ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 6, Issue, 3, pp.3125-3129, March, 2015

International Journal of Recent Scientific Research

RESEARCH ARTICLE

A COMPARATIVE STUDY ON VERMICOMPOSTING OF EPICARP OF FRUITS (POMEGRANATE AND SATHUKUDI) USING EARTHWORM EISENIA FOETIDA

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ARTICLE INFO

Article History:

Received 2nd, February, 2015
Received in revised form 10th, February, 2015
Accepted 4th, March, 2015
Published online 28th, March, 2015

Key words:

Vermicompost, *Eisenia foetida*, *Punicagrantum balasta*, *Citrus sinensis*, and *Cyamopsis Tetragonoloba*.

ABSTRACT

The trend of using inorganic fertilizers is on a boom amongst agricultural society, farmers are magnetized towards the short term advantages privileged by inorganic fertilizers, but they are unable to understand the ill effects these fertilizers on human health and soil fertility. Epicarp of pomegranate and citrus are throughout from fruit stall and market as waste. They are potential organic waste creating solid waste problem. They were compost using earthworm. Chemical composition of compost exhibited decrease of carbon content C: N ratio and increased content of nitrogen content, phosphorus content, pottossium content and calcium content. This paper aimed to find out the role of earthworm species *E. foetida* in the recycling of the epicarp of two wastes varieties like Pomegranate (*Punicagrantum balasta)* and Sathukudi (*Citrus sinensis).* This paper also studies the nutritional status of different vermicomposts processed by the earthworm *E. foetida* were analyzed and compared.

INTRODUCTION

Vermicompost (also called worm compost, vermicast, vermicasting, worm humus or worm manure) is the end-product of the breakdown of organic matter by some species of earthworm. Vermicompost is a nutrient – rich, organic fertilizer and soil conditioner. The process of producing vermicompost is called vermicomposting. As reported by some of the researchers veremicomposting is an appropriate technology for residue and wate management (Jambhekar, 1992). Vermicomposting is an easy and effective way to recycle agricultural waste, city garbage and kitchen waste along with bioconversion of organic waste materials into nutritious compost by earthworm activity (Arunkumar, 2000). Vermicompost is potential organic manure rich in plant nutrients compared to formyard manure (FYM) or other organic manures in respect to supply of N, P, and K fertilizers (Arunkumar, 2000). Roy *et al*. (2000) observed that the activities of dehydrogenase, nitrogenase, phosphatase, arylsultatase and urease were found higher in process of vermicomposting. Vermicomposting is fast growing popularity as a tool of reclamation of waste and (Bhawalkar, 1993) used vermicompost for reclamation of waste land. (Sinha *et al*., 2005). Fertilizer have almost replaced use of farmyard manures and resulted in severe depletion of soil quality by erosion and loss of organic content (Lavelle *et al*., 1998). Edwards *et al.* (1998) reported that vermicomposts have a much finer structure than compost and contain nutrients informs that are readily taken up by the plants such as nitrates, exchangeable phosphorous and soluble potassium, calcium and magnesium. Their growth productivity and ability to transform organic waste as animal dung, agricultural residues, urban washes and sludge have been widely reviewed. The objective of the present study was to compare the nutritional value of the vermicompost of epicarp of fruits pomegranate and sathukudi using earthworm *E. foetida*.

MATERIALS AND METHODS

Collection of Waste (Samples) and Earthworm

The epicarp of Fruit in pomegranate (*Punicagrantum balasta*) and Sathukudi (*Citrus sinensis*) were used as an organic waste and they were collected from fruit stall in Madurai city. Wastes were sun dried and powdered well so as to quicken and decomposition process. The earthworms *E. foetida* were collected from the scientific company (SACS) vermiform in Hawa valley near Madurai. They were allowed to live in selected waste for few days for acclimatization.

