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Macronutrient Status of Vermicompost Prepared from Garden Waste

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Abstract

The vermicomposting process carried out by earthworms transforms biodegradable waste into nutrient-rich excrement, enhancing its nutritional content. In Vermicomposting, nutrients are release and transformed into soluble, readily accessible forms, supplying essential elements like available nitrogen, soluble potassium, exchangeable calcium, and magnesium, phosphorus, trace minerals such as iron, molybdenum, zinc, and copper which plants can easily absorb (Orozco *et al.,* 1996). Vermicomposting contains plant growth regulators and improves soil structure. It has been show to promote better plant growth compared to inorganic and extra bio-fertilizers. Incorporating inexpensive vermicompost into the soil enhances its structure, improving water retention and porosity (Edwards and Burrows, 1988). In Study at D.S.M. College, Jintur dist. Parbhani, By using garden waste analysis was done on micronutrient N, P, K, $CaCO_3$ organic carbon. Waste converted into black gold.

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Keywords

Garden waste, earthworm *Eisenia fetida* sp. NPK, organic farming, Vermicomposting etc.

Introduction

Organic composting is a traditional technique used in agriculture for producing nutrient-rich manure. Vermicomposting is a scientific technique that utilizes compost enriched with NPK. Earthworms, commonly found in soil, feed on organic matter and excrete it in a digested form, enhancing soil fertility.

Vermiculture also known as worm-farming Rapid population growth, unplanned urbanization and the transition from traditional to modern agricultural practices have significantly increased waste generation. Waste materials can serve as secondary hosts for diseases and pests since nature cannot quickly degrade large quantities of waste. Earthworms consume organic residues and produce vermicast which is rich in nitrates and essential minerals like nitrogen, phosphorous, magnesium, calcium and potassium. They enhances soil fertility and used as fertilizers (Maulini-Duran *et al.,* 2014; Cerda *et al.,* 2018).

Vermicompost serves as nutritious a highly organic fertilizer and a potent growth enhancer compared to regular compost, rapid population growth, unplanned urbanization and the transition from traditional to modern agricultural practices have led to a significant increase in generation.

These waste materials can become secondary hosts for diseases and pests, as nature alone cannot break them down quickly (Albanell *et al.,* 1988; Atiyeh *et al.,* 2001). The effective management of solid waste has become a major challenge in developing countries due to limited economic resources and the lack of suitable disposal techniques aligned with their available infrastructure.

Vermicomposting enhances physical properties such as bulk density, porosity, aggregate formation, and hydraulic conductivity (Lee *et al.,* 2018). Earthworms are often called ecosystem engineers due to their ability to transform soils and influence plant communities (Lavelle *et al.,* 1997; Hale *et al.,* 2005). Vermicompost is ecofriendly, protective and restorative process that prevents waste from reaching landfills and minimizes greenhouse gas emissions by requiring very little energy for production (Korkmaz Bellitürk, 2018). Vermicomposting offers dual benefits by producing high-quality bio-fertilizer while simultaneously reducing organic waste through its conversion into a bioreactive, nutrient-rich soil conditioner (Manaig Elena, 2016). Composting paunch manure promotes agricultural sustainability and provides a safe, eco-friendly contributing to a healthier environment (Ron Fleming *et al.,* 2004). According to results, College waste such as plantation, flower waste can be used for Vermicomposting for quick decomposition. Organic carbon, N, P, K, pH and $CaCo_3$ are present in the Vermicomposting in abundant quantity.

Hypothesis

Nutrient rich black gold improves soil fertility and promotes plant growth.

Null Hypothesis

No Effect of Nutrient rich black gold improves soil fertility and promotes plant growth.

Objective: Evaluating the Nutrient Compositions of Vermicompost

Purpose

1.To break down organic waste using earthworms, creating nutrients rich compost that boosts soil fertility, enhance plant growth, and supports sustainable waste management
2. It recycles biodegradable materials, enriches the soil with essential nutrients.

Significance

1) Integration with NEP 2020 Sustainability and Environmental Education
2) Waste Reduction
3) Soil Conservation
4) Improved Crop Yields
5) Food Security : Healthy Produce
6) Interdisciplinary Connections
7) Increased Nutrient Intake

Methodology: Qualitative analysis of organic fertilizer (physicochemical) pH, organic carbon, N, P, K.

Analysis Methods

Nitrogen (N)

Kjeldahl Method: Use the Kjeldahl method to determine total nitrogen content.
- Weigh 1-2 g of the sample into a Kjeldahl flask.
- Add 10 mL of concentrated sulfuric acid and 2-3 boiling chips.
- Heat the mixture until the sample is fully digested.
- Cool and add 10 mL of distilled water.
- Titrate with 0.1 N sodium hydroxide to determine the nitrogen content.

Phosphorus (P)

1. Olsen's Method: Use Olsen's method to determine available phosphorus content.
- Weigh 1-2 g of the sample into a 50-mL centrifuge tube.
- Add 20 mL of 0.5 M sodium bicarbonate solution.
- Shake the mixture for 30 minutes.
- Centrifuge and filter the supernatant.
- Determine phosphorus content using a spectrophotometer.

