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**RESEARCH ARTICLE**

# EFFECT OF VERMICOMPOST PREPARED FROM DIFFERENT ORGANIC WASTES ON GROWTH AND YIELD OF OKRA (*Abelmoschus esculentus* L. (Moench))

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## ABSTRACT

Waste management is a recycling practice in which composting of waste is effective technology in making organic fertilizer availability for crop farming as well as in minimising the waste disposal problem. The aim of the present research was to study the effect of vermicompost prepared from water hyacinth (*Eichhornia* sp.), leaf litters and cow dung on growth and yield of okra (*Abelmoschus esculentus*) under greenhouse conditions. The experiment was conducted at the Botanical garden of Annamalai University during September, 2011 to January 2013. Vermicomposting of organic wastes was carried out by using surface burrowing type of earth worms (*Eudrilus eugineae*). The pot experiment was conducted with four treatments via $T_1$-Control, $T_2$- Cow dung vermicompost, $T_3$ – Leaf litter vermicompost and $T_4$ – Eichhornia vermicompost. The results showed significant variations in plant vegetative and reproductive parameters on par with physico-chemical properties of different vermicompost. The vegetative growth characters of okra such as plant height, number of leaves per plant and reproductive parameters like number of days of flowering, fruit length, fruit diameter, fruit weight and number of fruits per plant were observed at 20th day, 40th day, and 60th day from the date of planting. There was maximum value of growth parameters observed in leaf litter vermicompost followed by Eichhornia vermicompost, cow dung vermicompost and control. Yield parameters also showed the similar trend of growth parameters. The investigation clearly reveals that the biochemical properties of vermicompost play major role in growth and yield of okra.



## INTRODUCTION

As India is an agriculture based country, farmers need adequate resources to replenish soil fertility and maintain the productivity of soil. Really, the green revolution has popularized the use of chemical fertilizers to achieve higher productivity. But due to continuous and indiscriminate use of fertilizers, the natural fertility of soil has been lost and this activity has contaminated our soil, water and food. Therefore farmers are in need of searching alternative to replace the chemical fertilizers. In recent days, the use of organic inputs like vermicompost, biofertilizers and biopesticides is becoming popular in the world wide. There is a need of effective technology to deal with disposal of wastes which continues to be a challenge as population increases. Vermicomposting has been identified as one of the potential processes in managing waste, since it is a natural process, cost effective and required only shorter duration. The application of vermicompost helps in increasing the organic matter content of the soil, in maintaining soil natural productivity (Anil Kumar *et al*., 2011).

The need of increased food production in most developing countries becomes an ultimate goal, to meet the dramatic expansion of their population (EI-Shaikh and Mohammed, 2009). Among the major food crops, vegetables are the most important one by cultivation and consumption in Tamilnadu, India. In recent years the use of different organic fertilizers and biofertilizers are being recommended not only to minimize the use of hazardous chemical inputs but also for sustainable crop production particularly in vegetables.

Okra, *Abelmoschus esculentus* L. (Moench) is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. Among the immature vegetables, okra is one of the major in cultivation and consumption in Tamilnadu. The crop is from West African origin, annual or perennial up to 0.5m-4m tall, heat and drought tolerant. The crop is suitable for cultivation as a garden crop as well as large commercial farms. It is grown commercially in India, Turkey, Iran, Africa, Southern United States, Japan etc. It is called Lady's finger in England, Gumbo in the U.S and Bhendi in India. It is well for its antioxidants and provides an important source of vitamins, calcium, potassium and other minerals (Biology of Okra, Ministry of Environment and Forest, Department of Biotechnology, Ministry of Science and Technology, Government of India).

