وقائع المؤتمر العلمي السنوي الثالث لكلية التربية الاساسية
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The Importance of Recycling Household Organic Waste

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Abstract

Plant waste has become a major burden and an unhealthy phenomenon, both for the environment and public health. Many countries have begun working to convert this waste into organic fertilizer, which has economic and vital value for the soil. Organic fertilizer made from this waste provides the necessary mineral elements that the soil needs, especially in our current time, where the soil has become poor in organic materials for many reasons

The use of chemical fertilizers, in addition to their high prices, threatens human health and is one of the main causes of various types of cancer, such as thyroid cancer and other diseases. Therefore, the research aims to reduce the use of chemical fertilizers and adopt organic fertilizers resulting from the decomposition of household waste, due to their great benefits, whether by increasing soil fertility or reducing environmental pollution

The main objective of this research is to produce a cheap organic fertilizer rich in organic materials and microorganisms necessary to increase plant growth and soil fertility through the organic decomposition of household waste in a period not exceeding three months. In this study, we relied on the descriptive and quantitative method to measure the percentage of minerals present in the compost that was made at home from plant remains and waste

home where it was fermented in semi-aerobic conditions with humidity and appropriate temperature. The mineral content of the compost was higher than that of the soil, containing iron (3328 ppm), calcium (13553 ppm), potassium (2126 ppm), magnesium (1052 ppm), nitrogen (483 mg/kg), and phosphorus (768 mg/kg). Microorganisms present in the compost were also identified depend on morphological characteristics, like *Bacillus subtilis* , Staphylococcus Spp. and Rhizobium bacteria. Some fungi were also identified, such as Penicillium, *Aspergillus niger*, and *Mucor piriformis*.

Keywords: Compost, Mineral, Microorganisms, Recycling, Household Organic Waste

1. Introduction

The problem of food and population growth has become one of the problems of our time.

[Mahanty et al., 2017; Suryanto et al., 2023]. Therefore, increasing food crop production is a necessary solution to address the problem of overpopulation [Ahmed, 2023]. To increase agricultural crop productivity, manufactured chemical fertilizers have been widely used. This excessive use has led to damage to human health and the environment. [Soleimani et al., 2023 ; Khatun et al., 2022].

Composting technology involves producing organic fertilizer containing essential nutrients for the soil by recycling food waste. This organic fertilizer has a high concentration of organic matter, up to 95%, and also contains phosphorus, nitrogen, and other nutrients necessary for the soil. These composting activities are comparable to peat moss in improving soil composition and are also considered a form of organic waste recycling, given that organic matter in landfills can reach up to 30%. This composting process transforms foul-smelling, damp waste into a pleasantly scented material rich in soil nutrients. [Knight, 1997].

Producing organic fertilizer from agricultural waste is a promising option for disposing of waste in a healthy way without side effects. [Moretti, 2015]. This fertilizer is a dark brown soil resulting from the aerobic decomposition of agricultural waste, rich in large and small organic materials [Baruah and Srivastava, 2015]. Compost not only improves soil fertility in terms of

micro- and macronutrients, but it also increases its ability to retain water and air, thus contributing to better plant growth [Ingrao, 2016]. This technology, in addition to its benefit in waste disposal, has proven to increase plant absorption of organic matter, enrich the soil with essential nutrients, improve crops, and enhance soil physical indicators. [Ahmad et al., 2007; Manna and Singh, 2018]. The use of fertilizer has proven highly effective in reducing environmental pollution and improving soil quality. [Oyetunji et al., 2022].

