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Effect of vermicompost prepared from different domestic wastes on seed germination and growth of bhendi (*Abelmoschus esculentus* L. (Moench)

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Abstract
Composting trash is an efficient recycling technique in waste management that helps to both reduce the problem of waste disposal and increase the availability of organic fertilizer for crop growth. The current study's objective was to examine the impact of vermicompost made from domestic waste cow dung on bhendi (*Abelmoschus esculentus*) growth and germination in the field. From September 2020 to January 2021, the experiment was run in the Salem district's sadhasivapuram Attur Taluk. Surface-burrowing earth worms were used to perform vermicomposting of organic wastes (Udrilus ugenia). Six treatments were used in the field experiment: T0-Control (untreated), T1- 10 kg of vermicompost, and T2-20 kg of vermicompost. T3 is 30 kg of vermicompost, T4 is 40 kg, and T5 is 50 kg of vermicompost. The findings revealed notable changes in plant seed germination and growth parameters in line with the physico-chemical characteristics of various vermicomposts. At the seventh day after planting, the growth characteristics of bhendi, including seed germination, plant height, and the number of leaves per plant and the number of days per plant, were observed. T5-50kg vermicompost, followed by domestic waste vermicompost, cow dung vermicompost, and control, had the highest value of the growth metrics. Similar trends were evident in growth indices as well. The study unequivocally demonstrates that the physical characteristics of vermicompost play a significant effect in the growth of Bhendi.

Keywords: vermicompost, *abelmoschus esculentus* (L.) *Udrillus ugenia* farm yard manure, plant growth components

Introduction

This could be attained by adding organic materials. Compost made from non-toxic wastes including animal manures, agricultural waste, sewage sludge, and other non-toxic wastes is one of the most efficient ways to increase soil fertility (Norman *et al*. 2005). Composting has several advantages over inorganic fertilizers, including preventing nitrate leakage into groundwater and controlling plant diseases to boost agricultural productivity. Vermicomposting is one of the biological processes in which earthworms transform organic wastes into nutrient-rich manure. High porosity and moisture retention capacity are two characteristics of vermicompost that promote the establishment of pathogen-free plants (Yadav & Garg 2019). Vermicomposting improves the microbial enzyme activity that aids in the conversion of trash into stable organic manure. Additionally, it raises the biomass C, total organic C, and basal respiration. Plants will easily absorb soluble potassium, phosphorus, calcium, magnesium, and other essential elements from vermicompost (Atiyeh *et al*. 2000). The presence of plant growth hormones and the amount of humic acid in the vermicompost are the two main factors influencing plant growth. Vermicompost utilization promotes plant growth and yield, which boosts the agricultural sustainability and market value (Arancon *et al*. 2006; Ananthavallia *et al*. 2019).

An economically significant vegetable crop growing in tropical and subtropical regions of the world is bhendi, Abelmoschus esculentus L. (Moench). Bhendi is one of the most widely grown and consumed young vegetables in Tamilnadu. The crop is from West Africa, annual or perennial, and grows to a height of 0.5–4 metres while tolerating heat and drought. Both huge commercial farms and gardens can grow the crop well. It is grown for profit in places like India, Japan, South America, Turkey, Iran, and Africa. In England and the United States, it is known as Lady's finger, Gumbo, and Bhendi. It benefits from antioxidants and offers a significant source of vitamins, minerals, and other nutrients (Biology of Okra, Ministry of Environment and Forest, Department of Biotechnology, Ministry of Science and Technology, Government of India). Plants receive the nutrients they need for a healthy growth from fertilizers. In addition to macronutrients, there are a number of recognised micronutrients that are crucial to the metabolism of plants. Organic fertilizers like manure or compost Plants receive the nutrients they need for a healthy growth from fertilizers. In addition to macronutrients, there are a number of recognized micronutrients that are crucial to the metabolism of plants. Organic fertilisers like compost or manure derived from animal waste or vegetative waste have been employed because of the high value of their physical and biological features. But in modern agriculture, chemical pesticides and fertilisers are sprayed indiscriminately in an effort to increase yield, which degrades crop quality and soil fertility (Ntanos *et al*., 2002) [12]. An excellent and practical way to provide nutrients for the soil is through organic fertilizer. Vermicompost, which contains growth regulators like hormones that boost crop development and output, is one of the best organic manures available (Canellas *et al*., 2002) [4]. Compost is crucial for enhancing the physical characteristics of soil and has higher concentrations of comparably available nutrients. Compost is crucial for enhancing the physical characteristics of soil and has larger concentrations of comparatively accessible nutrients, which are vital for plant growth (Mona *et al*., 2011) [11]. Vermicomposting is the process through which earth worms and microorganisms work together to bio-oxidize and stabilize organic waste. Microorganism's biochemically breakdown organic matter, but they are also the process' key players because they aerate and fragment the substrate, which radically changes microbial activity and promotes further degradation (Dominguez *et al*., 1997) [5]. Vermicompost is a stable, fine-grained organic material that, when applied to soil, loosens it and makes it easier for air to enter. The cast's hydroscopic mucous absorbs water, preventing water logging and enhancing water holding capacity. Vermicompost's organic carbon slows the release of nutrients into the system so that they can be absorbed by the plant. Vermicompost enriches the soil by adding additional nutrients that chemical fertilizers do not contain (Abdullah Adil Ansari and Kumar Sukhraj, 2010) [3]. So the present study was carried out to examine the effect of vermicompost prepared from domestic waste and Cow dung on growth of bhendi.

