ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 6, Issue 4, pp: (161-169), Month: October - December 2018, Available at: www.researchpublish.com

A Comparative Study of the effect of different Potting mixtures on the growth of *Zea mays* L. and *Trigonella foenum- graecum* L.

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Abstract: **The aim of the study was to compare the effect of vermicompost, compost, foliage mix and urea on the growth of selected plants. In our investigation two earthworm species *Eisenia foetida* and *Eudrilus eugeniae* converted leaf litter into vermicompost. Household kitchen waste converted to compost was also used. Foliage mix and urea were procured from the local market.. The efficacy of the potting mixtures on plant growth was evaluated. The effect of vermicompost leachate on the growth of onion root tips was also observed.**

Keywords: **Vermicompost, vermicompost leachate, Pit compost, foliage mix, urea.**

1. INTRODUCTION

A major threat faced across the globe is environmental degradation. The rampant use of chemical fertilizers contributes largely to the deterioration of the environment by reducing the soil fertility and degradation. Now there is a growing realization that the adoption of environmental friendly and sustainable practices may help to reverse the declining trend of the environment. (Nagavallemma *et al*., 2004).

To preserve the global agro-ecosystems and protect human health from harmful agro-chemicals, 'Eco-freindly and Organic Farming' has to be adopted. Composting and vermicomposting are alternate bio-oxidative methods which can be employed to convert waste to wealth. (Kaur *et al*., 2015 ; Uma Maheswari *et al.*, 2015).

Vermicomposting is a cost effective and eco- friendly process used to treat organic waste. Vermicomposting (Vermi is the Latin Word for worm) is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product. The biomass consumed by the earthworms is digested and the excreted products are called worm casts. popularly called as 'Black gold'. Vermicompost leachate is an organic liquid produced from the earthworm's digested material and casts during the vermicomposting process. It improves crop performance, increases plant growth hormone , enzyme content and microbial populations. The concept of the preparation of vermicompost leachate is that nutrients that have been mineralized and assimilated by earthworms and microorganisms during the vermicomposting process will be leached out along side (Thangaraj, 2015). Earthworms are mainly divided into two types-Burrowing type and Non-burrowing type. The non-burrowing type of earthworms (*Eisenia spp, Eudrilus spp*) is used for preparing vermicompost. These earthworms dwell on the surface of the soil and eat 90% organic waste materials.

Compost is composed of organic materials. It is mainly plant and animal matter that has been decomposed through aerobic decomposition. Composting process is dependent on micro-organisms. They are important in breaking down organic matter into compost. Compost rich in nutrients is used in gardens, horticulture, and agriculture. The compost is beneficial to the land in many ways, as a soil conditioner, a fertilizer, addition of vital humus and as a natural pesticide for the soil.

Foliage mix is a complete planned food for the plants. Mixture of various organic nutrients which are extracted from all types of oil cakes such as neem cake, honge cake, castor cake, bone meal, groundnut cake, naturally available rock phosphate, fish meal, farm by products, sea weed extracts and ayurvedic plants materials which supplies all required nutrients for indoor and outdoor foliage plants forms the foliage mix . Its improves soil structure by loosening the soil, provides aeration, increases the uptake of nutrients and water by plants and also has the capacity to hold water. It also works as a pest repellent because it contains neem which also enhances the health of the plants.

Urea being a nitrogenous fertilizer (Kodithuwaaku *et al*., 2009) provides the plants with nitrogen to promote growth and make them look lush. It is also necessary for the photosynthetic activity.

This study used the two species of earthworms–***Eisenia foetida*** and ***Eudrilus eugeniae*** to convert organic waste (Leaf litter) into vermicompost. An attempt was made to compare the effectiveness of Vermicompost, Pit compost, Foliage mixture and Urea on the growth of Maize (***Zea mays*** **L**.) and Fenugreek (***Trigonella foenum-graecum*** **L**.). ***Allium cepa***. (Onion bulbs) were used to study the effect of different concentrations of 'vermicompost leachate' on the growth of the root tips and shoots.

