

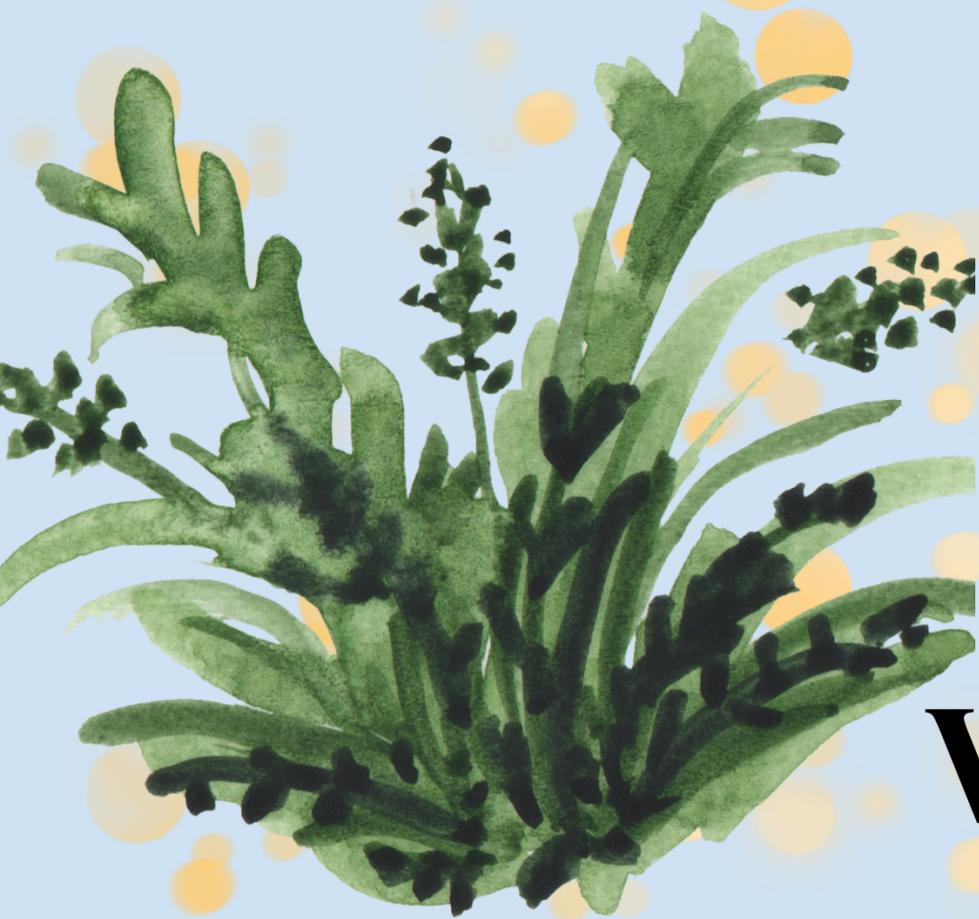
# **Grow Big or Go Home**

**Charlize Erickson**

**West Lafayette**

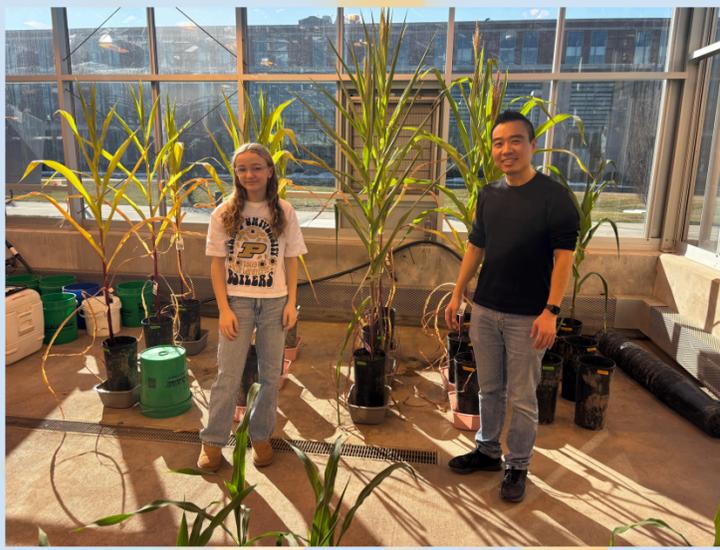
**Intermediate School**

**West Lafayette, Indiana**



# **How do the different types of fertilizers affect Soil Organic Matter, Soil Microbial Activity, and Plant Growth?**

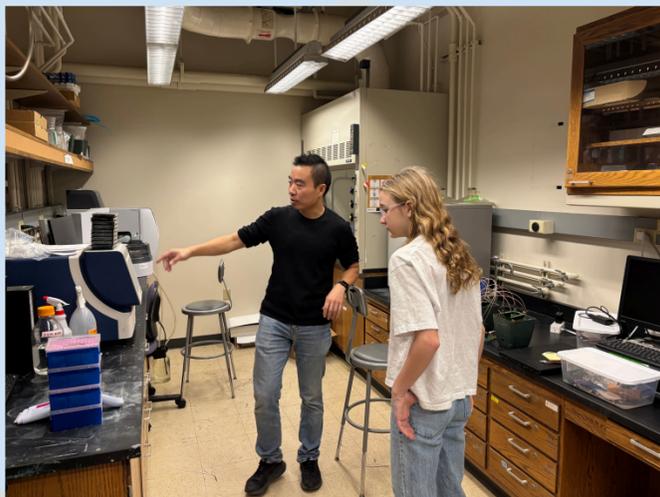
- **Purpose - How does different types of fertilizer affect Soil Organic Matter, Soil Microbial Activity, and Plant Growth? I wondered if the different types of fertilizer can help benefit soil and plant growth in positive ways, and if it does, what kind of fertilizer works best. By finding what fertilizer works best this could help agricultural workers in their selection of fertilizers. This is important because 44% of the world is used for agriculture, and these agricultural workers need fertilizer for their crops.**
- **Hypothesis - I hypothesize that natural biofertilizers containing organic matter will enhance soil organic matter, increase soil microbial activity, and thereby improve plant growth.**



# Procedures



1. Get Materials at Store
2. Put Soil into all 12 pots
3. Put Fertilizers in the soil pots
4. Wait one day to let the fertilizers set
5. Put the Cucumber Seeds into the Fertilized Pots
6. Water the pots with 7 sprays from water spray can everyday for a month