Fertilization is the process of converting organic materials such as twigs, leaves, food scraps, and other organic matter by microorganisms in the soil into simpler organic compounds that are easily absorbed by plants. This process takes place under controlled conditions of temperature and humidity. [Baruah and Srivastava, 2015; Qian et al., 2023]. This process can be carried out in an underground pit or in special containers. [El-Desuki et al., 2010]. The key factors that must be controlled are temperature, humidity, pH, and the quality and type of organic materials to ensure the efficiency of the fertilization process. [Baruah and Srivastava, 2015]. One of the most important factors to consider in the fertilization process is the carbon-to-nitrogen ratio (N/C), which is essential for plant growth. Fertilizer is also important in improving the physical and chemical properties of the soil. [Tumuhairwe and Tenywa, 2018]. One of the problems facing the application of compost is the long preparation time and its effectiveness in supplying plants with the necessary organic materials compared to synthetic fertilizers. [Manna and Singh, 2018]. Several reports have been published on converting agricultural organic materials into organic fertilizers, which contribute to improving plant growth and increasing soil effectiveness. In addition, many experts around the world have proven the effectiveness of microbial communities and plant diversity. [Osman et al., 2022 ; Mahapatra et al., 2022].

This review examines the benefits and properties of biofertilizers based on the fermentation of organic materials from agricultural waste in the presence of microorganisms that contribute to the fermentation process under controlled conditions of temperature, humidity, and aeration to obtain compost rich in living organisms and organic matter. Beneficial for plant

growth, this represents a promising alternative to chemical fertilizers. Using this fertilizer offers significant benefits in enhancing soil sustainability and increasing overall plant productivity.

2-Materials And Methods

2.1.Compost production

Select food waste from home, recycle it, and use it as fertilizer to improve the soil, instead of the fertilizers offered in the markets, which are characterized by their high prices and the presence of some chemicals that are hazardous to the environment. The semi-aerobic fermentation method was tried to obtain compost from food scraps at home. The high temperature in the summer, the low humidity, and the wind were exploited, as these factors help in accelerating the fermentation and decomposition process. The wind is also hot and dry, which is beneficial and contributes to accelerating the fermentation of waste. These factors contribute to the production of compost at home without the need for special ovens. In winter, compost production requires environmental conditions such as high temperatures and good ventilation.

2.2 Steps for making compost:

1- Collect household waste (vegetable and fruit scraps, tea and coffee grounds, and food scraps) as shown in Appendix 1 and place it in a container designated for collecting household waste.

2- Prepare the compost container, which is usually made of plastic or any perforated material. Make holes on all sides to ensure good ventilation, as well as on the bottom to remove excess water during composting. Also, make holes in the lid for ventilation.

3- To prepare the compost: Place dry leaves, used papers, and even tissue papers at the bottom of the container. This is the first step in getting rid of waste at home or even papers in government offices. These leaves are placed after being cut into small pieces to ensure the fermentation and decomposition process is accelerated. Then, a layer of various household waste, also cut, is placed on top of them, followed by a layer of soil. This is because the soil speeds up the decomposition process, then a layer of waste is placed on top of the soil, then a layer of soil, and this is until all the waste

is complete. The last layer is either tree leaves or sawdust left over from lumber factories or used papers, as these are considered a source of carbon, the basic element in compost.

4- After completing the layers, add water to the container and close it with the perforated lid 5- The turning process is done once every two days, and after 3-4 days the decomposition process begins, with the presence of a foul odor resulting from the decomposition. During the fermentation period, the temperature of the compost will rise to 60 degrees Celsius, and we will notice the swelling of the food waste. After a period of time and continued stirring, the swelling will decrease, which will last for 10-11 weeks. We will obtain the compost in approximately week 12, and it will be ready for use. [Page et al., 1982] . shown in Appendix 1 . Characteristics of this compost produced in this way: - It is odorless, black in color, and insect-free. - It requires sifting to obtain a smooth, easy-to-use product. - It contains the following chemical compounds:

2.3. Nutrient content testing in soil and compost

The nutrient content of the soil used for agriculture was tested before and after adding fertilizer using specialized equipment. The concentrations of organic elements(k ,ca , fe , mg) were estimated using atomic spectroscopy. The nitrogen content was measured using a Kjeldahl apparatus. [Sposito et al., 1983]

2.4. Characterization of microorganisms in soil and compost

Colonies were identified using selective medium according to phenotypic traits as shape, color, and smell. The bacteria were studied under a light microscope after staining with Gram stain to determine their shape and distinguish between positive and negative bacteria.[AOAC, 1983]

2.5.Plant growth testing before and after adding compost

In this experiment, tomato seeds were planted in a soil mixture. Observations were made about plant growth in terms of plant mass and fruit size before and after adding compost.

