week.
- 5) Separate out the data by days and complete a 1-Var Stat analysis for each day.
- 6) Using the statistic button to calculate 1-Var Stat on each day and compare to the values for the 1-Var Stat for the week.
- 7) Were any diurnal means (averages) farther from the weekly mean than others? What days were they? What can be done to correct these temperature fluctuations?
- 8) What were the diurnal standard deviations? Compare them to the weekly standard deviations.
- 9) Place the weekly standard deviation in the last cell in the last column.
- 10) Attach a print out of the weekly temperature readings from Graphical Analysis.

Expectations

The students should be able to:

- 1) use the DataMate application and set up more than one sensor.
- 2) make good decisions about the time interval between readings.
- 3) make better decisions about the location of the Habitat and the sensors in or around the Habitat.
- 4) recall how to do a 1-Var Stat and recall the meaning of mean/average, range, and standard deviation.

Data Table 1

Day	Average temp	Range of temp		Standard deviation
		Max	Min	
1				
2				
3				
4				
5				
6				
7				
Average of following values				