

# Return of the Microbes

## Soil vs. Compost & Soil Mixture

### Abstract:

For my experiment, I will be testing the difference between lettuce growth in soil compared to a mixture of soil and compost. In order to increase not only the plant health but the soil's health as well, compost is essential. When using compost, it allows more air, nutrients, microbes, as well as fewer pests. The soil is able to hold more moisture and a balance of pH. On a bigger scale, if people started to compost, we could help decrease landfill usage which then helps minimize climate change. My project will investigate if and how much better lettuce grows in a soil and compost mixture compared to the soil alone.

### Background:

Soil provides the essential nutrient plants need to grow. The type of essential nutrients and the amount of air in the soil are important because when you add compost to the soil, it acts as an amendment. Compost returns organic material to the soil which results in healthier plants.<sup>1</sup> It also helps add important nutrients which then acts as a slow-release fertilizer that is natural for plants and microbes. Compost increases the population and diversity of soil microbes.<sup>2</sup> Being able to take scraps and turn that into a healthier alternative for plants can save a lot of money. Aside from not having to buy planting soil from the store, when you create and use your own compost, it is able to retain more moisture concluding in not having to water it as much so you can save water. When you mix compost into the soil, it has been scientifically proven that it has many benefits. A few of these benefits are, it reduces and prevents pests and diseases at the same time as increasing soil life. It also helps balance pH in the soil which then results in a decrease in plant stress. Lastly, compost assists soil by improving its structure so that their roots can easily expand and access nutrients.<sup>3</sup> In the article "The Benefits of Using Compost in Your Garden," it sites the U.S. Composting Council saying that when you use a decent amount of compost, it has both immediate and long-term positive impacts on the soil structure. This allows humus proteins to bind the soil particles together. This allows the soil to resist compaction as well as an increase in its ability to hold moisture and nutrients.<sup>4</sup>

---

<sup>1</sup> <https://mcgillcompost.com/blog/compost-products-and-use/topsoil-mulch-compost-difference>

<sup>2</sup> <https://anrcatalog.ucanr.edu/pdf/8367.pdf>

<sup>3</sup> <https://themicrogardener.com/how-to-use-compost-and-7-benefits-of-composting/>

<sup>4</sup> <https://earth911.com/home-garden/garden-compost-benefits/>

## Significance:

There are so many benefits to compost that it almost becomes a cycle. Using homemade compost minimizes the need to buy chemical fertilizers. Both chemical fertilizers and compost supply basic nutrients like nitrogen, potassium, and phosphorus, but compost also holds trace minerals and other nutrients that the fertilizer doesn't. Compost can not only help your health and save money, but it also helps the environment. We have a big problem spending money on landfills to make sure that the trash dumped doesn't get into our air, land, and water. It has come to spending several hundred millions of dollars building pipes, liners, and machines that capture gas. Because we are throwing so much away, the landfills are filling up, ending up with us needing more space for more landfills, but it is getting tougher to not get them denied of the fact that nobody wants one in their backyard. 80% of our "trash" can either be re-used, recycled or composted, resulting in not having to throw nearly as much away, saving space and money.<sup>5</sup> When people don't compost all perfectly compostable food scraps, it builds up and can create greenhouse gas which is 21 more times potent than carbon dioxide. When composting does occur, that helps minimize landfills' contribution to climate change.<sup>6</sup> In conclusion, when you compost food scraps instead of throwing them away, it makes a healthier environment as well as healthier soil and food. Composting reduces carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). Nationally, the amount of food being composted rose from 1.84 million tons in 2013 (5% of food) to 2.1 million tons (5.3% of food) in 2015.<sup>7</sup> My research will be focused on growing and comparing lettuce grow in plain soil from the Old Fort Lewis farm and the same soil but with compost that my family made mixed into it.

---

<sup>5</sup> <https://www.youtube.com/watch?v=ufsbrz8IRgY>

<sup>6</sup> <https://homeguides.sfgate.com/composting-helps-environment-23577.html>

<sup>7</sup>

<https://www.epa.gov/sustainable-management-food/reducing-impact-wasted-food-feeding-soil-and-composting>

## Methods:

**Plants:** For my experiment, I am using lettuce. More specifically, I will be using Muslim lettuce seeds. I chose lettuce because it grows fast, can be planted easily and in a condensed way, and is a healthy and nutritious food option.