2. MATERIALS AND METHODS

I. PROCESS OF PREPARING VERMICOMPOST: Leaf liiter was converted into vermicompost by using two species of earthworms *Eisenia foetida* and *Eudrilus eugeniae* .

A medium sized plastic bin was used as composting bin.

Before the earthworms were introduced initially bedding was done.

Shredded newspaper, coconut coir and cow dung are the bedding materials used in the ratio 1:1:2.

Bedding materials were immersed in water. The wet bedding was spread inside the bin and a handful of soil was added to aid in the digestion of the worms.The adult worms of *Eisenia foetida* and *Eudrilus eugeniae* were introduced into the experimental bin and leaf litter collected from the college campus was the feed for the worms.Temperature and moisture content were maintained by sprinkling adequate quantity of water at frequent intervals. The bin was covered by a lid which was provided with holes for proper air circulation and protection.A tray was kept at the bottom of the bin to collect the drained liquid. The experimental set up was placed in a cool dark place and periodically checked. After about a month complete decomposition had occurred and the vermicompost was ready . The compost was dark black, light in weight and had a pleasant earthy smell. Vermicompost was then harvested from the bin.

II. PREPARATION OF POTTING MIXTURES

The pot experiment was carried out to compare the effectiveness of Vermicompost, Pit compost, Foliage mixture and Urea on the growth of ***Zea mays*** **L. (MAIZE) and** ***Trigonella foenum- graecum*** **L. (FENUGREEK).** . Household kitchen waste from the house of Yathiender, Bangalore converted to compost was used. Foliage mix and urea were procured from the local market..

The following potting mixtures were used for the study:

T_1 - 100gm vermicompost + garden soil.

T_2 - 100gm Pit compost + garden soil.

T_3 - 20 gm foliage mixture+ garden soil.

T_4 - 1% urea solution + garden soil.

T_5 - Garden soil (control)

The plants were given sufficient quantity of water every day and were exposed to a good amount of sunlight during the day . On the 40^{th} day the plants were taken out of the pot and growth parameters like root length and shoot length were recorded.

III. To study the effect of different concentrations of vermicompost leachate on the growth of onion.

Vermicompost leachate was collected and used in three dilutions – VCL I (10% concentration), VCL II (20% concentration) and VCL III (30% concentration) , The Onion Bulbs were placed in glass tubes filled with the following concentrations 10%, 20% and 30%. At the same time control experiment was run by using distilled water.

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Observations were recorded after 30 days and growth parameters like root length and shoot length was measured using the centimeter scale and the mean length was expressed in centimeters.

IV OBSERVATIONS AND RESULTS

Two species of earthworms *Eisenia foetida* and *Eudrilus eugeniae* were used to convert organic waste (Leaf litter) in to vermicompost. The vermicomposting process was allowed for 30 days. (Figs: 1,2)

Fig 1 : Day 1 of vermicomposting process.

Fig 2: Final product of vermicomposting process on the 30th day

The pot experiments was carried out to study the effect of vermicompost, pit compost, Foliage mix and Urea on the growth of Maize and Fenugreek. The growth of the plants was observed on the 10th, 20th, 30th and 40th day. (Figs: 3, 4, 5, 6). The observations are as follows:

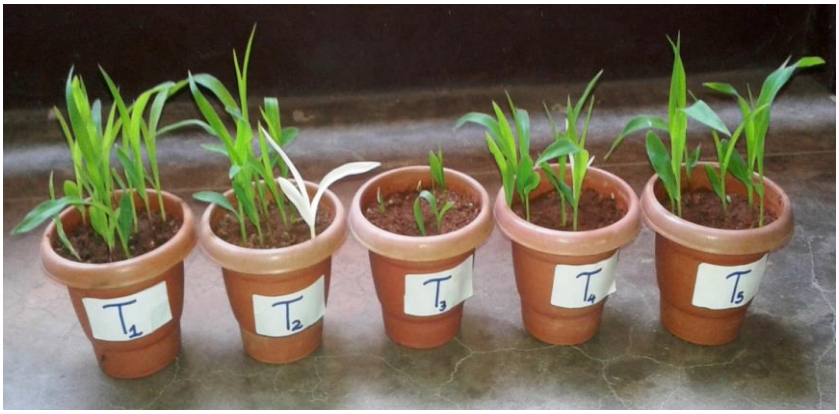

Fig 3: Effect of vermicompost, compost, foliage mix and urea on the growth of maize seedling after the 10th day of sowing.