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Experimental Design

Preparation of Vermicompost bed

Two different wastes were used. For each waste one control and five experimental sets were maintained. The culture bed for control and experimental sets were prepared by putting a layer of garden soil up to 10 cm at the base of the wide mouthed bag. Over this softened wastes mixed with cow dung in equal proportion was added on the surface of the soil. The entire culture trough was left for 10 day prior to experimentation for composting of the bedding materials. These stock foods were stabilized by moistening with tap water to maintain 75 - 80% moisture content. The heat produced due to decomposition process was reduced by sprinkling water over the bed. In 10 – 15 days, the predigested compost was ready for the preparation of vermicompost.

Introduction of the worms into the vermibed

After 15 days 80 worms were introduced in each bag. Surface of the composting setups were covered with wire mesh nets, to prevent the entry of predators and to keep away flies. This setup was left without disturbing the beds and worms until the vermicast were produced. Water was sprinkled over the surface once a day and sometimes alternate days if the bed was wet and covered by net during the time of vermicomposting.

Collection of Vermicastings

Vermicompost were collected from control and the experimental samples on 0^{th}, 15^{th}, 30^{th} 45^{th} days. The collected samples were dried and powdered with a pestle and mortar and used for the biochemical analysis of Nitrogen, Carbon, Phosphorus, Potassium and Calcium (Umbreit *et al.,* 1974). Nutrient contents of the vermicompost were compared.

The effect of Vermicomposts on plant growth

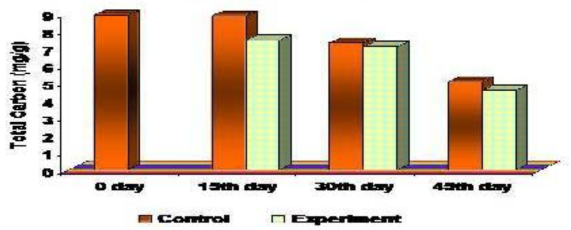
The pots were filled with 50% vermicompost and 25% red soil and 25% of loamy soil control pots without vermicompost were maintained Clusterbeans *Cyamopsis tetragonoloba* plant seeds were sowed in experimental and control pots. The pots were watered daily and their growth with respect to height, number of leaves and length of leaves were analyzed and studied.

RESULT

Organic Carbon Content

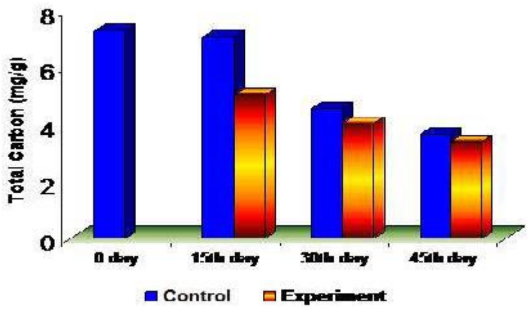
The organic carbon content was reduced in all experimental s

FIG 1: Organic Carbon content (mg/gm) of epicarp of Pomegranate on different days of vermicomposting



The carbon content was also showed remarkable and statistically significant reduction in all experimental pots (Fig 1& 2). The correlation co-efficient of the initial organic carbon with the different days of vermicomposting shows slight Negative correlation Viz., Pomegranate waste (r = -0.954) and sathukudi waste (r= -0.990).

FIG 2: Organic Carbon content (mg/gm) of epicarp of Sathukudi on different days of vermicomposting



Nitrogen Content

The Nitrogen content increased in the entire experimental sample than the control (Fig 3&4). The correlation coefficient of the initial nitrogen with the different days of vermicompost shows slight positive correlation Viz., Pomegranate waste (r =0.967) and Sathukudi waste (r=0.574).

