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Research Paper

Growth response of cucumber in different solid organic waste materials

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ABSTRACT

The study aims to investigate the effect of various organic waste materials on the growth of cucumber plants. The study is motivated by the increasing need for sustainable agricultural practices and the potential use of organic waste as a source of nutrients for plant growth. The experiment will be conducted using a randomized complete block design with three treatments: food scraps, animal manure, yard waste. Cucumber seeds will be sown in pots filled with soil mixed with the respective organic waste material. The growth parameters such as plant height and length of leaves will be measured at regular intervals. It is hypothesized that cucumber plants grown in soil amended with organic waste materials will exhibit better growth compared to those with no fertilizer. This hypothesis is based on previous studies that have shown the positive impact of organic waste on plant growth due to its nutrient content. The results obtained from this research will contribute to our understanding of the potential use of different organic waste materials as a sustainable alternative to synthetic fertilizers in agriculture. It may also provide insights into effective methods for recycling and managing organic waste for agricultural purposes.

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1. INTRODUCTION

1.1 Background of the Study

The effective use of organic waste has a significant impact on a plants' growth. Organic waste is biodegradable materials that can decompose naturally, it is the byproduct of living organisms. Items such as

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food scraps, yard waste, and agricultural residues are examples of organic waste [1]. It is distinguished by its ability to be broken down by micro- organisms like bacteria and fungi which plays a vital role in the decomposition process [2]. This organic waste can be recycled through the composting process to create valuable soil amendments under controlled conditions to create nutrient-rich compost, a valuable soil conditioner and fertilizer. Plants can benefit greatly from organic - waste. It offers the vital elements that plants require to develop healthily and robustly, including nitrogen, phosphorus, and potassium. Organic waste makes the soil more breathable and water- retentive, which benefits plant growth. It can aid in reducing pests and diseases as well as enhancing the soil's capacity to store carbon, which reduces the effects of climate change [3].

There's a chance that plants exposed to organic waste will generate more fruits, vegetables, or flowers. This is particularly apparent in crops where productivity is greatly impacted by nutrient availability. Through better aeration and increased water-holding capacity, organic waste strengthens the structure of the soil. As a result, the environment is more conducive to root growth and nutrient uptake. Beneficial bacteria and fungus are among the microorganisms found in organic waste. These microbes aid in the further breakdown of organic matter and release nutrients in a form that plants can easily absorb. Compost and other organic waste products have the potential to help plants resist disease. They encourage the development of advantageous bacteria that pose a threat to hazardous diseases.

Organic waste plays a pivotal role in sustainability, primarily from the perspective of nutrient recycling and its contribution to agriculture and horticulture. Organic waste management is integral to building a more sustainable society. It embodies resource principles of circular economy, reduces waste, conserves resources, supports agriculture, and mitigates climate change. As awareness of these benefits grows, there is increasing emphasis on the responsible handling and recycling of organic waste in pursuit of a more sustainable future.

Organic farming has experienced rapid growth and widespread recognition in recent years, despite occupying just 1% of the global agricultural area. The organic label is highly regarded, and a significant portion of the population in developed countries now incorporates organic food into their diets. However, the term "organic" can be subject to various interpretations within the sector. Different actors, including farmers, consumers, and regulatory bodies, may have varying perspectives on what constitutes organic farming practices. This diversity of interpretations often centers on principles such as avoiding synthetic chemicals, promoting sustainability, and prioritizing soil health and biodiversity. As the organic farming sector continues to expand, bridging these interpretations and maintaining the integrity of organic standards will be essential to ensure consumer trust and the continued growth of sustainable agricultural practices [4].

1.2 Objectives of the Study

The researchers aim to assess the feasibility of different solid bio-waste materials to the growth response of cucumber.

Specifically, the study aims to:

1. Assess the nutrient composition of various solid bio-waste materials.
2. Measure cucumber growth parameters such as height, and leaf area to determine the impact of different bio-waste materials on plant development.
3. Analyze the nutrient uptake efficiency of cucumber plants when grown with different bio-waste materials, providing insights into the plant's ability to utilize available nutrients; and
4. To enhance our understanding of sustainable agricultural practices by exploring the potential of utilizing bio-waste materials as organic fertilizers for cucumber cultivation [5].

1.3 Significance of the Study

The researcher believes that this study will not only yield data that will be helpful to her, more so to the following groups of people: FOR FARMERS. The study provides valuable insights into how organic waste materials can be used as a low-cost and environmental-friendly source of nutrients, farmers may be able to improve the growth and productivity of their cucumber crops. This can lead to increased yields and profitability.