Potassium (K)

Flame Photometry: Use flame photometry to determine potassium content.
- Weigh 1-2 g of the sample into a 50-mL volumetric flask.
- Add 20 mL of distilled water and shake well.
- Filter the solution and analyze using a flame photometer.

Organic Carbon

Walkley-Black Method: Use the Walkley-Black method to determine organic carbon content.
- Weigh 1-2 g of the sample into a 500-mL Erlenmeyer flask.
- Add 10 mL of 1 N potassium dichromate solution.
- Add 20 mL of concentrated sulfuric acid.
- Heat the mixture for 30 minutes.

- Cool and add 200 mL of distilled water.
- Titrate with 0.5 N ferrous sulfate to determine the organic carbon content.

pH

pH Meter: Use a pH meter to determine the pH of the vermicompost sample.
- Weigh 1-2 g of the sample into a 50-mL beaker.
- Add 20 mL of distilled water and stir well.
- Insert the pH electrode into the solution and read the pH value.

Data Collection

Two Samples collected from beds and one is vermicompost and another is controlled (without earthworms) from D.S.M. College garden Area Jintur.

Materials and Methods

HDPE 12 ft x 4 ft x 2 ft beds, shed, water, soil, different types of leaves, earthworm species *Eisnea fetida*.

Results and Discussion

In the present study assessed vermicomposting based on various parameters. Vermicomposting is a process of producing organic manure in which earth worms transform organic waste into nutrient-rich fertilizer.

This fertilizes contains soluble nutrients such as available nitrogen, potassium, exchangeable Calcium, magnesium, Phosphorus essential which are easily absorbed by plants. The addition of vermicompost to the soil enhances its structure, improving water holding capacity and porosity.

Interpretation

Making is encompassed by different types of leaves, it may refer to the composting process, imply tran where leaves decompar organic matter. Where various lear influence the outcome of vermicomposting.

Implications

Ecofriendly Waste Management Improved Soil Structure Enhanced Soil Nutrients.

Figure.1

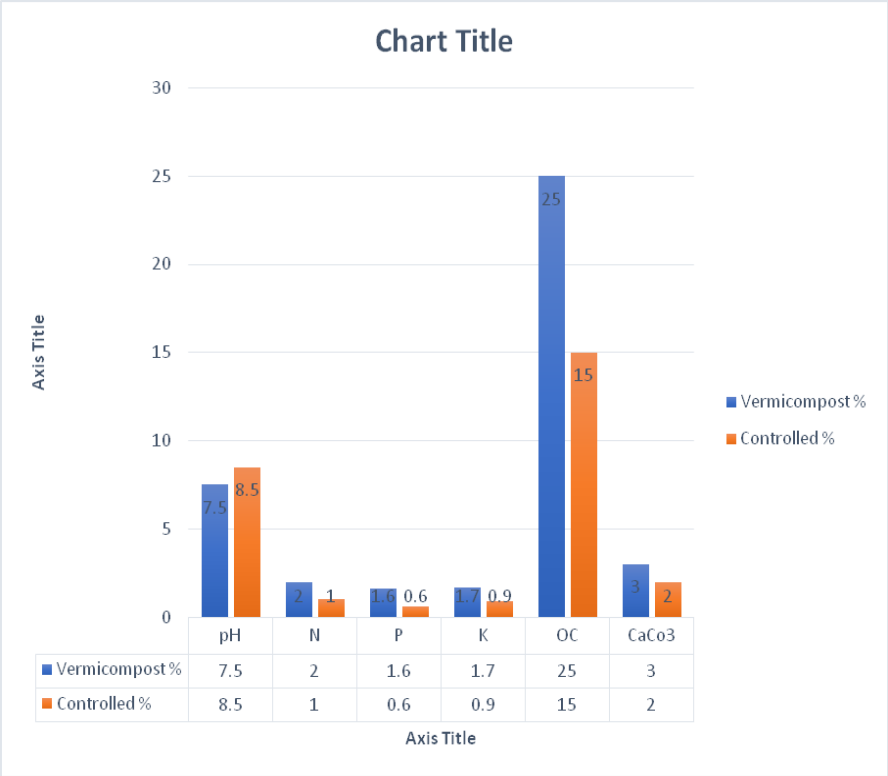

Table.1

S.No.	Nutrients	VC%	Controlled%
1	pH	7.5	8.5
2	N	2.0	1
3	P	1.6	0.6
4	K	1.7	0.9
5	OC	15-25	25-45
6	$CaCo_3$	2-6	1-3

Conclusion

Vermicomposting is an ecofriendly way to convert organic waste into nutrient-rich compost, enhancing soil fertility and plant. It reduces reliance chemical on contributions fertilizers, supports sustainable agriculture, and promotes cost-effective farming and waste management.

Limitations

- ✓ Limited waste Types
- ✓ Risk of worm mortality
- ✓ Scalability challenges
- ✓ Very sensitive to environmental conditions

Recommendations

The earthworm *Eisenia fetida* (Red wigglers) more suitable earthworm to speedup waste management as compared to controlled technique**.**

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