FIG 3: Nitrogen content (mg/gm) of epicarp of Pomegranate on different days of vermicomposting

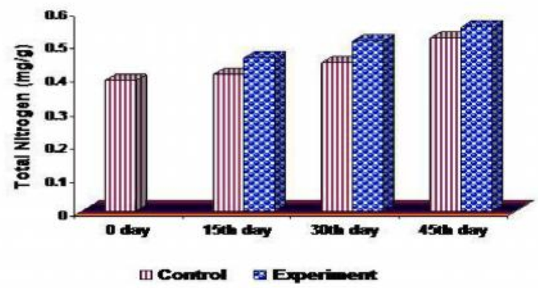
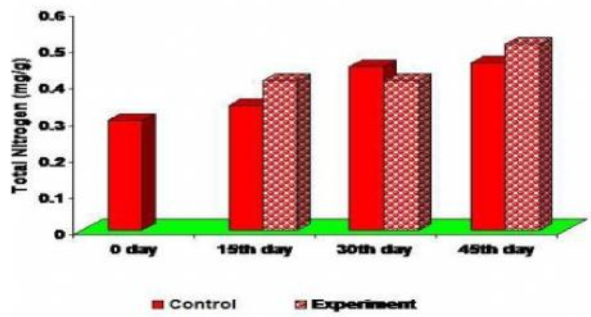


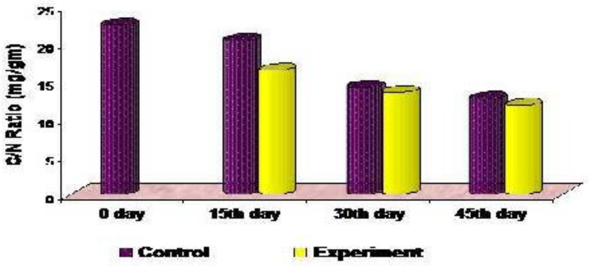
FIG4: Nitrogen content (mg/gm) of epicarp of Sathukudi on different days of vermicomposting



C/N Ratio

The carbon and nitrogen ratio of vermicompost was decreased in all experimental samples than the control (Fig 5& 6). The correlation co-efficient of the C/N ratio showed slight negative correlation Viz., Pomegranate waste (r= -0.980) and sathukudi waste (r= -0.949).

FIG 5: C/N Ratio (mg/gm) of epicarp of Pomegranate on different days of vermicomposting



Phosphorus content

The phosphorus content was also increased in experimental sample than the control (Fig 7& 8). The correlation co-efficient values of Phosphorous content Viz., Pomegranate waste (r =0.997) and Sathukudi waste (r =0.986).

FIG 6: C/N Ratio (mg/gm) of epicarp of Sathukudi on different days on vermicomposting

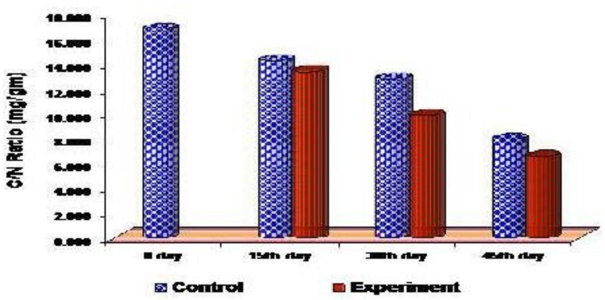


FIG 7: Phosphorus content (mg/g) of epicarp of Pomegranate on different days of vermicomposting

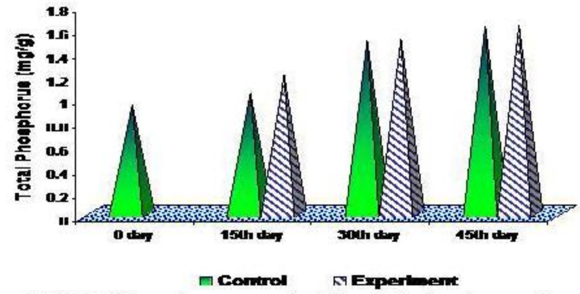
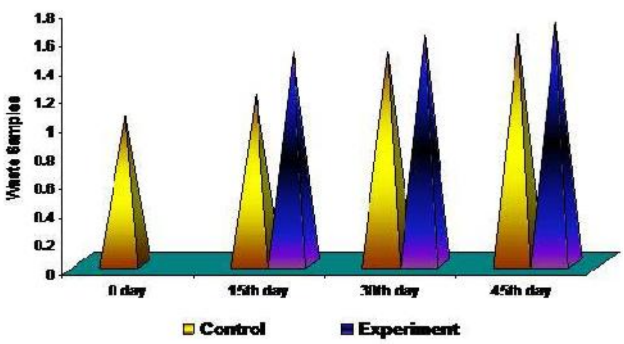