7. Get Journal and record what I changed, what I observe, and what changes for a month.
8. Get plant and soil samples and go to Purdue's Agroecology Lab
9. Let plant samples dry out for 2 days before collecting analysis and send soil sample to lab in Frankfort
10. Put a little bit of soil in a sealed container. Make sure you make a control that has water in the sealed container
11. Put plant samples in a water tray with the plant cut off and only the roots, and put them in a root scanner with a white cover on top. Repeat for every root
12. Scan roots and look at data on a computer, then put that data into an excel spreadsheet
13. Make the data into a Root Scanning Data Chart
14. Let the Licor 870 CO<sub>2</sub> analyzer warm up for about 10 minutes
15. Use the Licor 870 CO<sub>2</sub> analyzer to measure the CO<sub>2</sub> levels in each soil
16. Collect data then put in into an excel spreadsheet
17. Make a chart with the data from the analyzer
18. Get data from lab in Frankfort and make a chart
19. Put charts in final report and finish report



# Graphs

**Root Scanning Data**

<i>Sample ID</i>	<i>Date/Time</i>	<i>Length(cm)</i>	<i>SurfArea(cm2)</i>	<i>AvgDiam(mm)</i>
Control 1	2/17/26 16:03	31.2629	3.2958	0.3356
Control 2	2/17/26 15:49	56.8504	5.5545	0.311
Worm Casting 5.0mL	2/17/26 15:56	45.4192	5.8804	0.4121
Worm Castings 10.0mL	2/17/26 16:09	45.4192	2.1379	0.4024
Manure 2.5mL	2/17/26 16:06	45.4192	1.5237	0.396