- **For Teachers:** The study provides teachers with valuable resources to support their teaching and engage their students in the exploration of sustainable agriculture practices.
- **For Parents**: This information can be helpful for parents who are interested in exploring alternative sources

of fertilizer for their home or community gardens. Parents may be able to improve the growth and productivity of their cucumber crops.

- **For Students:** Students can gain valuable skills and knowledge that they can apply to their own gardens and agriculture projects. By examining the growth responses of cucumber plants in different organic waste materials, students can gain valuable knowledge about the nutrient requirements of plants and how organic waste materials can meet those needs.
- **For Future Researchers:** This information can be used by future researchers to develop sustainable and environmentally friendly crop cultivation practices. By exploring the growth responses of cucumber plants in different organic waste materials, future researchers can gain valuable insights into the nutrient requirements of plants and how organic waste materials can meet those needs [6].

1.4 Scope and Delimitation

The scope of this research involves a comprehensive investigation into the effects of various bio-waste materials, including composted kitchen scraps, organic yard waste, and animal and plant residues on the growth parameters of cucumber plants. This study will focus on assessing factors such as plant height, leaf area, fruit yield, and nutrient content in the soil. However, this research will be delimited to the specific variety of cucumber under study, the local climate conditions of the research area, and a limited duration of the experiment. The researchers will compare each bio-waste material, whether the food scraps, animal and plant residues will have a better effect on the growth of the cucumber. This research will not examine the detailed chemical analysis of the bio-waste materials but will only concentrate on their overall impact on cucumber growth.

1.5 Theoretical Framework

This study is anchored to the study of [7] which entitled Response of Cucumber (Cucumis Sativus L) to Waste Wood Fiber Substrates and Additional Nitrogen Fertilization, stated that the best growth was seen when the plants were grown on PS, as opposed to plants grown on other growing media without additional compensatory nitrogen fertilization, using conventional fertilization (CF). This was true when the cucumber biometric parameters were evaluated in different growing media and at different nitrogen fertilization rates. At the start of flowering, plants raised on WF were 1.4 times shorter than those grown on PS and 1.6 times shorter than those grown on WF and PS blends. When cultivated in PS with N23 nitrogen fertilizer. As opposed to when they were grown without additional fertilization, the plants were 24% shorter at the start of flowering. The increased nitrogen fertilization had no appreciable impact on the cucumbers' height 27 days after transplanting, even though the greatest rate of N30 tended to encourage vegetative development.

2. RELATED WORK

Vermicomposting, facilitated by compost earthworms, has the capability to produce structures utilizing a wide array of organic waste types, provided proper preprocessing and regulated environmental conditions are adhered to. The quality and ultimate characteristics of the resulting vermicompost, which serves as a medium conducive to plant development, are markedly influenced by the specific organic waste materials from which they originate. Substantial evidence supports the notion that vermicompost fosters plant growth both in natural field environments and within controlled greenhouse settings.

Composts, known as vermicompost, produced through earthworm activity, can utilize diverse organic waste sources under appropriate preprocessing and regulated vermicomposting conditions. The attributes and efficacy of vermicompost, suitable for fostering plant growth, hinge upon the nature of the initial organic waste materials utilized. Compelling evidence suggests that vermicompost significantly stimulates plant growth, whether in outdoor agricultural settings or within controlled indoor environments [8].

One particularly noteworthy vegetable crop, highly esteemed for its economic significance and nutritional value, is the cucumber (Cucumis sativus L.). Utilizing organic waste materials as soil supplements has garnered attention for its potential to enhance plant development while mitigating environmental degradation. The importance of sustainable agricultural practices continues to rise, underscoring the need for studies exploring the effects of various organic waste components on cucumber growth.

This study aims to explore the impact of waste materials on the growth of cucumber plants. Our null hypothesis posits that there will be no discernible disparities in growth parameters such as plant height, leaf area, and fruit production—among groups of cucumber plants subjected to different organic waste treatments. Any observed deviations in these growth parameters are attributed solely to stochastic fluctuations inherent in biological systems, without direct causal links to the organic waste materials utilized in our study [9].

Conversely, the alternative hypothesis, representing the central conjecture, suggests that significant and distinguishable variations in growth parameters will emerge among different groups of cucumber plants exposed to various organic waste treatments. Attributing observed disparities in growth parameters solely to random fluctuations in biological systems would overlook the meticulous scientific methodology employed.

Rather, we contend that the type and composition of organic waste materials indeed exert substantial influence on the growth trajectories of cucumber plants [10]. This study asserts that any deviations in growth outcomes stem from systematic effects associated with the organic waste treatments under investigation, rather than mere manifestations of random variability. It anticipates that cucumber plants' responses to different organic waste materials will exhibit recognizable and distinct patterns.