Fertilizers provide plants with the nutrients necessary for healthy growth. Apart from the macronutrients, there is known suit of micronutrients that play important roles in the plants metabolism. Organic fertilizers such as compost or manure

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prepared from vegetative matter or animal excreta have been utilized due to its high value of physical and chemical properties. But in modern agriculture, the chemical fertilizers and pesticides are being applied indiscriminately with desire of getting higher yield which deteriorate the soil fertility as well as crop quality (Ntanos *et al.,* 2002). An organic fertilizer serves as a good and suitable source to supply soil food elements. Among the organic manure, vermicompost is one of the best which contains growth regulators like hormones which increase the growth and yield of crops (Canellas *et al*., 2002). Compost plays an important role for improving soil physical properties and contains higher levels of relatively available nutrients elements, which are essential to plant growth (Mona *et al*., 2011). Vermicomposting involves the bio-oxidation and stabilization of organic material by the joint action of earth worms and microorganisms. Although it is a microorganism, that biochemically degrade the organic matter, they are the crucial drivers of the process, as they aerate and fragment the substrate there by drastically altering the microbial activity and further decomposition (Dominguez *et al*., 1997). Vermicompost is being a stable fine granular organic matter, when added to soil, it loosens the soil and improves the passage to the entry of air. The mucous associated with the cast being hydroscopic absorbs water and prevent water logging and improves water holding capacity. The organic carbon in vermicompost releases the nutrients slowly and steadily into the system and enables the plant to absorb the nutrients. The soil enriched with vermicompost provides additional substances that are not found in chemical fertilizers (Abdullah Adil Ansari and Kumar Sukhraj, 2010). So the present study was carried out to examine the effect of vermicompost prepared from aquatic weed *Eichhornia* sp, leaf litters and Cow dung on growth and yield of okra.

## MATERIALS AND METHODS

Epigeic species, *Eudrilus eugeniae* was obtained from M/s Vishal vermiform, Nellore, and Andhra Pradesh, India and maintained in a rearing box by feeding cowdung for further studies. Common weed such as *Eichhornia* sp. collected from local ponds located around Annamalai University and leaf litter from the campus of Annamalai University and 30days old cow dung from nearby dairy farm in Annamalainagar, Tamilnadu, India were collected and transported to experimental site. The fresh biomass of Eichhornia was washed with tap water and chopped into small pieces. The chopped weed biomass and leaf litter were made as a heap individually under shady conditions and decomposing bacterial culture was inoculated (Bacillus sp MTTC No.: 297), and moisture was maintained up to 60% by spraying water regularly. The heaps were turned up 7 days gap to accelerate decomposition and after 30days the pre composted *Eichhornia* and leaf litter biomass were collected and fed to the earthworms individually during vermicomposting.

### *Preparation of vermicompost*

Vermicompost of *Eichhornia*, Leaf litter and cow dung weeds were prepared in clay pots, sized 12inch height and 9inch width. The clay pots were filled with sandy soil followed by dried coconut epicarp up to $1/4^{th}$ of pot height for providing shelter to earthworms uniformly. The partially pre decomposed *Eichhornia* and leaf litter were mixed with 30 days old cowdung at 4:1 ratio and filled in the pots up to top individually with uniform biomass weight. Simultaneously, only cowdung also filled in pots as control. Moisture was adjusted to 60% and 50 numbers of adult earthworms (*Eudrilus eugeniae)* from rearing box were transferred to each vermipots and covered with jute gunny sheets, and kept under complete shade. Moisture of the earthworm feed mixture was maintained between 50 -60% by spraying water regularly. The formation of vermicastings was observed after one week from the date of introducing earthworms. After formation of vermicastings from complete feed mixture, the vermicastings were harvested, and stored for further studies. The harvested different vermicompost were analyzed for physical and chemical properties such as pH, electric conductivity, organic carbon, nitrogen, phosphorous, potassium, calcium, magnesium, sodium, chloride, sulphate and carbon and nitrogen ratio at Department of Soil Science, Tamilnadu Agriculture University, Coimbatore, India.

A pot experiment was conducted at Botanical garden, Annamalai University, Annamalainagar, Tamilnadu during, September, 2012 to February, 2013. Experimental pots were kept in randomized design with three replications. Altogether there were 12 pots, three replicates in each for control, cowdung vermicompost (CV), Leaf litter vermicompost (LV), Eichhornia vermicompost (EV). Okra plant (*Abelmoschus esculentus*) was grown as test crop. 20days old Okra plant seedlings of local variety planted in pots and applied different vermicompost as uniform dosage by soil application. Treatments consisted of $T_1$ - control with 100% recommended dose of inorganic NPK; $T_2$- cow dung vermicompost supplemented with 50% NPK; $T_3$- leaf litter vermicompost supplemented with 50% NPK; $T_4$ –Eichhornia vermicompost supplemented with 50% NPK. Inorganic NPK was applied through urea, single super phosphate (SSP) and muriate of potash (MOP). Inorganic NPK and vermicompost were applied to okra plant by soil stench method at the time of planting and $40^{th}$ day and $60^{th}$ day from the date of planting.