FIG 8: Phosphorus content (mg/g) of epicarp of Sathukudi on different days of vermicomposting



Potassium content

The Potassium content was also increased in experimental samples than the control (Fig 9 &10). The correlation co-efficient values of Potassium content Viz., Pomegranate waste (r =0.862) and Sathukudi waste (r =0.954)

FIG 9: Potassium content (mg/g) of epicarp of Pomegranate on different days of vermicomposting

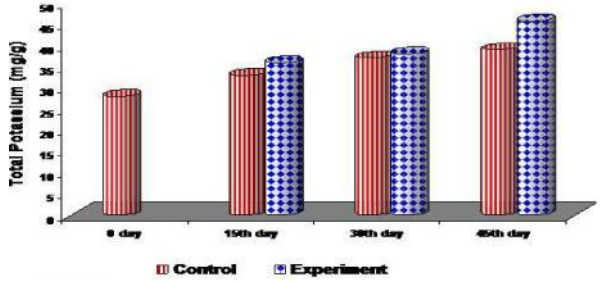


FIG 10: Potassium content (mg/g) of epicarp of Sathukudi on different days of vermicomposting

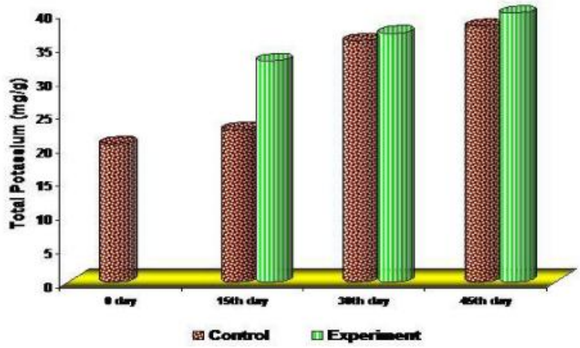


FIG 11: Calcium content (mg/g) of epicarp of Pomegranate on different days of vermicomposting

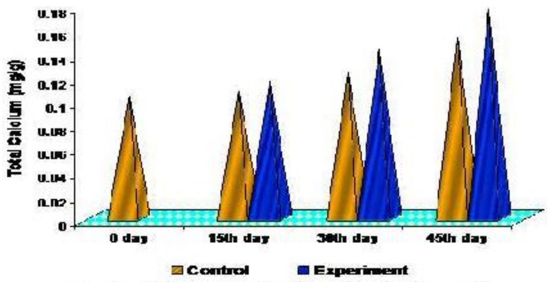
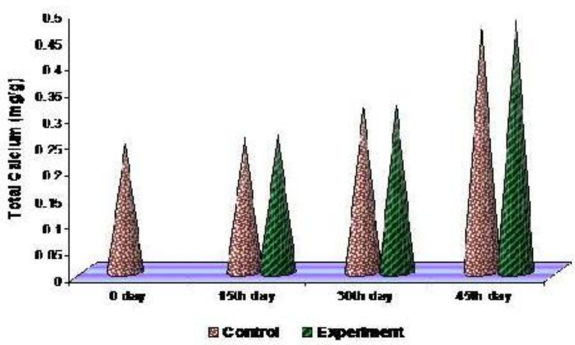


FIG 12: Calcium content (mg/g) of epicarp of Sathukudi on different days of vermicomposting



Calcium Content

The Calcium content were also increased in experimental samples than the control (Fig 11&12). The correlation co-efficient values of Calcium content Viz., Pomegranate waste (r =0.946) and Sathukudi waste (r =0.999).

Effect on Cyamopsis tetragonoloba

The effect of vermicompost on the growth parameters such as plant height and length of leaves of *Cyamopsis tetragonoloba* were taken (Fig 13&14) *Cyamopsis tetragonoloba* showed the increased growth rate in experimental pot manured with vermicompost produced out of pomegranate *punica grantu balsta* then the other vermicompost produced out of sathukudi.