Fig 4: Effect of vermicompost, compost, foliage mix and urea on the growth of maize seedling after the 20th day of sowing

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Fig 5: Effect of vermicompost, compost, foliage mix and urea on the growth of maize seedling after the 30th day of sowing

Fig 6: Effect of vermicompost, compost, foliage mix and urea on the growth of maize seedling after the 40th day of sowing.

On the 30th day the maize seedlings have continuously shown comparatively more growth in vermicompost than in any of the potting mixtures. The compost is obtained from decomposing domestic waste and is thus found to be very essential for plant growth. The growth in compost was similar as in vermicompost. The seedlings showed poor development in foliage mix. The seedling in the soil medium containing urea shows a significantly better growth as compared to control. (Fig: 5)

On the 40th day, the maize showed significant growth in the plants treated with vermicompost. The growth of maize in compost is considerably rapid in all aspects when compared to the inorganic fertilizer and foliage mix. Foliage mix has a lesser efficiency in supporting the growth of the maize plant. Thus it shows stunted growth when compared to the other treatments. Urea being an inorganic fertilizer aids in the proper overall development and growth of the maize plant .This could be due to the high nitrogen content in urea. Therefore the urea medium provides a better growth in the maize plant as compared to the foliage mixture and the control.

Fig 7: Effect of vermicompost, compost, foliage mix and urea on the growth of fenugreek seedling after the 10th day of sowing.

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Fig 8: Effect of vermicompost, compost, foliage mix and urea on the growth of fenugreek seedling after the 20th day of sowing.

Fig 9: Effect of vermicompost, compost, foliage mix and urea on the growth of fenugreek seedling after the 30th day of sowing.

Fig 10: Effect of vermicompost, compost, foliage mix and urea on the growth of fenugreek seedling after the 40th day of sowing.

On the 30th day the fenugreek seedlings in T_1 have shown a significant growth when compared to the growth in other pots. In foliage mix the seedlings show a good amount of growth when compared to the seedlings in the Urea and compost.In the potting mixtures containing compost and urea the seedlings grew well but it is not as efficient as vermicompost. Therefore the growth varies by a small degree compared to the plants in foliage mixture and the control.

On the 40th the growth of the methi plant is rapid in vermicompost and the growth is comparable to T_3 which contains foliage mix. The rate of growth shows a drop, in the compost potting mixture but grows well in urea and growth is more compared to the foliage mix and control. (Figs : 7,8,9,10, Table 1 & Graph 1)

Table 1: Showing the average length of root and shoot of Maize plants after 40 days.

SL NO	TREATMENTS	AVERAGE VALUE (cm)	
		ROOT LENGTH	SHOOT LENGTH
1.	T_1 –Vermicompost	36.02	14.07
2.	T_2 – Pit compost	30.04	9.3
3.	T_3 – Foliage mix	0.0	0.0
4.	T_4 -1% urea solution	26.9	7.14
5.	T_5 – control	23.25	6.5