3. METHODOLOGY

Table 1. Tools and Materials Used in the Experiment

Materials		
Shovel	Used for Digging and Moving the Soil	
Measuring Tools	Utilized to Measure the Height and Growth of the Cucumber	
Cucumber Seed	Is the Participant of the Experiment	

Food Scraps	One of the Fertilizers Used for the Experimentation	
Animal Manure	One of the Fertilizers Used for the Experimentation	
Yard Waste	One of the Fertilizers Used for the Experimentation	

3.1 Process

The researcher would design a controlled experiment with different groups of cucumber plants exposed to different organic waste treatments. This would involve randomly assigning cucumber plants to each treatment group to ensure unbiased results. The researcher would apply the organic waste treatments to the respective groups of cucumber plants according to the experimental design. This could involve applying different types of organic waste materials such as food scraps, animal residues, or plant residues.

Throughout the duration of the experiment, the researcher would collect data on various growth parameters of the cucumber plants. This would include measuring factors such as plant height, leaf area, fruit yield, and potential nutrient content in the soil [11].

The collected data would be recorded systematically, either on data collection sheets or using digital data logging devices. Accurate measurements and observations would be recorded for each group of cucumber plants and corresponding organic waste treatment. The researcher would interpret the results of the data analysis and draw conclusions based on the observed patterns and statistical significance. The researcher would evaluate whether the organic waste materials had a significant impact on the growth of cucumber plants and discuss the implications of the findings.

4. RESULTS AND DISCUSSION

The research results are presented, along with their significance analysis. The conversation then delves into interpretation, comparison with previous studies, shortcomings, and wider implications, enhancing our understanding of the study findings and their wider relevance within the current knowledge corpus.

4.1 Prototypes

This study investigated the differential growth response of cucumber seedlings (Cucumis sativus

L.) to three types of solid bio-waste fertilizers: food scraps, yard waste, and animal manure. Seedlings were randomly assigned to each fertilizer treatment and monitored for growth parameters, including height.

Within the food scraps and yard waste treatments, significant height disparities were observed among individual seedlings. Plant B in the food scraps treatment demonstrated the greatest height (17 inches), while Plant A in the yard waste treatment achieved the maximum height of 18 inches. The growth response of seedlings differed across the three fertilizer treatments. Food scraps and yard waste exhibited variability in seedling height, suggesting differential nutrient availability or utilization by individual plants. In contrast, the seedlings fertilized with animal manure displayed remarkable uniformity in height (5 inches for all three plants), indicating a more consistent nutrient profile in this type of bio-waste [12].

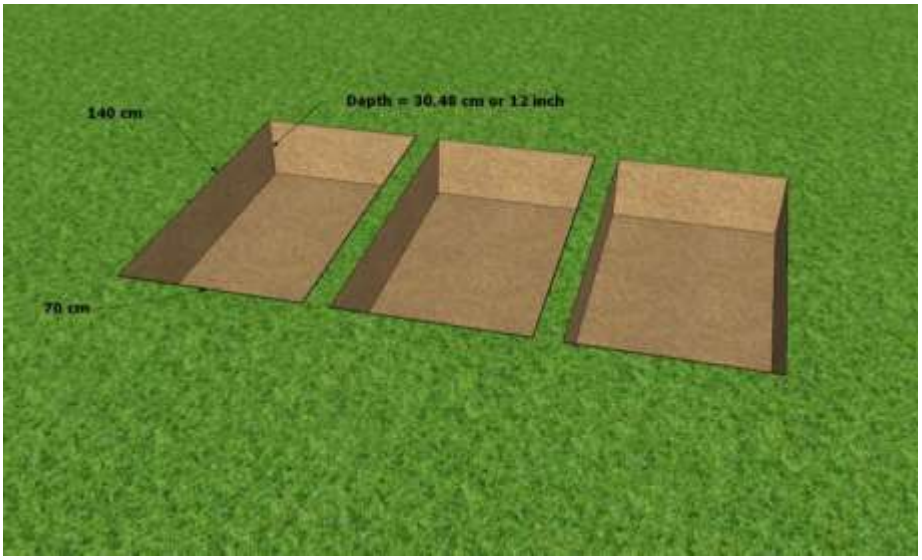

Figure 1. Organic Waste Composting Pit Layout

4.2 Table Output

Table 2. Growth of Cucumber after 30 Days (Food Scraps)

1st Plot	Height of Plant (inch)	Length of Leaves(inch)
Plant A	13	4
Plant B	14	4
Plant C	12	4

Table 3. Growth of Cucumber After 30 Days (Animal Manure)

2nd Plot	Height of Plant(inch)	Length of Leaves(inch)
Plant A	3	2
Plant B	3	2
Plant C	3	2

Table 4. Growth of Cucumber after 30 Days (Yard Waste)

3rd Plot	Height of Plant(inch)	Length of Leaves(inch)
Plant A	16	5
Plant B	1	1
Plant C	-	-

5. CONCLUSION

In the plot where food scraps were used as fertilizer, all three grew although the growth were not equal, they had almost correspondent progress of growth. While the plants were growing, it hardly had an

issue cultivating. This plot showed more favor able findings compared to the other plots.