**This graph shows  
the data that I got  
from the Root  
Scanner and how I  
was able to compare  
the results**

# Graphs

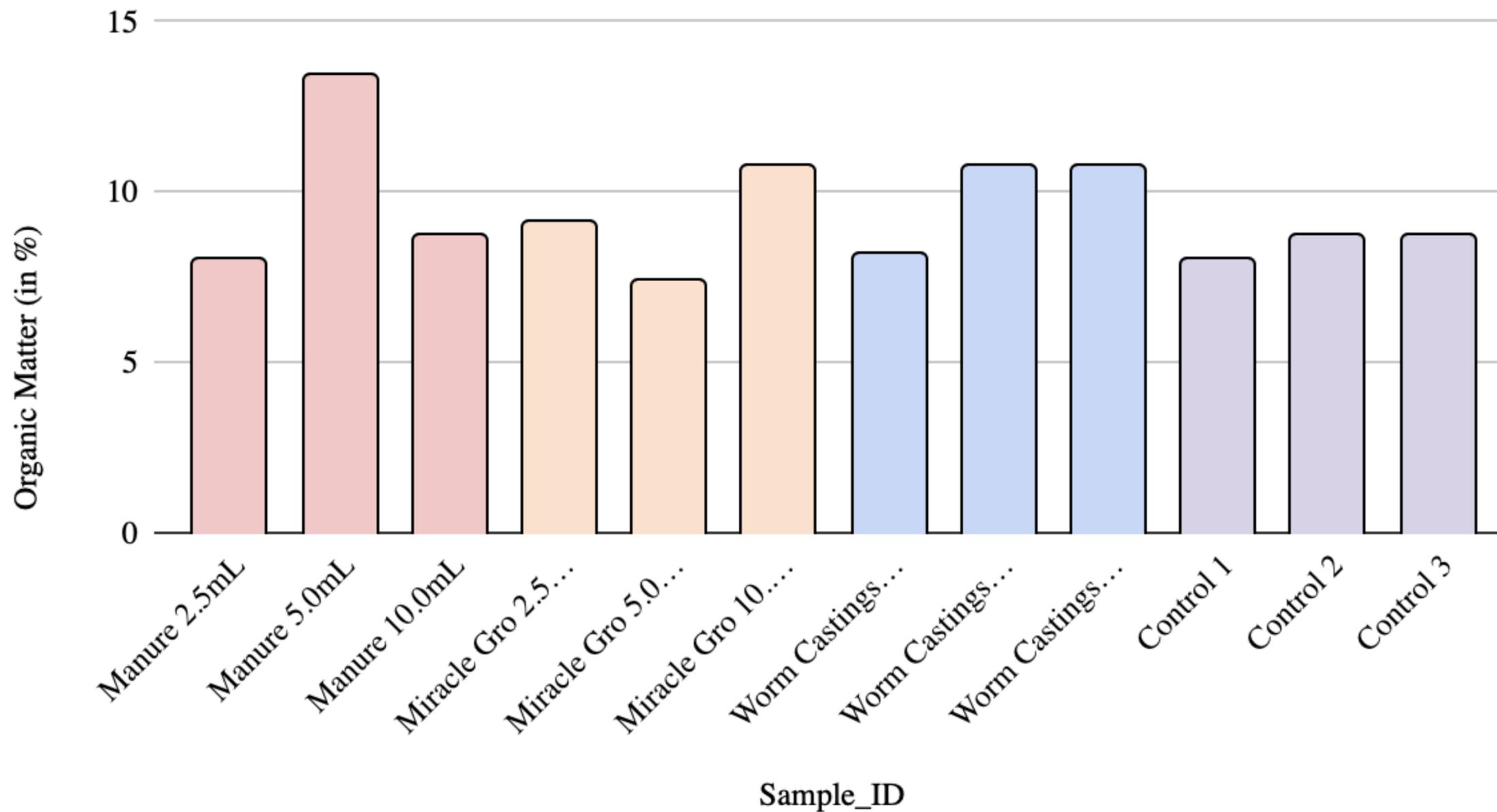
## Nutrient Table

<i>Sample ID</i>	<i>Soil pH</i>	<i>Phosphorus (extracted by Bray-1 solution) (in ppm)</i>	<i>Phosphorous (extracted by Mehlich-3 reagent) in (ppm)</i>	<i>Potassium (in ppm)</i>	<i>Magnesium (in ppm)</i>	<i>Calcium (in ppm)</i>	<i>Cation Exchange Capacity</i>
<b><i>Manure 2.5mL</i></b>	<b><i>7</i></b>	<b><i>47</i></b>	<b><i>62</i></b>	<b><i>78</i></b>	<b><i>510</i></b>	<b><i>3550</i></b>	<b><i>22.2</i></b>
<b><i>Manure 5.0mL</i></b>	<b><i>7.2</i></b>	<b><i>56</i></b>	<b><i>73</i></b>	<b><i>81</i></b>	<b><i>385</i></b>	<b><i>2850</i></b>	<b><i>17.7</i></b>
<b><i>Manure 10.0mL</i></b>	<b><i>7.1</i></b>	<b><i>98</i></b>	<b><i>126</i></b>	<b><i>139</i></b>	<b><i>475</i></b>	<b><i>3300</i></b>	<b><i>20.8</i></b>
<b><i>Miracle Gro 2.5mL</i></b>	<b><i>7.4</i></b>	<b><i>24</i></b>	<b><i>33</i></b>	<b><i>55</i></b>	<b><i>435</i></b>	<b><i>3500</i></b>	<b><i>21.3</i></b>
<b><i>Miracle Gro 5.0mL</i></b>	<b><i>7.4</i></b>	<b><i>24</i></b>	<b><i>33</i></b>	<b><i>56</i></b>	<b><i>475</i></b>	<b><i>3550</i></b>	<b><i>21.9</i></b>