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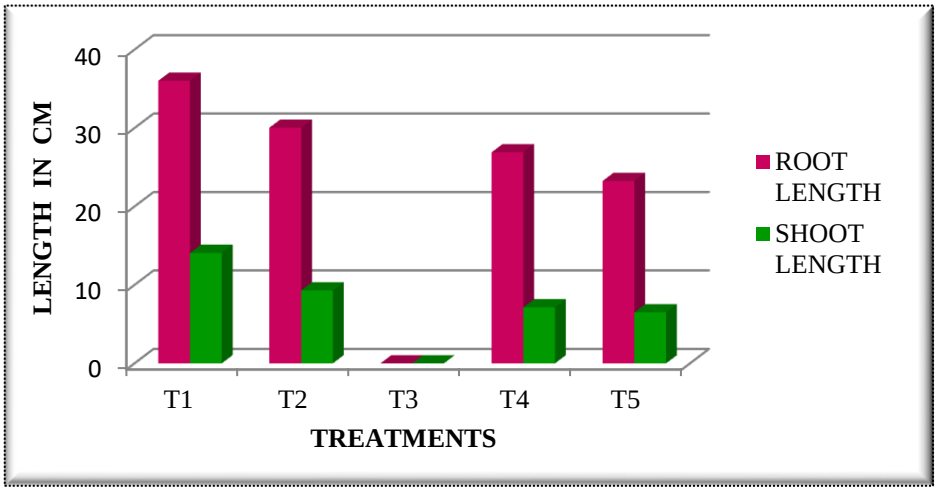
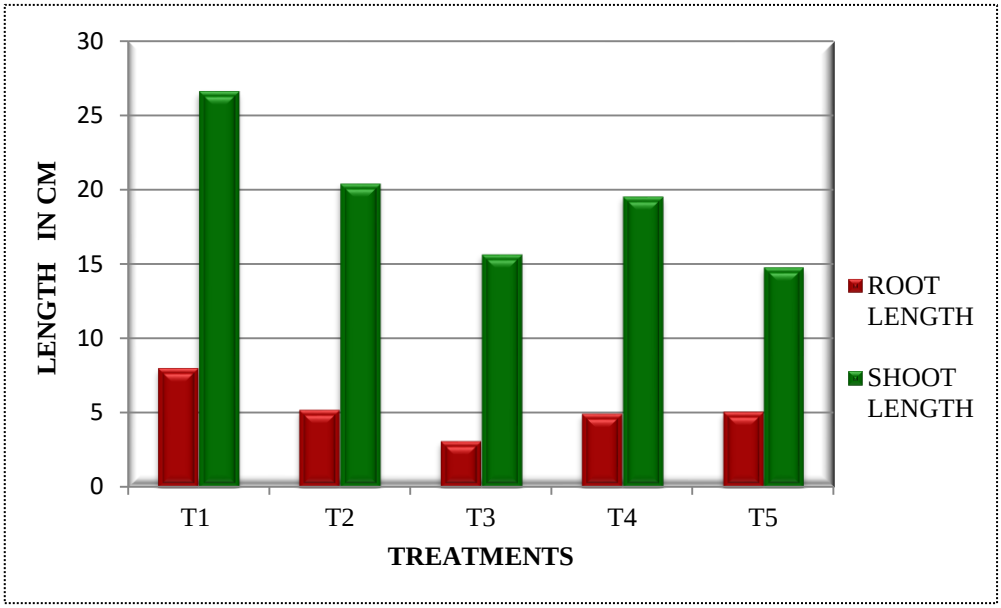


Graph 1: Influence of different treatments on the root and shoot length of Maize in 40 days.

Table 2: Showing the average length of root and shoot of Fenugreek plants after 40 days.

SL NO	TREATMENTS	AVERAGE VALUE (cm)	
		ROOT LENGTH	SHOOT LENGTH
1.	T_1 –Vermicompost	7.97	26.6
2.	T_2 – Pit compost	5.20	20.42
3.	T_3 – Foliage mix	3.10	15.67
4.	T_4 -1% urea solution	4.94	19.56
5.	T_5 – control	5.06	14.81



Graph 2: Influence of different treatments on the root and shoot length of Fenugreek in 40 days

Average **root** and **shoot** length of onion was maximum in 30% vermicompost leachate concentration followed by 20% vermicompost leachate and lower in 10% vermicompost leachate and minimum in control.