For the second plot (animal manure), all three plants had an equal growth. They showed a coordinated growth but during the second week, the leaves of all three plants had holes in them indicating the appearance of pests during cultivation. Out of all three plants, the plants in the Animal Manure plot were the only ones that were affected heavily due to pests. In comparison to Food Scraps, the plants in the Animal Manure plot were smaller in terms of height. This suggests that the appearance of pests might have hindered the growth of plants.

5.1 Summary of Findings

Based on the analysis of the data, these are the following findings of the study.

- As seen in chapter 3, Table 2, the change in height, and leaf growth of the plant is significant. It indicates the impact of food scraps (a solid bio-waste materials) used as a fertilizer on the plants' development. This data could reveal the effectiveness of these materials as growth enhancers or inhibitors, offering insights into their potential use in agriculture or horticulture practices.
- Plot #2, treated with animal manure as fertilizer exhibited a higher incidence of leaf tearing in the seedlings compared to plots treated with other solid bio-waste materials (food scraps and yard wastes). This observation suggests a potential relationship between the elevated bacterial content in animal manure and the leaf damage.
- Table *4* showed plant A (shows) a promising initial growth, reaching a height of 18 inches with leaves already spanning 5 inches. Plant B, while smaller in overall size, still exhibits some growth with a 3-inch height and a matching leaf length. Unfortunately, Plant C hasn't shown any growth. A possible reason could be lack of sunlight and excessive plant-watering.
- Within the food scraps and yard waste treatments, significant height differences were observed among individual seedlings. Plant B in the food scraps treatment demonstrated the height (14 inches), while Plant A in the yard waste treatment achieved maximum height of 18 inches. The growth response of seedlings differed across the three-fertilizer treatment. Food scraps and yard waste exhibited variability in seedling height, suggesting differential nutrient availability or utilization by individual plants. In contrast, the seedlings fertilized with animal manure displayed remarkable uniformity in height (5 inches for all three plants), indicating a more consistent nutrient profile in this type of bio-waste.

5.2 Recommendations

While elevated bacterial content in animal manure could be detrimental to plant health, our observation suggests that the environmental factor like insufficient sunlight and over watering may also play a significant role in the observed leaf damage and the Plant C seedling of yard waste experienced no development. Therefore, a holistic approach considering both biological and environmental influences is recommended for further investigation. We recommend Botanists to investigate the plant- microbe interactions in bio waste-amended soils: Research the specific microbial communities associated with different bio waste materials and their influence on cucumber root systems and nutrient intake. For Agriculture, conduct field trials to verify the observed effects of different bio-wastes on cucumber growth under real-world conditions, including varying sunlight and water availability. This would provide more accurate data for agricultural decision-making. This research lays a crucial foundation for future researchers by providing a comprehensive understanding of the growth of cucumbers to different bio waste used a fertilizer. Building upon this knowledge, they can delve deeper into the potential relationship of elevated bacterial content of animal manure and the leaf growth of cucumbers.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Blessy G. Rubillos	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓	✓
Kazel Geian Ponio	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
Jear Claudette M. Pendon		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Janis Krishna C. Ondap	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study and their voluntary consent was obtained prior to data collection.

Ethical Approval

Not Applicable.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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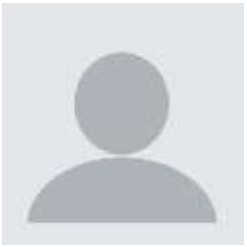	**Janis Krishna C. Ondap,** is an educator researcher who is affiliated with the Association of Science and Mathematics Coaches of the Philippines, and also with the Philippine Association of Teachers and Educational Leaders. She spends time doing agricultural, and environmental research that is mostly about sustainable plant growth, plus orgaic waste management too. What stands out in her work is the way she tries to blend hands on science education with agricultural sustainability, like in a practical sense. She also works in collaborative educational organizations, and from there she helps push science teaching and related research, in the Philippines. Email: pendonjearclaudette@gmail.com