<b><i>Miracle Gro 10.0mL</i></b>	<b><i>7.3</i></b>	<b><i>25</i></b>	<b><i>34</i></b>	<b><i>53</i></b>	<b><i>435</i></b>	<b><i>3400</i></b>	<b><i>20.8</i></b>
<b><i>Worm Castings 2.5mL</i></b>	<b><i>7.4</i></b>	<b><i>29</i></b>	<b><i>39</i></b>	<b><i>188</i></b>	<b><i>475</i></b>	<b><i>3550</i></b>	<b><i>22.2</i></b>
<b><i>Worm Castings 5.0mL</i></b>	<b><i>7</i></b>	<b><i>52</i></b>	<b><i>69</i></b>	<b><i>327</i></b>	<b><i>470</i></b>	<b><i>3450</i></b>	<b><i>22</i></b>
<b><i>Worm Castings 10.0mL</i></b>	<b><i>7.3</i></b>	<b><i>63</i></b>	<b><i>82</i></b>	<b><i>712</i></b>	<b><i>480</i></b>	<b><i>3350</i></b>	<b><i>22.6</i></b>
<b><i>Control 1</i></b>	<b><i>7.4</i></b>	<b><i>17</i></b>	<b><i>24</i></b>	<b><i>52</i></b>	<b><i>415</i></b>	<b><i>3300</i></b>	<b><i>20.1</i></b>
<b><i>Control 2</i></b>	<b><i>7.6</i></b>	<b><i>26</i></b>	<b><i>35</i></b>	<b><i>58</i></b>	<b><i>430</i></b>	<b><i>3300</i></b>	<b><i>20.5</i></b>
<b><i>Control 3</i></b>	<b><i>7.4</i></b>	<b><i>19</i></b>	<b><i>27</i></b>	<b><i>49</i></b>	<b><i>430</i></b>	<b><i>3300</i></b>	<b><i>21</i></b>