3.Results And Discussion

3 .1 . The effect of nutrient accumulation in soil before and after adding compost

The results of the nutrients in the soil used in agriculture and in the compost, as in (Table 1), showed that the percentage of these elements in the compost was higher than in the normal soil, which provides a fertile environment for better plant growth due to their effective role in the metabolic processes in the plant. The elements contributed to improving the growth of tomato plants in terms of mass and fruit size, as shown in Appendix 1. We observe a clear increase in organic matter in the compost, and this is normal because it results from the aerobic decomposition of organic matter present in the waste. This is consistent with a study [Garcia et al,2009] . We also note that the potassium content is high in compost, which is an important percentage for plant growth, accelerating woody growth and maturity, and resistance to environmental factors. This is consistent with the study [Gopinathan and Thirumurthy, 2012]. Also note the Phosphorus concentration is high which important improves rooting, flowering, and fruit set, thus improving plant growth, as shown in the study [Lasaridi, et al . 2006].

Table .1 Nutrients in the soil and compost

NO.	Sample	Fe Ppm	Ca Ppm	K ppm	Mg Ppm	N Mg/kg	P Mg/kg
1.	Soil	4193	1975	284	1494	73	105
2.	Compost	3328	13553	2126	1052	483	768

3.2. The microorganisms isolated from soil before and after adding compost

Using selective media, some bacterial genera were identified in the soil, , *Enterobacter cloacae* in MacConkey and blood agar, Staphylococcus spp. in mannitol agar.

In the compost, *Bacillus subtilis* , Staphylococcus spp. and Rhizobium bacteria in yeast mannitol agar w/congo red. in mannitol agar were identified. The lipids, carbs, and amino acids in the feedstock provide these microorganisms with energy. [Shilev et al., 2007; Gil et al., 2008]

Certain kinds of fungi have been found in compost and soil, such as *Penicillium*, *Aspergillus niger*, and *Mucor piriformis*. as shown in Appendix 3.

3.2.3 The effect of compost on plant growth

Good results were recorded for plant growth at the level of vegetative parts and fruits after adding compost to the plant, and this is due to its beneficial contents. such as shown in Appendix 2

4. Conclusions

The investigation of alternative technologies for sustainable agriculture practices, like compost and rhizospheric bacteria, has gained traction in response to these worries, providing a profitable and environmentally beneficial option. The potential of bacterial, cyanobacterial, and fungal biofertilizers for a variety of crops has been thoroughly studied worldwide. In arable areas, the use of these biofertilizers has been shown to improve crop yields and soil fertility**.**

Through the synthesis of advantageous plant hormones, the induction of stress resistance, and the biocontrol of plant diseases, these bacteria support plant growth in addition to increasing nutrient availability. The usage of microbial fertilizers is expected to increase in the near future due to their ecological and economic advantages, even though their performance may fluctuate depending on the field circumstances.

5. Recommendations

Producing compost from fruit waste only and detection the concentration of organic elements in it . Producing organic fertilizer from animal waste and comparing its organic elements with fertilizer made from fruit waste.

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Appendix 1



household waste



Compost after fermentation

Appendix 2



Plant before fertilization



Plant after fertilization

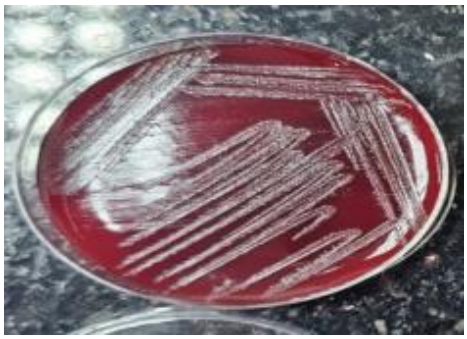
Appendix 3



Enterobacter cloacae



Staphylococcus spp



Bacillus subtilis



Rhizobium bacteria



Mucor piriformis and Penicillium



Aspergillus niger

Appendix 4

bioMérieux Customer: Microbiology Chart Report Printed May 13, 2025 9:10:47 PM CDT

