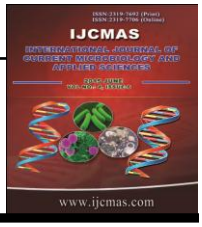
Int.J.Curr.Microbiol.App.Sci (2015) 4(6): 501-506

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 4 Number 6 (2015) pp. 501-506**
http://www.ijcmas.com



Original Research Article

Recycling of Vegetable Market Waste into Vermicompost and its Effect on the Growth and Yield of Okra Plant (*Abelmoschus esculentus*)

A. Kanimozhi and K. Jayakumar*

Department of Animal Behaviour & Physiology, School of Biological Science, Madurai Kamaraj University, Madurai, Tamilnadu, India

**Corresponding author*

A B S T R A C T

The present study was to convert vegetable market waste into vermicompost by using earthworm species *Eudrilus eugeniae*. The vegetable waste was mixed with cow dung at different ratios 20:80, 40:60, 60:40 and 80:20 (vegetable waste: cow dung). Field experiment was conducted using different treatments to determine their effect on growth and yield of okra plant. The six treatments were V_1V, V_2V, V_3V, V_4V, C_1V and C control with three replicates each. Plant height, number of leaves, flowering days and yield of every plant were measured. The maximum plant height (117.33 ± 2.08 cm), number of leaves (12 ± 2), early flowering (38.33 ± 1.15 day) and yield (446.93 ± 5.94 g) were observed in V_4V treated okra plants compared to other treatments and control. The growth (biomass) of earthworm species *Eudrilus eugeniae* as influenced by vegetable waste with cow dung using different feeding mixture was studied. The maximum biomass of earthworms was recorded in V_3 (1028.33 + 3.05 g) treatment.

K e y w o r d s

Vermicompost, Vegetable market waste, Cow dung, *Eudrilus eugeniae*, Biomass, Okra

Introduction

Increasing civilization and urbanization has led to an everlasting generation of wastes, there by polluting the environment from various sources. Disposal and environmental friendly management of these wastes are becoming a serious global problem. Hence intensive attention has been paid in recent years to develop efficient low-input technologies to convert nutrient rich organic wastes into value-added products for sustainable land practices (Padma *et al*., 2002; Kale *et al*., 1982; Daniel *et al*., 1999; Garg and Kaushik, 2005).

Vermicomposting is a mesophilic process carried out by earthworms, involves ingestion, digestion, and absorption of the organic waste followed by excretion of castings through the worm's metabolic system, which enhance the levels of plant-nutrients of organic waste during their biological activities (Pattnaik *et al*., 2010). The earthworm species *Eudrilus eugeniae*, commonly known as the African night crawler is the familiar type of earthworm used for vermicomposting in tropical and sub-tropical countries (Giraddi *et al*., 2008).

The potentially nutritious vegetable waste is soft, succulent and its decomposable ability is humungous.

The colossal amount of vegetable waste may be utilized for the production of valuable vermicompost. This is essential for replenishment of plant nutrients, sustenance of soil health, reduction of pollution hazard and creates employment opportunities, which is being increasingly recognized as a strategy for sustainable organic farming (Ranjit Chatterjee *et al*., 2014).

Vermicompost is odorless, pathogen free and is also rich in plant nutrients (Anbalagan and Manivannan, 2012). Vermicomposting not only provides nutritional elements but exhibits prospects to control certain diseases in plants.

The present study deals with the effect of vermicompost from vegetable market waste on growth and yield of okra plant *(Abelmoschus esculentus)*. The influence of vegetable market waste with cow dung substrate or feeding material on the growth (biomass) in composting earthworm species *Eudrilus eugeniae* has been noticed.

Materials and Methods

Collection of vegetable market waste and cow dung

Vegetable waste was collected from the market in Batlagundu, Dindigul district, Tamilnadu, India. The vegetable waste was collected in random manner.