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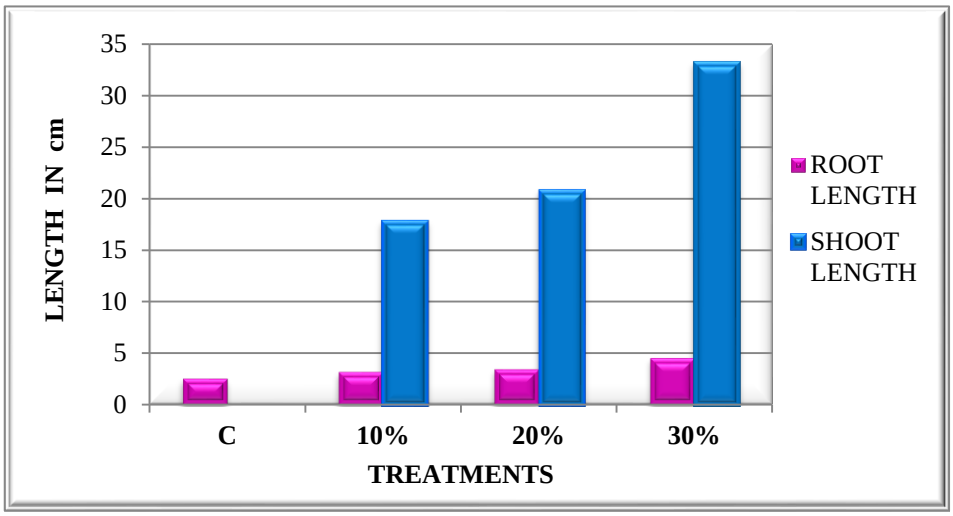
Table 3: Showing the average length of root and shoot of onion after 30 days

SL NO	TREATMENTS	AVERAGE VALUE (cm)	
		ROOT LENGTH	SHOOT LENGTH
1.	CONTROL (C)	2.52	0.0
2.	VERMICOMPOST LEACHATE - I (10%)	3.16	17.82
3.	VERMICOMPOST LEACHATE –II (20%)	3.43	20.76
4.	VERMICOMPOST LEACHATE-III (30%)	4.51	33.19



Graph 5: Effect of different concentrations of vermicompost leachate on onion growth.

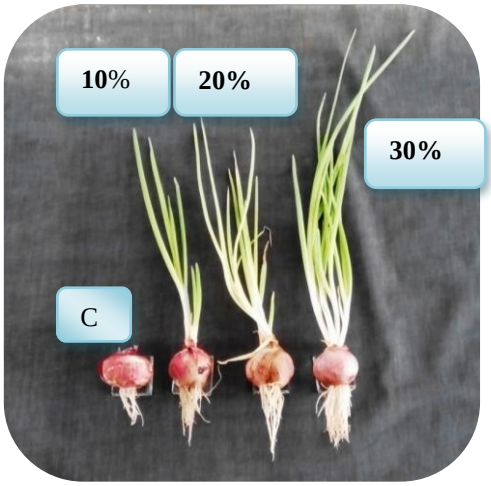


Fig 12: Onion (Allium cepa L.) showing length at different concentrations

3. DISCUSSION

Vermicompost have considerable potential for significant plant growth , when used as components of horticultural soil or container media. Nevertheless, there appear to be major differences between the effects of the vermicompost and compost that were used in our study, in terms of their influence on plant growth which may depend on the source of the waste material used for their production.These differences in growth responses could be due to fundamental differences between the composting and vermicomposting processes which use quite different microbial communities, whereas vermicomposting releases most of the nitrogen in the nitrate form, the form readily avaliable for plant uptake. Amir Khan and Fouzia Ishaq (2011) reported that Vermicompost also played a crucial role in improving soil properties, increasing crop yield and enhanced the growth of *Pisum sativum* as compared to compost and garden soil which was used as the control. Our studies on maize and fenugreek plants also yielded similar results.The study by Edwards and Burrows (1988)

showed distinct differences between vermicompost, pit compost and garden soil (control) in terms of their nutrient content and their effect on plant growth. Our results showed that vermicompost has the potential for improving plant growth when added to soil. However, there could be distinct differences between specific vermicompost and compost in terms of their nutrients , the nature of their microbial communities, and their effects on plant growth.