Patient Name: Patient ID:
Location: Physician:
Lab ID: ruqaya MAC Isolate Number: 1

Organism Quantity:
Selected Organism : Enterobacter cloacae complex

Source: **Collected:**

Comments:	

Identification Information	**Analysis Time:** 4.87 hours	**Status:** Final
Selected Organism	99% Probability **Enterobacter cloacae complex**	
	Bionumber: 0627634551573010	
ID Analysis Messages		

Biochemical Details

2	APPA	-	3	ADO	-	4	PyrA	-	5	lARL	-	7	dCEL	+	9	BGAL	+
10	H2S	-	11	BNAG	+	12	AGLTp	-	13	dGLU	+	14	GGT	+	15	OFF	+
17	BGLU	-	18	dMAL	+	19	dMAN	+	20	dMNE	+	21	BXYL	+	22	BAlap	-
23	ProA	-	26	LIP	-	27	PLE	+	29	TyrA	+	31	URE	-	32	dSOR	+
33	SAC	+	34	dTAG	-	35	dTRE	+	36	CIT	+	37	MNT	-	39	5KG	-
40	lLATk	+	41	AGLU	-	42	SUCT	+	43	NAGA	+	44	AGAL	+	45	PHOS	+
46	GlyA	+	47	ODC	+	48	LDC	-	53	lHISa	-	56	CMT	-	57	BGUR	-
58	O129R	+	59	GGAA	-	61	lMLTa	-	62	ELLM	-	64	lLATa	-			

RAYAN SPECIALIST LABORATORY

Laboratory Report

bioMérieux Customer:
System #:
Patient Name:
Isolate: SAMPLE-1 (Qualified)
Card Type: BCL Bar Code: 2392987203412120 Testing Instrument: 00000EEA8322 (VITEK2C)
Setup Technologist: Laboratory Administrator(Labadmin)

Printed by: Labadmin
Patient ID:

Bionumber: 3373420537457260
Organism Quantity:

Selected Organism: Bacillus subtilis/amyloliquefaciens/atrophaeus

Comments:	

Identification Information	**Card:**	BCL	**Lot Number:**	2392987203	**Expires:**	Jan 30, 2026 12:00 CST
	Status:	Final	**Analysis Time:**	13.83 hours	**Completed:**	May 15, 2025 09:00 CDT
Organism Origin	VITEK 2					
Selected Organism	87% Probability		**Bacillus subtilis/amyloliquefaciens/atrophaeus**			
	Bionumber: 3373420537457260		Confidence: Acceptable identification			

Analysis Organisms and Tests to Separate:

Bacillus subtilis/amyloliquefaciens/ atrophaeus	
Bacillus amyloliquefaciens	BrownBlack(10),INULIN(11),CellChains(84),
Bacillus atrophaeus	BrownBlack(90),CellChains(20),
Bacillus subtilis	BrownBlack(10),INULIN(83),CellChains(22),

Analysis Messages:
See product labeling for additional information.

Contraindicating Typical Biopattern(s)
Bacillus subtilis/amyloliquefaciens/atrophaeus dMLZ(1),GLYG(69),LysA(3),IRHA(3),INU(25),GlyA(88),

Biochemical Details

1	BXYL	+	3	LysA	+	4	AspA	(-)	5	LeuA	+	7	PheA	+	8	ProA	-
9	BGAL	(+)	10	PyrA	+	11	AGAL	+	12	AlaA	+	13	TyrA	+	14	BNAG	(-)
15	APPA	-	18	CDEX	-	19	dGAL	(+)	21	GLYG	-	22	INO	+	24	MdG	(-)
25	ELLM	(-)	26	MdX	-	27	AMAN	-	29	MTE	(+)	30	GlyA	-	31	dMAN	+
32	dMNE	+	34	dMLZ	+	36	NAG	-	37	PLE	+	39	IRHA	+	41	BGLU	+
43	BMAN	-	44	PHC	-	45	PVATE	+	46	AGLU	+	47	dTAG	-	48	dTRE	+
50	INU	+	53	dGLU	+	54	dRIB	+	56	PSCNa	-	58	NaCl 6.5%	+	59	KAN	-
60	OLD	-	61	ESC	+	62	TTZ	+	63	POLYB_I	-						