FIG 13 : Height attained by clusterbeans *Cyamopsis tetragonoloba* in control and experimental manure (in cm) in 45th day

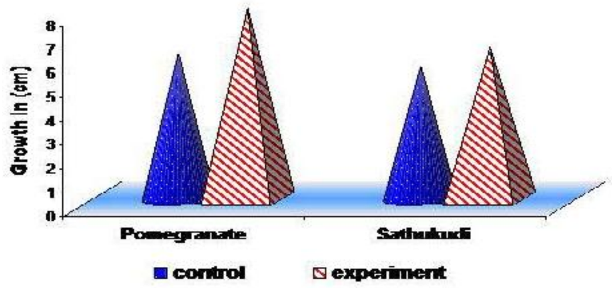
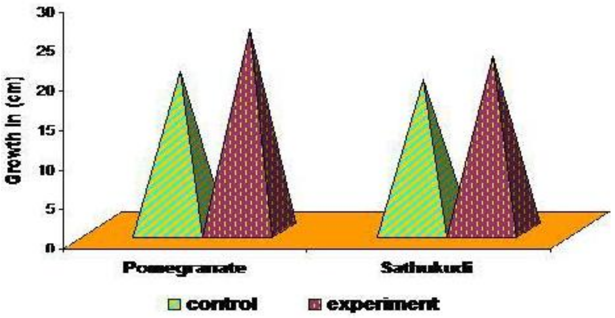


FIG 14 : Length of the leaves attained by *Cyamopsis tetragonoloba* in control and experimental manure (in cm) in 45th day



DISCUSSION

Vermicomposting has been recently universally accepted as eco friendly technology for sustainable development and abatement of pollution caused by municipal; garbage, sewage, sludge, agricultural wastes. The results at the present experiment revealed that the Vermicomposts prepared from different organic wastes processed by earthworm. *E. foetida* is used as a best organic fertilizer in terms of nutritional quality and the impact on the growth of the vegetable plant, *Cyamopsis tetragonoloba.* The earthworm activity accelerated the process of waste products decomposition and stabilization and promoted biochemical characteristics of the Vermicastings that were favorable for plants growth. The reduced C:N ratio of the substrate material reflects the organic waste mineralization and stabilization during the process of composting or vermicomposting.. The loss of carbon as carbon dioxide through microbial respiration and simultaneous addition of nitrogen by worms in the form of mucus and nitrogenous excretory material lowered the C:N ratio of the substrate (Suthat, 2007).The enhanced phosphorous level in vermicompost suggests phosphorous mineralization during vermicomposting process. Lee, (1992) suggests that the passage of organic matter through the gut of earthworm's results in phosphorus is converted to forms, which are more available to plants. Some previous studies also indicate enhanced potassium content in vermicompst by the end of the experiment (Manna, *et al*., 2003; Suthat, 2007). The results obtained in this study are similar to those by Delgado, *et al*., (1995), who demonstrated higher potassium concentration in the end product prepared from sewage sludge. The calcium level was more in experimental than control. This is due to microbs in gut of earthworms and their metabolic process. According to Atiyeh *et al*., (2002) Calcium, Potassium are higher in Vermicompost.It was found that pots containing soil amended with vermicompost at the time of plant growth achieving significantly better height and large number of leaves than control *Punica grantum balasta* showed the richest contents of organic carbon, Nitrogen Phosphorus, Potassium and Calcium than the Sathukudi *Citrus sinensis.* The Vegetable Plants *Cymopsis tetragonoloba* supplied with Vermicompost of *Punica gratum balasta* produced rich growth.

Acknowledgement

Authors would like to thank the management of Madura college, Madurai, Tami nadu , India for their encouragement and for providing laboratory facilities.

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How to cite this article:

Chellachamy, V and Dinakaran, S., A Comparative Study On Vermicomposting of Epicarp of Fruits (Pomegranate and Sathukudi) Using Earthworm Eisenia Foetida. *International Journal of Recent Scientific Research Vol. 6, Issue, 3, pp.3125-3129, March, 2015*

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