Thangaraj, (2015) reported that 20% Vermicompost Leachate concentration is effective in increasing the rate of germination and seedling growth that would result in increased plant growth of *Trigonella foenum-graecum* L. Enhanced rate of germination and seedling growth in vermicompost leachate treatments may be due to the presence of macronutrients (Nitrogen, Phosphorus and Potassium) and plant growth promoting substances. Our study also showed similar results in *Allium cepa*.

Results of (Keeling *et al*., 2003, Hemanth *et al*., 2015; Ragavi *et al*; 2015) showed that vermicompost application caused an increase in root development and resulted in improving plant growth. Humic acid from vermicompost application increases root length in *Zea mays* L. (Manyuchi *et al.*, 2013). Studies have shown that vermicompost plays a major role in improving growth and yield of different field crops, including vegetables, flowers and fruit crops (Chandan Singh Ahirwar and Azad Hussain 2015; Chellachamy. V. and Dinakaran. S., 2015). The application of vermicompost gave higher germination (93%), growth and yield of mung bean (*Vigna radiata* L.) compared with the control (84%) (Nagavallemma *et al*., 2004; Eswaran. N and Mariselvi.S., 2016). Gajalakshmi and Abbasi (2002 ; 2004) reported more flowers per plant in brinjal (*Solanum melongena* Linn.) in the vermicompost treatments compared with the control plants. The percentage of seed germination and seedling length of chilli and bhendi were maximum due to the application of vermicompost. Fruiting stage was observed, it is noted that fruits are healthy without any of nutritional deficiency. The number and weight of the fruits also increased due to vermicompost. (Manish Kumar, 2016).

4. CONCLUSION

The present study proved that the vermicomposting of leaf litter with cow dung appears to be the most promising high value bio – fertilizer. It not only increases the plant growth but also is cost effective and eco- friendly. It highlights that leaf waste can be converted into vermicompost by using two species of earthworm – *Eisenia* fo*et*ida and *Eudrilus eugeniae*. The vermicompost produced has a good fertilizer value.The study also showed distinct differences between Vermicompost, Pit compost, Foliage mixture, urea and garden soil in terms of their effect on plant growth. Composting is a slower process hence vermicomposting is better as it increases the rate of formation of organic manure. However both methods of composting will help to manage waste efficiently. Use of vermicompost enhances soil aggregation and stabilizes the soil structure. improving the air- water relationship of the soil. This increases the water retention capacity and encourages extensive development of the root system of plants.Vermicompost leachate has been used in different concentrations. In comparison to control all the concentrations showed significant growth.Based on the results it is concluded that morphological characteristics such as root length ,shoot length, fresh and dry weight of maize and fenugreek plants were better with the application of vermicompost than other potting mixture.The results conclusively indicate that leaf litter vermicompost can be effectively used to enhance the growth of maize and fenugreek plant in place of synthetic fertilizers .

Vermicompost leachate is the best alternative to chemical fertilizer. It can be used as liquid manure as it posses plant growth promoting factors.Vermicompost produced from the organic waste (Leaf waste) is not only having beneficial effect on soil health and growth of the plant but also plays a vital role in eradication of pollution hazards.

Disposal of solid waste is a major problem faced in most countries. As an alternative way of waste disposal composting can be done. Composting process will help to manage food and yard waste, also serve as a source of fertilizer for growing crops in the field. The results of the growth of the plants showed that both compost and vermicompost were, rich in nutrients but also laid emphasis on the fact that vermicompost was richer in nutrients than the pit compost. Plant growers should be enlightened and encouraged not only to use pit compost, but also vermicompost, because it is richer in nutrients than the pit compost.

ACKNOWLEDGEMENT

The authors thank Dr. Sr. Elizabeth C S , Principal , Jyoti Nivas College Autonomous, Bangalore for her constant support and also for giving permission to carry out the work on the college campus.