### *Analysis of physico-chemical and biological properties*

Soil samples were collected from initial pot soil mixture before planting of okra plant seedlings and pot soil after final harvesting of fruits, and analyzed for pH, electrical conductivity, organic carbon, available nitrogen, phosphorus and potassium at soil testing laboratory, Department of agriculture, Cuddalore, Tamilnadu, India.

### *Growth and yield parameters of okra plant*

The plant height, number of leaves per plant was recorded at $20^{th}$ day, $40^{th}$ day and $60^{th}$ day from the date of planting. The number of days for flowering, fruit length, fruit diameter, fruit weight and number of fruits per plant were recorded. The results were statistically analyzed.

## RESULTS AND DISCUSSIONS

The physical and chemical properties of different vermicompost were analysed and represented in Table 1. There were significant differences were found in each physical and chemical properties of the vermicompost prepared different organic wastes. Leaf litter vermicompost (LV) shows high value in both pH (6.9) and electrical conductivity of (2.85). The maximum percentage of organic carbon was observed in LV (18.50%) followed by Eichhornia vermicompost (EV) (16.40%) compared with cow dung vermicompost (CV)

(12.40%). The major macronutrients of nitrogen and phosphorous were high in LV (1.12 % and 0.65%) followed by EV (0.96 % and 0.32%). But the potassium content of 0.74% was observed as high in EV than LV (0.62%).

**Table1** Physical and chemical properties of different vermicompost

| PARAMETERS | CV | LV | EV |
|---|---|---|---|
| pH | 6.6 | 7.2 | 6.8 |
| Electric conductivity | 1.68 | 2.78 | 2.24 |
| Organic carbon (%) | 12.40 | 18.50 | 16.40 |
| Nitrogen (%) | 0.62 | 1.12 | 0.96 |
| Phosphorous (%) | 0.50 | 0.65 | 0.32 |
| Potassium (%) | 0.54 | 0.62 | 0.74 |
| Calcium (ppm) | 295 | 385 | 410 |
| Magnesium (ppm) | 113 | 102 | 202 |
| Sodium (ppm | 45 | 85 | 73 |
| Chloride(ppm) | 32 | 66 | 48 |
| Sulphate (ppm) | 10 | 12 | 15 |
| C/N ratio | 20:23 | 26:32 | 27:26 |

Data represents mean value of three determinations
CV=Cow dung vermicompost; LV=leaf litter vermicompost; EV=Eichhornia vermicompost

The application of different vermicompost such as CV, LV and EV showed significant difference in vegetative parameters of okra, observed at 20$^{th}$, 40$^{th}$, and 60$^{th}$day from date of planting. The effect of different vermicompost on plant height and number of leaves per plant as 20$^{th}$ day, 40$^{th}$ day and 60$^{th}$ day were recorded. The maximum value of plant height and number of leaves per plant were observed in plants treated with LV followed by CV and EV (Table 3).

**Table 2** Chemical analysis of the experimental soil

| Parameters | Before planting | After harvest | | |
|---|---|---|---|---|
| | | $T_1$- control | $T_2$- CV | $T_3$L V | $T_4$- EV |
| pH | 7.1 | 6.8 | 7.2 | 6.9 | 7.1 |
| EC(mmhos/cm/25$^o$C) | 1.34 | 1.21 | 1.31 | 1.15 | 1.13 |
| Organic carbon (%) | 0.65 | 0.52 | 0.78 | 0.72 | 0.68 |
| Available nitrogen(mg/100gm soil) | 124.23 | 87.35 | 112.4 3 | 120. 12 | 118. 23 |
| Available phosphorus(mg/100gm soil) | 8.23 | 7.65 | 7.85 | 7.21 | 7.24 |
| Available potassium(mg/100gm soil) | 0.78 | 1.87 | 1.56 | 1.34 | 1.25 |

Data represents mean value of three determinations

Also, this result is similar to the findings of M.F.Khatun *et al*., (2010) who observed significant increase in Plant height and number of leaves per plant with the effects of different tree litters, followed by Abdullah Adil Ansari and Kumar Sukhraj (2010) found that the combination of organic fertilizers (vermicompost + vermiwash) had great influence on the nutritional value of Okra and also have a significant influence on the biochemical characteristics of the soil with marked improvement in soil nutrients.

