Worms are eating our leftovers!

Introduction

Food Waste at School is a Serious Problem

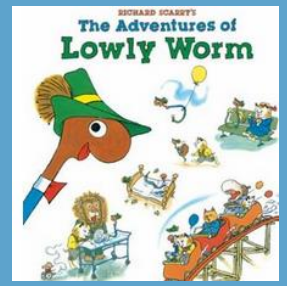
U.S. schools waste about 530,000 tons of food per year. U.S. students toss about 27% to 53% of the food on their plate. U.S. students waste more than the students in many other developed countries. Students waste vegetables and fruit the most (representing about 50% of waste). Students waste eggs and meat are the least.

Food Waste Contributes to Climate Change

When we waste food, we also waste all the energy and water it takes to grow, harvest, transport, and package it. If the food waste goes to landfill and rots, it produces methane. Methane is a greenhouse gas linked to climate change even more than carbon dioxide.

Worms may be Part of the Solution

Worms can eat between half and all of their body weight in scraps per day. That means 1 pound of worms can eat between 0.5-1 pounds of scraps. Worms can eat many of the items that students often throw out especially vegetables and fruit. Composting with worms is called vermicomposting.



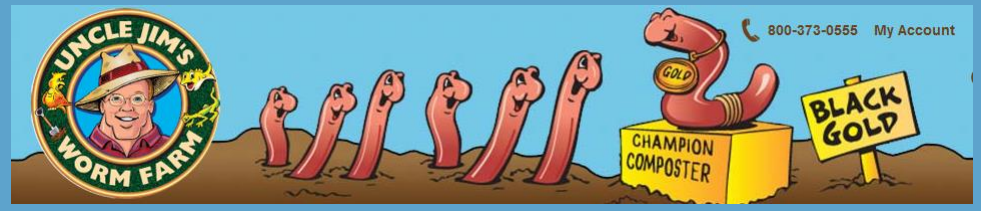
Introduction

Red Wiggler Worms are Considered the Best Composters

Red Wigglers are considered the best composters because they are tough and reproduce quickly. The worms' life cycle starts by an egg. Once they exit the egg the juveniles are eating and can be used for composting. It takes 40-60 days for a young worm to be an adult. Adult red wigglers grow to about 3- 5 inches and can live 4-5 years.

Red Wiggler Worms have very Few Needs

Red Wigglers only need food scraps, dirt, air, and moisture to survive.



Question and Predictions

We wanted to find out if worms could help us turn our lunch leftovers into rich soil for our school's gardens.

Hypothesis

Our hypothesis was that adding worms to a compost bin would help improve the efficiency of the composting process of our leftovers.

Investigative Methods

Materials

- two large plastic bins with lids
- a drill
- approximately 700 Red Wiggler Worms
- shovel
- used potting soil from school planters
- water from half empty discarded water bottles
- a sharp knife
- fruits and vegetables leftover from the cafeteria on Wednesdays
- 2 identical bowls to contain the leftovers
- a scale

Investigative Methods

Procedures

We wanted to make this as easy as possible to demonstrate how schools can easily start composting programs. The only actual measuring was at the very end.

1. **We purchased two large plastic bins with lids. We put the two bins side by side outside of our cafeteria.**
2. **An adult volunteer drilled 9 airholes in each lid.**
3. **Using a shovel we placed two large scoops of used potting soil in each of the bins.**
4. **Every Wednesday our teacher went around the lunchroom collecting the fruits and vegetables that the 4th graders would normally toss into the garbage.**
5. **On Thursday, we evenly divided the fruits and vegetables between the two bins. We would match the vegetables according to size. We would put one large baby carrot in one bin and another one the same size in the other bin. If there were an odd number of vegetables, we split the last one in half. Our teacher did cut the apples in half to make sure the two bins would have an equal amount of apples.**
6. **In the beginning the compost piles were a bit dry so we added an equal amount of water to each of the bins.**
7. **We did steps 4-6 nine times.**
8. **On the last day of our experiment (day 76), the teacher removed all of the solid fruits and vegetables from the bin. If a fruit or vegetable was partly solid, the teacher hit the fruit or vegetable against the side of the bin to remove the squishy bits. The teacher then used our health office's scale to measure the solid fruits and vegetables.**

Investigative Methods

Independent Variable

- Whether the bin had worms was the independent variable

Dependent Variables

- The amount (weight) of solid fruit and vegetables remaining at the end of the experiment

Controlled Variables

- The type of bin
- The location of the bins
- The amount of potting soil in each bin
- The amount of fruit and vegetables put in each bin
- The amount of water added to each bin

Results and Data Visualization

Fruits and Veggies Saved from the Garbage

Date	Brocolli	Apples	Baby Carrots
12/2/2021	0	7	11
12/9/2021	0	13	66
12/16/2021	0	6	55
1/6/2022	0	16	76
1/13/2022	23	15	51
1/20/2022	0	7	272
1/27/2022	0	21	728
2/3/2022	0	17	374
2/10/2022	0	22	376
Total	23	124	2009

Results and Data Visualization

Worms	No Worms
The appearance of the bin with worms on day 76 • drier, earthy smell, less flying insects 	The appearance of the bin without worms on day 76 • wetter, rotting smell, lots of flying insects 
The remaining solid fruits and vegetables from the worm bin on day 76 (13.5 lbs) 	The remaining solid fruits and vegetables from the non-worm bin on day 76 (11.5 lbs) 

Results and Data Visualization

POUNDS OF SOLID FRUITS AND VEGETABLES REMAINING IN THE BINS

Worm Bin	Non-Worm Bin
13.5 pounds	11.5 pounds

Trends

- The bin with worms had more pounds of solid fruits and vegetables at the end of the experiment.
- The bin with worms had better soil quality (aeration and smell) than the bin without worms.

Discussion and Interpretation

Overall, our experiment went well.

- We were able to collect a lot of fruits and vegetables from fourth graders on Wednesdays.
    - 23 pieces of broccoli
    - 124 apples
    - 2009 baby carrots
- In terms of the efficiency of composting our hypothesis was not supported.
    - We were surprised that the presence of the worms did not decrease the amount of solid fruits and vegetables at the end of the experiment. In fact, there was more solid fruit and vegetables (13.5 lbs) leftover in the worm bin than the non-worm bin (11.5 lbs).
- We did notice that the quality of the compost in the worm bin was much better.
    - We noticed that the bin with worms had less rotting liquid, a more earthy smell, and almost no flying insects. The soil was also more aerated and loose.
    - We noticed that the bin without worms had more liquids on the bottom. We also noticed that the bin without worms had a rotting smell and lots of little flying insects. The soil was dense and wet.
- Perhaps we just did not have enough worms or give the worms enough time to prove their effectiveness.

Implications and Ideas for Future Research

- We designed this experiment to be super easy in order to encourage other schools to start a composting program. We added fruits and vegetables, mixed the compost, and added water only once a week.
- The cost of the project was very low. The cost for each bin was only about $20. The worms were the biggest cost (about $70), but might not be completely necessary. Schools might save money by starting with less worms. We learned that the number of worms would double in about 90 days.
- If we collected food every day, not just Wednesdays, we would have made a lot more enriched soil for the gardens. We could have also collected leftovers from students in the other grades.
- If we did this project again, we would have probably bought more worms in the beginning, or done the project for more months.

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