Installed VITEK 2 Systems Version: 9.04.4
MIC Interpretation Guideline:
AES Parameter Set Name:

Therapeutic Interpretation Guideline:
AES Parameter Last Modified:

Page 1 of 2

RAYAN SPECIALIST LABORATORY

Laboratory Report

bioMérieux Customer:
System #:
Patient Name:
Isolate: SAMPLE-1 (Qualified)
Card Type: BCL Bar Code: 2392987203412120 Testing Instrument: 00000EEA8322 (VITEK2C)
Setup Technologist: Laboratory Administrator(Labadmin)

Printed by: Labadmin
Patient ID:

Bionumber: 3373420537457260
Organism Quantity:

Selected Organism: Bacillus subtilis/amyloliquefaciens/atrophaeus

Action	Name (User ID)	Date/Time	Comment

أهمية إعادة تدوير النفايات العضوية المنزلية

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مستخلص البحث:
أصبحت مخلفات النباتات عبئًا كبيرًا وظاهرة ضارة بالبيئة والصحة العامة. وقد بدأت العديد من الدول العمل على تحويل هذه المخلفات إلى أسمدة عضوية، لما لها من قيمة اقتصادية وحيوية للتربة. توفر الأسمدة العضوية المصنوعة من هذه المخلفات العناصر المعدنية الضرورية التي تحتاجها التربة، لا سيما في عصرنا الحالي، حيث أصبحت التربة فقيرة بالمواد العضوية لأسباب عديدة.
إن استخدام الأسمدة الكيميائية، بالإضافة إلى ارتفاع أسعارها، يُهدد صحة الإنسان ويُعدّ أحد الأسباب الرئيسية لأنواع مختلفة من السرطان، مثل سرطان الغدة الدرقية، وغيرها من الأمراض. لذا، يهدف هذا البحث إلى الحدّ من استخدام الأسمدة الكيميائية والاعتماد على الأسمدة العضوية الناتجة عن تحلل النفايات المنزلية، لما لها من فوائد جمّة، سواءً من خلال زيادة خصوبة التربة أو الحدّ من التلوث البيئي.يهدف هذا البحث بشكل أساسي إلى إنتاج سماد عضوي رخيص غني بالمواد العضوية والكائنات الدقيقة اللازمة لزيادة نمو النباتات وخصوبة التربة، وذلك من خلال التحلل العضوي للنفايات المنزلية خلال فترة لا تتجاوز ثلاثة أشهر. اعتمدنا في هذه الدراسة على المنهج الوصفي والكمي لقياس نسبة المعادن الموجودة في السماد العضوي المُعدّ منزليًا من بقايا النباتات والنفايات المنزلية، حيث تم تخميره في ظروف شبه هوائية مع توفير الرطوبة ودرجة الحرارة المناسبة. وقد تبين أن محتوى المعادن في السماد العضوي أعلى من محتواه في التربة، إذ يحتوي على الحديد (3328 جزءًا بالمليون)، والكالسيوم (13553 جزءًا بالمليون)، والبوتاسيوم (2126 جزءًا بالمليون)، والمغنيسيوم (1052 جزءًا في المليون)، والنيتروجين (483 ملجم/كجم)، والفوسفور (768 ملجم/كجم).تم تحديد الكائنات الدقيقة الموجودة في السماد العضوي بناءً على خصائصها المورفولوجية، مثل بكتيريا العصوية الرقيقة (Bacillus subtilis) وأنواع المكورات العنقودية (Staphylococcus spp.) وبكتيريا الريزوبيوم (Rhizobium). كما تم تحديد بعض الفطريات، مثل البنسيليوم (Penicillium) والرشاشية السوداء (Aspergillus niger) والمكور الكمثري (Mucor piriformis).

الكلمات المفتاحية: سماد عضوي، معادن، كائنات دقيقة، إعادة تدوير، نفايات عضوية منزلية.