**Control Group:** Will be grown in original soil from the Old Fort Lewis Farm

**Experimental Group:** Will be grown in a mixture of soil from the Old Fort Lewis Farm compost made on my farm.

**Question:** How does adding compost to the soil affect the growth of lettuce?

**Null hypothesis:** There is not a difference between how well lettuce grows when using plain soil and a mixture of soil and compost.

**Alternative Hypothesis 1:** Lettuce will grow larger in the compost & soil mixture compared to the regular soil.

**Alternative hypothesis 2:** Lettuce will grow larger in the regular soil compared to the compost & soil mixture

## Planting Conditions:

**Sample size:** 20 plants for each type of soil, 40 plants in total

**Planters:** I am going to build two planters out of cardboard and duct tape and then line it with plastic

**Placement:** I am going to put both of my planters on a metal shelf

**Watering schedule:** Lettuce is supposed to be watered every 4-5 days so I am going to water my plants Mondays and Fridays between 10:00 and 11:00 am.

**Amount of water:** In order for lettuce to grow the best it can, when watered you are supposed to soak the first 6 inches of soil.

**Lighting times:** I will use grow lights while growing my lettuce. Grow lights consist of 15 Red/ 7 Blue/1IR/1UV/ 2 White/ 2. In order to make sure my plants get enough light, I am going to keep the grow light on 24/7.

**Temperature:** Lettuce can withstand temperatures ranging between 40 degrees to 85 degrees Fahrenheit, which we will keep the classroom I am growing it in monitored.

**Data Collection:**

**Measuring Leaf Length:** In order to collect data throughout my experiment, I am going to measure each leaf when it starts growing out of the soil. I will compare the process of lettuce leaf growth in the end. I am also going to take the biggest leaf's from each of the 40 plants and create an average for both of the different soils.

**Recording Table:**

	Week 1 Plant Length (cm)	Week 2 Plant Length (cm)	Week 3 Plant Length (cm)	Week 4 Plant Length (cm)	Week 5 Plant Length (cm)	Week 6 Plant Length (cm)	Week 7 Plant Length (cm)	Week 8 Plant Length (cm)
C <sub>1</sub>								
C <sub>2</sub>								
C <sub>3</sub>								
.....								
S <sub>1</sub>								
S <sub>2</sub>								
S <sub>3</sub>								
.....								

**Analysis Table:**

//////////////////// /	Plants in Compost	Plants not in Compost	Total
Plant leaf length above (8 cm)	2	0	2
Plant leaf length below (8 cm)	18	20	38



## Sources:

1. <https://mcgillcompost.com/blog/compost-products-and-use/topsoil-mulch-compost-difference>
2. <https://www.youtube.com/watch?v=UgtYSJq0lko>
3. <https://themicrogardener.com/how-to-use-compost-and-7-benefits-of-composting/>
4. <https://www.gardeningknowhow.com/composting/basics/garden-compost-benefits.htm>
5. <https://earth911.com/home-garden/garden-compost-benefits/>
6. <https://www.planetnatural.com/composting-101/soil-science/compost-soil/>
7. <https://www.backyardboss.net/compost-vs-topsoil/>
8. <https://www.growveg.com/guides/the-pros-and-cons-of-cultivating-soil/>
9. <https://tendingmygarden.com/soil-test-the-pros-and-cons/>
10. [http://makedirtnotwaste.org/sites/default/files/composting\\_factsheet\\_0.pdf](http://makedirtnotwaste.org/sites/default/files/composting_factsheet_0.pdf)
11. <https://homeguides.sfgate.com/composting-helps-environment-23577.html>
12. <http://www.lhpowerandlight.org/benefits-of-composting.html>
13. <https://www.planetnatural.com/composting-101/environmental-issues/>
14. <https://anrcatalog.ucanr.edu/pdf/8367.pdf>
15. <https://www.epa.gov/sustainable-management-food/reducing-impact-wasted-food-feeding-soil-and-composting>
16. <https://www.epa.gov/recycle/composting-home>
17. <https://www.youtube.com/watch?v=ufsbrz8IRgY>
18. <https://www.youtube.com/watch?v=joYIbQIeYR0>
19. <https://www.youtube.com/watch?v=n4Ph7bWFwSk>
20. <https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/ecs2.1270>
21. <http://www.portlandediblegardens.com/blog/2017/1/19/compost-the-perfect-amendment>
22. <https://www.sunset.com/garden/garden-basics/improving-soil-structure>
23. <https://m.extension.illinois.edu/homecompost/science.cfm>

**Approval:**

Summer Sanford \_\_\_\_\_

Date: \_\_\_\_\_

Dan Thurbur \_\_\_\_\_

Date: \_\_\_\_\_