**This is one of the  
graphs I  
converted from  
the data I got  
back from the  
lab in Great  
Lakes**

# Graphs

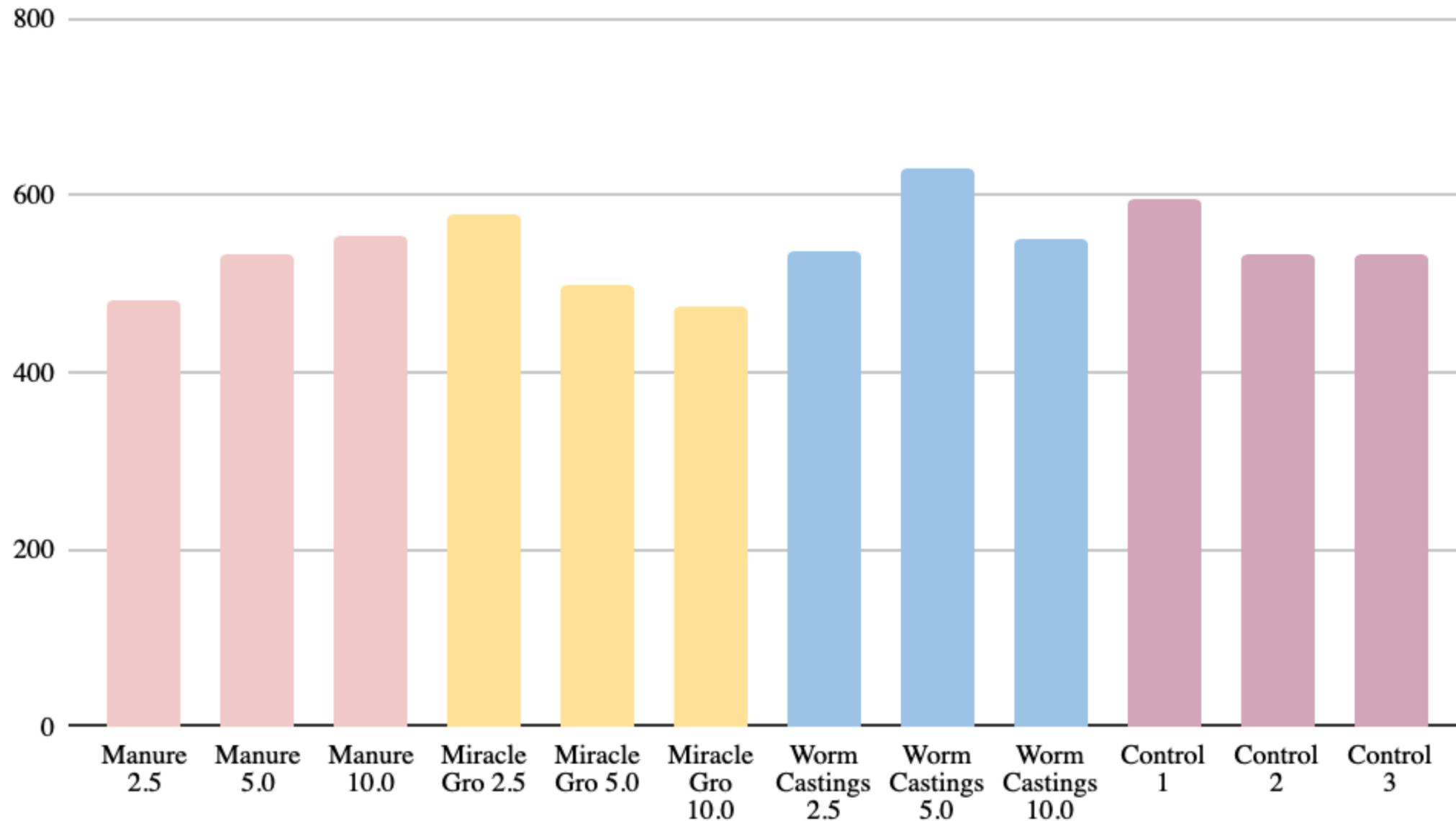
***Organic Matter Chart***



**This is another  
graph I  
converted from  
the data I got  
from the lab in  
Great Lakes**

# Graphs

*Respiration Chart*



**This chart shows which fertilizer had the best respiration levels**

# Results

- **The Root Scanning Table showed that the Worm Casting 5ml did best because it had the longest length compared to the control average, largest surface area (biggest improvement), and thicker average diameter than control.**
- **The Nutrient Table showed that the Worm Casting 10ml did best because it had highest potassium by far (712 ppm), higher phosphorus than control, strong CEC (22.6), meaning soil holds nutrients better, and healthy pH (~7.3).**
- **The Organic Matter Chart showed that the Manure 5ml had higher organic matter levels, and far exceeded the other fertilizers in the numbers.**
- **The Respiration Chart showed that the Worm Castings 5ml had a higher Respiration Level, which is good because this means that it is taking in more Carbon Dioxide.**

# Analysis

- **After drawing conclusions my hypothesis was supported. I found out that natural biofertilizers, like the worm castings and manure, were more beneficial than the Mirale Gro and the controlled test. You can see this in all charts as the biofertilizers scored way higher than the synthetic fertilizers in numbers and scores.**
- **My errors in this experiment were buying the wrong soil, spraying the plants with a spray bottle rather than using a watering can, and my plant not getting enough sunlight and warmth.**
- **Future experiments could test additional organic fertilizers such as compost or fish emulsion to see if they produce similar effects on soil health and plant growth. I could also grow different plant species, such as beans or tomatoes, to determine whether certain fertilizers work better for specific crops. In addition, a longer experiment lasting several months could be conducted to study the long term effects of fertilizers on soil organic matter and microbial activity.**

## **Works Cited**

**“AY-238.” Purdue Extension, <https://www.extension.purdue.edu/extmedia/ay/ay-238.html>. Accessed 3 February 2026.**

**Farr, Jim. “The Hidden Heroes of Home Gardens: The Importance of Soil Microbes | Over the Fence (Alameda County).” UC Agriculture and Natural Resources, 15 October 2024, <https://ucanr.edu/blog/over-fence-alameda-county/article/hidden-heroes-home-gardens-importance-soil-microbes>. Accessed 3 February 2026.**

**“Five important facts about fertilizers.” Yara, 12 October 2023, <https://www.yara.com/knowledge-grows/five-important-facts-about-fertilizers/>. Accessed 2 February 2026.**

**Ritchie, Hannah, and Max Roser. “Half of the world's habitable land is used for agriculture.” Our World in Data, <https://ourworldindata.org/global-land-for-agriculture>. Accessed 3 February 2026.**

**Zhang, Hailin, et al. “Building Soil Organic Matter for a Sustainable Organic Crop Production | Oklahoma State University.” Oklahoma State University Extension, <https://extension.okstate.edu/fact-sheets/building-soil-organic-matter-for-a-sustainable-organic-crop-production.html>. Accessed 2 February 2026.**