The effect of different vermicompost parameters such as number of days for flowering, fruit length, fruit diameter, fruit weight and number of fruits per plant shows significant difference (Table 4). The maximum value of number of days for flowering was recorded in control (66.45) followed by CV (60.24), EV (58.54) and LV (54.64). The maximum length of fruit was recorded in LV (12.18cm) followed by EV (11.25cm), CV (11.05cm) and control (10.33). The similar trend of fruit length was observed in fruit diameter, fruit weight and number of fruits per plant. Also, this result is similar to the findings of M.F.Khatun *et al*., (2010) who observed significant increase in fruit height, fruit diameter, number of fruits per plant and individual fruit weight with the effects of different tree litters. It also coincides with the results obtained by Olaniyi *et al*., (2010) who observed the effects of NPK and organo-minerals significantly increased the number of fruit per plant and fruit yield and the highest values were recorded with the application of sole NPK at 150Kgha$^{-1}$. Abd *et al*., (2010) also observed the effects of plant residues on some vegetative growth parameters and yield of Okra. Similar trends were observed by Abdullah Adil Ansari and Kumar Sukhraj (2010) the effects of vermicompost and vermiwash on soil parameters and productivity of Okra.

Agriculture in modern times is getting more and more dependent upon the steady supply of artificial fertilizer with the introduction of green revolution technologies (Dominguez *et al*., 1997). Vermicompost is one of the best organic manure in increasing the crop yield; they aerate and fragment the substrate there by drastically altering the microbial activity. But the nutrient status of produced vermicompost differs on the type of biodegradable waste usage during vermicomposting. It results variations in plant response such as growth and yield parameters when it is applied.

**Table 3** The Effect of different vermicompost on plant height and number of leaves per plant at 20$^{th}$ day, 40$^{th}$ day and 60$^{th}$ day from the date of planting

| Treatments | Plant height (cm) days after Planting | | | Number of leaves per plant days after Planting | | |
|---|---|---|---|---|---|---|
| | 20$^{th}$ day | 40$^{th}$ day | 60$^{th}$ day | 20$^{th}$ day | 40$^{th}$ day | 60$^{th}$day |
| T1-Control | 9.25±0.02775 | 26.52±0.10608 | 48.24±0.14472 | 5.62±0.01686 | 8.75±0.035 | 9.84±0.029 |
| T2-CV | 11.12±0.0448 | 28.95±0.08685 | 52.45±0.2098 | 7.78±0.03112 | 9.65±0.02895 | 10.85±0.05425 |
| T3-LV | 13.73±0.0419 | 33.85±0.16925 | 54.43±0.21772 | 8.25±0.04125 | 11.05±0.046 | 13.25±0.03975 |
| T4-EV | 13.15±0.0655 | 29.78± 0.1489 | 54.02±0.2701 | 8.40±0.0422 | 10.55±0.0422 | 13.04±0.03912 |

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

**Table 4** The effect of different vermicompost on number of days for flowering, fruit weight, fruit diameter and number of fruits per plant

| Control | Number of days for flowering | Fruit length(cm) | Fruit diameter(cm) | Fruit weight (g) | Number of fruits per plant |
|---|---|---|---|---|---|
| T1Control | 66.45± 0.2658 | 10.33±0.0515 | 1.68±0.00504 | 9.25±0.02775 | 8.07±0.02421 |
| T2-CV | 60.24±0.2406 | 11.05±0.0442 | 1.72±0.04272 | 10.68±0.0422 | 12.34±0.04936 |
| T3-LV | 54.64±0.1632 | 12.18±0.0364 | 1.85±0.0603 | 12.06±0.0603 | 14.75±0.07375 |
| T4-EV | 58.54±0.0565 | 11.25±0.0565 | 1.75±0.05725 | 11.45±0.0575 | 13.1±0.05248 |