Vegetable wastes include different leftover putrefied vegetables such as turnip, carrot, brinjal, cabbage, tomato, potato, cauliflower, leafy vegetables and ladies finger. Urine free cow dung was collected from Mela Kovil Patti near Batlagundu.

Collection of earthworms

The mature earthworms *Eudrilus eugeniae* were collected from S.S Vermicompost form, Pandiyarajapuram near vadipatti, Madurai district, Tamilnadu, India.

Vermicomposting - Experimental set up

Vegetable waste and cow dung were dried under shade and powdered. Vegetable waste was mixed with cow dung at different ratios V_1 = 20% Vegetable waste + 80% Cow dung, V_2 = 40% Vegetable waste + 60% Cow dung, V_3 = 60% Vegetable waste + 40% Cow dung, V_4 = 80% Vegetable waste + 20% Cow dung, C_1 = Cow dung (control). Added required amount of water and mixed of the content. All the wastes were pre-decomposed for 20 ± 2.449 days. Vermibeds were prepared in plastic troughs (60 × 41 × 43 cm size) and were maintained in triplicates. 500gms of earthworms *Eudrilus eugeniae* were introduced in each Vermibed. The Vermibeds were covered with wet gunny bags to maintain the optimal moisture. Water was sprinkled on alternate days. The experiment was set under shady place to avoid direct sunlight. The vermibeds were monitored every day and the vermicast were periodically harvested and separately stored.

Observation of growth of earthworm *Eudrilus eugeniae*

The growth rate (biomass) of the earthworms *Eudrilus eugeniae* was recorded by observing the weight gained by the worms at an interval of 10^{th}, 20^{th}, 30^{th} and 40^{th} day.

Field experiments

Field investigations were carried out to study the effect of vegetable waste with cow

dung vermicompost on the growth and yield of okra plant *(Abelmoschus esculentus)*. Okra or ladies finger seedlings were implanted on plot with six treatments and each treatment was replicated thrice. Treatment details V_1V - 20% Vegetable waste + 80% Cow dung Vermicompost, V_2V- 40% Vegetable waste + 60% Cow dung Vermicompost, V_3V - 60% Vegetable waste + 40% Cow dung Vermicompost, V_4V - 80% Vegetable waste + 20% Cow dung Vermicompost, C_1V – 100% Cow dung vermicompost and C – untreated control. At the outset the treatments were begun with 250gms of vermicompost and regularly 150gms of vermicompost was applied to each experimental okra plant in an interval period of 10 days. The control okra plant was untreated with vermicompost. The height of the plant, the number of leaves put forth by the plant (growth parameters), flowering days and yield (yield attributes) of per plant were measured. Watering was done on alternate days on plot and the unwanted weeds were removed frequently.

Statistical analysis

The data in this study were analyzed statistically, and all values are presented as Mean ± SD (Standard deviation). Further, the data were analyzed by using two - way analysis of variance (ANOVA).

Results and Discussion

Effect of vermicompost on plant growth

The results on the effect of vegetable waste with cow dung vermicompost had positive response on growth and yield parameters of okra plant are presented in Table-1 and Fig.1. Vegetative growth and yield attributes were higher in the V_4V treated okra plants compared to other treatments.

The highest plant height (117.33 ± 2.08 cm), number of leaves (12 ± 2), early flowering formation (38.33 ± 1.15 day) and yield (446.93 ± 5.94 gram) of okra plants were recorded from V_4V treatment. This was followed by V_3V, V_2V, V_1V and C_1V treatments. On the other hand the lowest plant height (78.33 ± 3.51 cm), number of leaves (6.66 ± 0.57), late flowering formation (50.66 ± 1.15 day) and yield (114.67 ± 5.77 gram) of okra plants were recorded from untreated control C (without vermicompost application). A two-way ANOVA test clearly indicated that there were significant variations in the growth and yield of okra plant between the treatments $P<0.01$. Gutierrez *et al*. (2007) reported that application of vermicompost increased the plant heights and yield of tomato (*Lycopersicum esculentum*) significantly which confirms the results of the present study. Many researchers have reported that application of vermicompost leads to improvement in growth and yield components in crops because of supplying optimum nourishment condition (Federico *et al*., 2007; Vijaya *et al*., 2008; Hernandez *et al*., 2010. Azarmi *et al*. (2008) studied on tomato (*Lycopersicum esculentum var.* Super Beta), the results of their study support and affirm the findings of our study that vermicompost has positive effect on growth and yield of plant as compared to control.