Materials and Methods

The *Udrilus ugenia* species of earthworms were procured from Iyarkai Pasumai vermicompost in Dhammampatti Salem, India, and kept in a rearing box by feeding them cow manure for additional research. Both common household garbage and cow dung from a nearby dairy farm in Gangavalli, Tamilnadu, India, that was 30 days old were gathered and transferred to the study site. With tap water, the fresh household garbage was cleaned and diced into little pieces. Individual piles of the chopped household waste were created in shaded areas, and by misting water frequently, decomposition moisture was kept at up to 60%. To speed up decomposition, the piles were changed over every seven days. After 30 days, the pre-composted household garbage was collected and fed to the earthworms individually during vermicomposting.

Preparation of vermicompost

Vermicompost made from household trash and cow dung weeds was created in cement shells that were 10 feet long, 3 feet wide, and 3 feet high. To uniformly provide shelter for earthworms, the cement shells were filled with sandy soil, followed by dried coconut epicarp up to 1/4th of the cement shell height. Domestic trash that had partially decomposed and cow dung that had been aged 30 days were combined at a 4:1 ratio, and each cement shell was filled to the top with a consistent weight of biomass. As a control, pots were simultaneously filled with nothing but cow manure. The humidity was set to 60%, and 50 adult earthworms (Udilus ugenia) were moved from the rearing box to each vermin cement shell. The shells were then covered with jute gunny sheets and kept completely shaded. By frequently misting the earthworm feed mixture with water, the moisture level was kept between 50% and 60%. After one week from the date of the introduction of the earthworms, vermicompostings started to form. Vermicastings were harvested and preserved for future research after vermicompostings were formed from the entire feed mixture. At the Department of Soil Science, Tamilnadu Agriculture University, Coimbatore, India, the harvested various vermicomposts were examined for their physical and chemical characteristics, including pH, electric conductivity, organic carbon, nitrogen, phosphorous, potassium, calcium, magnesium, sodium, chloride, sulphate, and carbon and nitrogen ratio,In the months of September 2020 to February 2021, a field experiment was carried out at the sadhasivaburam agricultural area in the Attur Taluk of Salem, Tamil Nadu. Three replications of the experimental plots were maintained in a randomised design. There were six total parts with three duplicates for each of the following: T0-control (unvaccinated), T1-10kg, T2-20kg, T3-30kg, T4-40kg, and T5-50kg. As a test crop, the bendi plant (Abelmoschus esculentus) was grown. 20-day-old CO-2 variety bhendi plant seedlings were planted in plots with various vermicomposts being applied as a uniform dosage through soil application. Control (unvaccinated), T1-10kg, T2-20kg, T3-30kg, T4-40kg, and T5-50kg were the various treatments. When planting the okra plant and on the seventh day after the date of planting, organic vermicompost was administered using the soil stench method.

Analysis of physico-chemical and biological properties

Before planting bhendi plant seedlings, soil samples were taken from the initial pot soil mixture and were tested at the soil testing laboratory of the Department of Agriculture in Cuddalore, Tamilnadu, India, for pH, electrical conductivity, organic carbon, available nitrogen, phosphorus, and potassium.

Growth and yield parameters of okra plant

At the 7th DAS day after the day of planting, the plant height and number of leaves per plant were measured. Shoot and root length, fruit diameter, and seedling fresh and dry weight along with the number of days for germination were all noted. Statistics were used to analyse the outcomes.

Results and Discussions

Table 1 displays the physical and chemical characteristics of various vermicomposts after analysis. Physical and chemical characteristics of the various organic wastes that were prepared for vermicomposting showed substantial variances. Vermicompost made from domestic trash has a high pH (6.6) and electrical conductivity of (2.85). Vermicompost made from domestic garbage contained the highest amount of organic carbon (18.50%). Domestic waste vermicompost had substantial levels of the key macronutrients nitrogen and phosphorus (1.12% and 0.65%, respectively). However, domestic waste and cow dung vermicompost were found to have a high potassium concentration of 0.74 percent.