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

The application of organic fertilizers has an emphatic effect on plant growth and production (Lalitha *et al*., 2000). The soil enrich with vermicompost provides additional substances that are not found in chemical fertilizers (Kale *et al*., 1992). Nowadays it is difficult to manage the aquatic weeds in lotic and lentic types of water bodies. So the present investigation proves that the conversion of organic biomass waste into vermicompost is an effective eco-friendly technology for not only managing the rapid growth of aquatic weeds but also can be fertilized the crops for sustainable production particularly vegetable crops.

## References


Anil Kumar Gupta, Biswas Ray, Mahendra pratap Singh, Vibha upadhyaya and Chandran Kumar singh. 2011. Effect of fertilizers and vermicompost on growth, yield and biochemical changes in *Abelmoschus esculentus*. Plant Archieves Vol.11, pp.285-287.

Abd EI-Kader, A.A., Shaaban, S.M and Abd EI-Fattah. M.S. 2010. Effect of irrigation levels of and organic compost on Okra plants (*Abelmoschus esculentus*) grown in sandy calcarious soil. Agriculture and Biology Journal of North America.

Abdullah Adil Ansari and Kumar Sukhraj. 2010. Effect of vermiwash and vermicompost on soil parameters and productivity of Okra (*Abelmoschus esculentus*) in Guyana. Middle – East Journal of Scientific Research 6(5): 429-435.

Canellas, L.P., Oliveres, F.L., Olorovola, A.L. and A.R. Facanda. 2002. Humic acid isolated from Earthworm compost enhance root elongation; aerial root emergence and plasma membrane H+ ATP activity Maize root.Plant Physiol., 130: 1951-1957.

Dominguez, J., C.A. Edwards and Subler,S. 1997. A comparison of composting and vermicomposting Biocyvle, 4:57-59.

El-Shaikh,K.A.A. and Mohammed, M.S. 2009. Enhancing Fresh and Seed Yield of Okra and reducing chemical phosphorus Fertilizer via using VA Mycorrhizal inoculants. World Journal of Agricultural Sciences 5(s): 810-818, 2009. ISSN 1817-3047.

Kale, R.D., Mallesh, B.C., Hubra, B. and Bagyara., D.J. 1992. Influence of vermicompost application on the available macronutrients and selected microbial populations in a paddy field. Soil Biology and Biochemistry, 24:1317-1320.

Lalitha, R., Fathima, K. and Ismail, S.A. 2000. The impact of biopesticides and microbial fertilizers on productivity and growth of *Abelmoschus esculentus*.Vasundara the Earth, 1&2: 4-9.

Khatun, M.F. Chodhury, M.A.H. Islam, M.S. Haider, S.M.S. and M.Z.A. Talukder. 2010. Effects of different leaf litters on growth and yield of Okra in Modhupur forest soil. Int. J.Expt.Afric.1 (1): 5-11.

Series of Crop Specific, Biology of Okra, Ministry of Environment and Forest, Department of Biotechnology, Ministry of Science and Technology, Government of India.

Mona, M.Abdel-Mouty., AsmaaR.Mahmoud., EL-Desuki, M. and Fatma Rizk, A. 2011. Yield and fruit quality of Egg plant as Affected by organic and Mineral Fertilizers Application. Research Journal of Agriculture and Biological Sciences.7 (2):196-202, 2011 ISSN 1816-1561.

Ntanos, D.A. and Koutroubas, S.D. 2002. Dry matter and N accumulation and translocation for indica and Japonica rice under Mediterranean conditions. Field Crops Sci., 74: 93-101.

Olaniyi, J.O, Akanbi, W.B. Olaniran, O.A. and Ilupeju, O.T. 2010. The effect of organo-mineral and inorganic fertilizers on the growth, fruit yield, quality and chemical composition of Okra. J. of Animal and Plant sciences. Vol.9s, Issue 1:1135-1140.


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