Earthworm growth

An observation was also made on the growth (biomass) of earthworms *Eudrilus eugeniae* as influenced by vegetable market waste with cow dung using different feeding mixture. The results of the biomass of earthworms in different intervals with five type of feed substrate are presented in Table – 2.

Table.1 Effect of vegetable market waste with cow dung vermicompost on growth and yield of okra plant (Mean ± SD)

Treatments	Plant height (cm)	Number of leaves	Flowering (days)	Yield (g)
V_1V	102.66 ± 2.51	9.33 ± 1.52	41.33 ± 2.08	307.82 ± 29.74
V_2V	107 ± 3	10 ± 3	39.33 ± 1.15	403.57 ± 54.84
V_3V	110 ± 2	10.33 ± 1.52	38.33 ± 1.52	427.89 ± 18.09
V_4V	117.33 ± 2.08	12 ± 2	38.33 ± 1.15	446.93 ± 5.94
C_1V	95 ± 1	8.33 ± 0.57	45.33 ± 0.57	260.35 ± 17.98
C_2	78.33 ± 3.51	6.66 ± 0.57	50.66 ± 1.15	114.67 ± 5.77

V_1V - 20% Vegetable waste + 80% Cow dung Vermicompost; V_2V- 40% Vegetable waste + 60% Cow dung Vermicompost; V_3V - 60% Vegetable waste + 40% Cow dung Vermicompost; V_4V - 80% Vegetable waste + 20% Cow dung Vermicompost; C_1V – 100% Cow dung Vermicompost and C – untreated control.

Table.2 Growth of *Eudrilus eugeniae* in vegetable market waste with cow dung under different intervals in days (Mean ± SD)

Treatments	Initial biomass of *Eudrilus eugeniae* (g)	Biomass (g) of *Eudrilus eugeniae* in different days			
		10th Day	20th Day	30th Day	40th Day
V_1	500 ± 0	568.06 ± 8.91	663.61 ± 20.55	813.27 ± 11.75	881.39 ± 1.86
V_2	500 ± 0	587.39 ± 2.62	703.12 ± 4.99	894.68 ± 10.71	970.19 ± 27.97
V_3	500 ± 0	602.35 ± 11.28	759.96 ± 5.07	976.56 ± 6.46	1028.33 ±3.05
V_4	500 ± 0	600.25 ± 9.97	763.86 ± 5.39	963.59 ± 5.50	1017.66 ±4.50
C_1	500 ± 0	554.31 ± 12.62	614.61 ± 29.63	778.07 ± 6.34	837.19 ± 2.63

V_1 = 20% Vegetable waste + 80% Cow dung; V_2 = 40% Vegetable waste + 60% Cow dung; V_3 = 60% Vegetable waste + 40% Cow dung; V_4 = 80% Vegetable waste + 20% Cow dung; C_1 = Cow dung (control)