Table 1: Physical and chemical properties of DWVC vermicompost

S. No	Parameters	DWVC
1.	pH	6.6
2.	Electric conductivity	2.85
3.	Organic carbon (%)	18.50
4.	Nitrogen (%)	1.12
5.	Phosphorous (%)	0.65
6.	Potassium (%)	0.74
7.	Calcium (ppm)	295
8.	Magnesium (ppm)	113
9.	Sodium (ppm	45
10.	Chloride(ppm)	32
11.	Sulphate (ppm)	10
12.	C/N ratio	20:23

Data represents mean value of three determinations
CWVC=Domestic waste vermicompost

Table 2: Chemical analysis of the experimental soil

S. No	Parameters	BPSA
1	pH	7.1
2	EC (mmhos/cm/25oC)	1.34
3	Organic carbon (%)	0.65
4	Available nitrogen (mg/100gm soil)	124.23
5	Available	8.23
6	Phosphorus (mg/100gm)	0.78

Data represents mean value of three determinations

Table 3: The impact of domestic waste vermicompost on seed germination, plant height, leaf count per plant, and seedling fresh and dry weight at the 7th day after sowing

S.NO	GER%	SL(cm)	RL(cm)	WPFW(g)	WPDW(g)	NOL/P
Control	95	1.9	1.2	1.10	0.05	01
T1	97	2.8	1.8	1.91	0.46	02
T2	98	3.9	2.9	2.10	1.05	02
T3	99	4.9	3.8	3.01	3.50	03
T4	100	5.3	4.4	3.02	1.51	04
T5	100	6.2	5.5	4.01	2.01	04

Values are mean SD; sample size (n) = 6

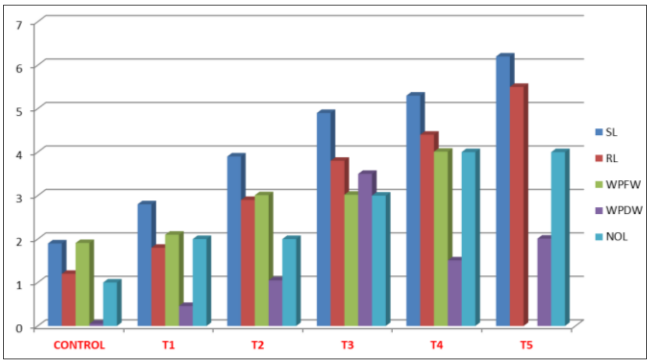

Fig 1: Effect of Domestic waste vermicompost on seed germination, plant height, number of leaves per plant and fresh and dry weight of *Abelmoschus esculentus*

Fig 2: An experimental field's design

Fig 3: Effect of domestic waste vermicompost on *Abelmoschus esculentus* seed germination, plant height, leaf count, and fresh and dry weight.

At the seventh day after planting, the application of various vermicomposts, such as domestic waste vermicompost, revealed a noticeable difference in the growth parameters of the bhendi plant. On germination, plant height, and the number of leaves per plant as of the 7th day, the impact of domestic waste vermicompost was noted. Vermicompost made from domestic trash had the highest average plant height and number of leaves per plant, followed by Control (Table 3). Additionally, this outcome is consistent with those of M.F. Khatun *et al.* (2010) [9], who noted a significant increase in plant height and the number of leaves per plant as a result of the effects of various tree litters, and Abdullah Adil Ansari and Kumar Sukhraj (2010) [3], who discovered that the combination of organic fertilizers (vermicompost + vermiwash) had a significant impact on the biochemical properties of the soil as well as the nutritional value of okra With the development of green revolution technologies, agriculture in modern times is becoming more and more dependent upon the consistent supply of artificial fertilizer (Dominguez *et al*., 1997) [5]. One of the best organic manures for enhancing crop output is vermicompost; by aerating and fragmenting the Substrate, they significantly change the microbial activity. However, depending on the kind of biodegradable waste used during vermicomposting, the nutrient level of the resulting vermicompost varies. When administered, it causes changes in plant responses like growth and yield characteristics.

The production and growth of plants are significantly impacted by the use of natural manure (Lalitha *et al*., 2000) [8]. Vermicompost enriching the soil adds extra ingredients not present in commercial fertilizers (Kale *et al*., 1992) [7]. Aquatic weed management in lotic and lentic types of water bodies is challenging today. Therefore, the current study demonstrates that turning organic biomass waste into vermicompost is an efficient, environmentally friendly approach for managing aquatic weed development that is accelerating as well as fertilizing crops for long-term production, particularly vegetable crops.

Conclusion

The main element stimulating plant growth is the quality of the soil. Our study illustrates the impact of vermicompost on the plant *Abelmoschus esculentus* L.'s growth and yield components. According to the findings, adding the right amount of vermicompost greatly improves the plant's growth and yield metrics. In addition, adding vermicompost raises the soil's porosity, ability to hold water, and macronutrient content. The plants' varied disease resistance. As a result, a significant association between vermicompost and plant development was discovered, aiding in the sustainability of agriculture. Additionally, the organic waste materials are used in a more advantageous way for industrial uses.

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