REFERENCES

[1] Amir khan and Fouzia Ishaq (2011) Chemical nutrient analysis of different composts (vermicompost and pit compost) and their effect on the growth of a vegetative crop *Pisum sativum*, Asian Journal of plant sciences and research, vol.1(1):116-130.

[2] Chandan Singh Ahirwar and Azad Hussain (2015) Effect of Vermicompost on Growth,Yield and Quality of Vegetable Crops, International Journal of Applied And Pure Science and Agriculture Vol 1 issue 8 :50-56

[3] Chellachamy. V. and Dinakaran. S (2015) 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 : 3125-3129.

[4] Edwards C.A. and Burrows I (1988) The potential of earthworm composts as plant growth media, SPB Academic press, the Hague, the Netherlands :21-42

[5] Eswaran. N and Mariselvi.S (2016) Efficacy of Vermicompost on growth and yield parameters of *Lycopersicum esculentum* (Tomato), International Journal of Scientific and Research Publications, Vol. 6, Issue 1: 93-108

[6] Gajalakshmi, S and Abbasi, S.A (2002) Effect of the application of water hyacinth compost / vermicompost on the growth and flowering of *Crossandra undulaefolia* and on several vegetables. Bioresource Technology 85 (2) : 197 – 9.

[7] Gajalakshmi.S. and Abbasi. S. A(2004), Earthworms and vermicomposting, Indian Journal of Biotechnology, Vol.3: 486-494

[8] Hemant Samadhiya, Praval Singh Chauhan, Gupta R.B and Agrawal O.P. (2015) Effect of vermiwash and vermicompost of *Eudrilus eugeniae* on the growth and development of leaves and stem of brinjal plant (*Solanum melongena*), Octa Journal of Environmental Research, Vol. 3(4): 302-307

[9] Kaur P., Bhardwaj M. and Babbar I., (2015) Effect of Vermicompost and Vermiwash on Growth of Vegetables Research Journal of Animal, Veterinary and Fishery Sciences Vol. 3(4) : 9-12

[10] Kodithuwakku.D.P.andKirthisinghe.J.P. (2009)The Effect of Different Rates of Nitrogen Fertilizer Application on the Growth, Yield and Postharvest Life of Cauliflower, Tropical Agricultural Research, Vol. 21(1): 110 - 11

[11] Keeling A., McCallum K R., & Beckwith C P. (2003) Mature green waste compost enhances growth and nitrogen uptake in wheat (Triticum aestivum L.) and oilseed rape (Brassica napus L.) through the action of water-extractable factors, Biosource technology, 90(2): 127-13

[12] Manish Kumar B., (2016)Effect of vermicompost on germination, growth and yield of vegetable plants, Scrutiny International Research Journal of Agriculture, Plant Biotechnology and Bio Products, Volume 3 Issue : 7-13.

[13] Manyuchi M.M, Kadzungura. L, Phiiri. A and Muredzi (2013) Effect of vermicompost, Vermiwash and application time on Zea mays growth International Journal of Scientific Engineering and Technology. Vol.2 issue 7 : 638-641

[14] Nagavallemma KP, Wani SP, Stephane Lacroix, Padmaja VV, Vineela C, Babu Rao M and Sahrawat KL.(2004). Vermicomposting: Recycling wastes into valuable organic fertilizer, An Open Access Journal published by ICRISAT, Vol.2 (1) : 1-16

[15] Raghavi.S, Chitra.M, Suganya.J, Vasanthi.A, Premalatha.A and Karpagam. M., (2015) Potential of vermicompost produced from kitchen waste on the growth of mustard, fenugreek and onion plants, International journal of comprehensive research in biological sciences 2(1): 66-70.

[16] Thangaraj.R (2015) Influence of vermicompost leachate on germination and seedling growth in *Trigonella foenum-graecum L*., Journal of Science, Vol 5 Issue 8 : 599-602.