Figure.1 Effect of treatments on growth and yield of okra plant

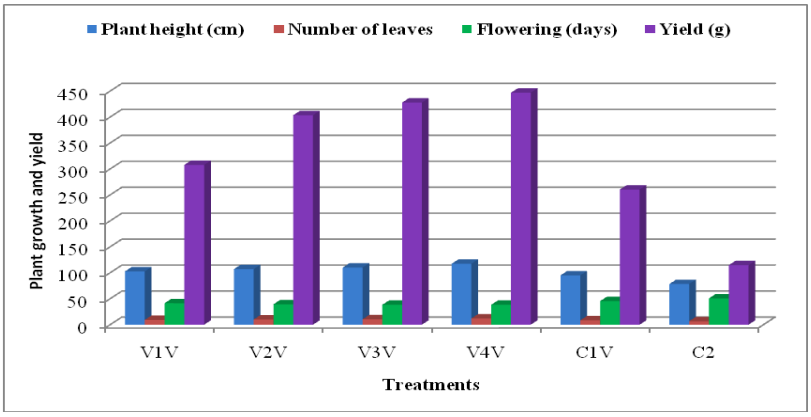
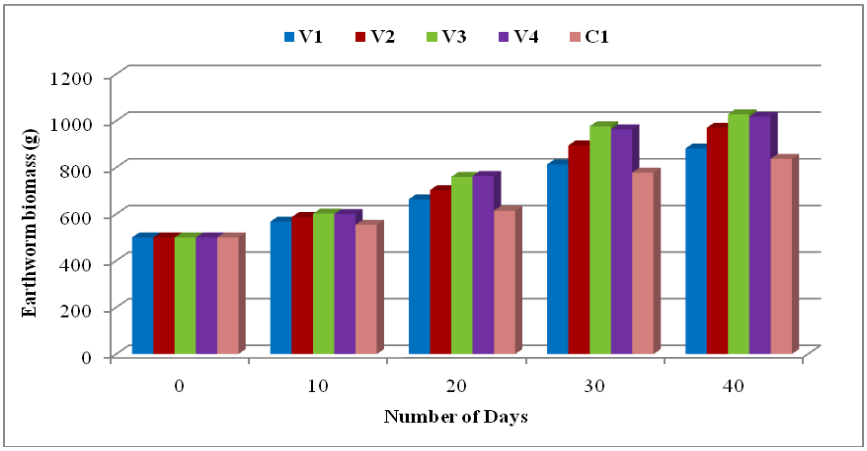


Figure.2 Growth of *Eudrilus eugeniae* in different treatments during vermicomposting



The growth rate was gradually increased on 10^{th}, 20^{th}, 30^{th} and 40^{th} days. The maximum growth rate (biomass) of earthworms was recorded in V_3 (1028.33 ± 3.05 g) followed by V_4 (1017.66 ±4.50 g), V_2 (970.19 ± 27.97 g) and V_1 (881.39 ± 1.86 g) treatments respectively on 40^{th} day (Fig.2). The minimum growth rate (biomass) of earthworms was recorded in C_1 control (837.19 ± 2.63 g) on 40^{th} day. A two-way ANOVA test clearly indicated that there were significant variations in the mean biomass weight of earthworms between the treatments ($P<0.001$). The difference in the growth rate of earthworms among different treatments seems to be closely related to feed quality. According to Fayolle *et al.* (1997) among the different permutations necessary for earthworm production, it seems that the type of food is most important. Yadav and Garg (2011) described the higher growth rate in a particular vermibed may be due to the more delectability and desirability of feed by worms. Suthar (2007) also realized that substrates that are easily decomposable and have excess nutrients will be more acceptable to earthworm. *Eudrilus eugeniae* escalated in total biomass much more rapidly than *E. fetida*, a species which grows relatively well in most organic wastes (Edwards, 1988). This is a more expeditious development than for any species of earthworm that has been reported to date and such growth rates make a very swift rate of population multiplication possible.

From the above study it has been concluded that vegetative growth and yield attributes were higher in the V_4V (80% Vegetable waste + 20% Cow dung Vermicompost) treated okra plants compared to other treatments. The biomass of earthworm *Eudrilus eugeniae* was superior in V_3 (60% Vegetable waste + 40% Cow dung) treatment compared to other treatments. The vermicompost of vegetable market wastes exhibited a greater potential as organic biofertilzers for the growth and development of okra cultivation for the sustainable agriculture. On the other hand, utilization of these wastes channelize to minimize or avoid pollutional effect on the environment in addition it would earn immense economic benefits.

References

Anbalagan, M. and Manivannan, S. (2012). Effect of organic additives on the microbial Population and humic acid production during recycling of fly ash

through vermitechnology. *International Journal of Research in Environmental Science and Technology*, 2(4): 96-100.

Azarmi, R., Ziveh, P.S. and Satari, M.R. (2008) 'Effect of vermicompost on growth, yield and nutrition status of tomato *(Lycopersicum esculentum)*'. *Pak. J. Biol. Sci.*,Vol 11, pp. 1797-1802.

Daniel, T. and Karmegam, N. (1999). Bio-conversion of selected leaf litters using an African epigeic earthworm, *Eudrilus eugeniae*. *Ecol Environ Conserv.*, 5: 273-277.

Edwards, C.A. (1998). The use of earthworms in the breakdown and management of organic wastes. In: Edwards CA (Ed) Earthworm ecology. CRC press, Boco Roton, Florida, 327-354.

Fayolle, L., Mitchell, H., Cluzeau, D. and Stawiec, J. (1997). Influence of temperature and

food source on the life cycle of the earthworm *Dendrobaena veneta* (Oligochaeta). *Soil Biology and Biochemistry*, 29: 747-750.

Federico, A., Miceli, G., Santiago-Borraz, J. an Molina, J.A.M. (2007). 'Vermicompost as a soil supplement to improve growth, yield and fruit quality of tomato'. *Bio. Tech.*, 98: 2781-2786.

Garg, V.K. and Kaushik, P. (2005). Vermistabilization of textile mill sludge spiked with poultry droppings by an epigeic earthworm *Eisenia foetida*. Bioresource Technology., 96: 1189-1193.

Giraddi, R.S., Gundannavar, K.P., Tippannavar, P. S. and Sunitha, N.D. (2008). Reproductive Potential of Vermicomposting Earthworms, *Eudrilus eugeniae (Kinberg) and Perionyx excavatus (*Perrier) as Influenced by Seasonal Factors. *Karnataka J Agric* Sci, 21-38.

Gutiérrez, M., Federico, A., Santiago, B., Jorge, M. M., Joaquin, A., Carlos, N., Camerino, A., Miguel, O. L., Maria, A., Rincón, R. and Dendooven, L. (2007) 'Vermicompost as a soil supplement to improve growth, yield and fruit quality of tomato (*Lycopersicum esculentum*)'. *Bioresource Technology*, Vol. 98, No.15, pp. 2781-2786.

Hernandez, A., Castillo, H., Ojed, D., Arras, A., Lopez, J. and Sanchez, E. (2010). Effect of vermicompost and compost on lettuce production. Chil. J. Agric. Res., 70(4): 583-589.

Padma, U., Rao, R.S. and Srinivas, N. (2002). Eco-friendly disposal of vegetable wastes through vermitechnology. *J. Ecobiol.*, 14: 155-159.

Pattnaik, S. and Reddy, M.V. (2010). Assessment of Municipal Solid Waste management in Puducherry (Pondicherry), India. Resources, Conservation and Recycling 54, 512-520.

Ranjit Chatterjee., Bandyopadhyay, S. and Jana, J.C. (2014). Evaluation of vegetable wastes recycled for vermicomposting and its response on yield and quality of carrot (Daucus carota L.). *Int. J. Recycl. Org. Waste Agricult.*, 3:60.

Suthar, S. (2007). Nutrient changes and biodynamics of epigeic earthworm during recycling of some agricultural wastes. *Bioresour Tech* 98:1608–1614.

Vijaya, D., Padmadevi, S.N., Vasandha, S., Meerabhai, R.S. and Chellapandi, P. (2008). Effect of vermicomposted coir pith on the growth of F *Andrographis paniculata*. *J. Syst*., 3(2): 51-56.

Yadav, A. and Garg, V.K. (2011). Recycling of organic wastes by employing *Eisenia foetida*. *Bioresour. Technol.* 102:2874-2880.