VOLUME 8 ISSUE 2 2022

ISSN 2454-3055

INTERNATIONAL JOURNAL OF ZOOLOGICAL INVESTIGATIONS

Forum for Biological and Environmental Sciences

Published by Saran Publications, India

International Journal of Zoological Investigations Vol. 8, No. 2, 469-474 (2022)

International Journal of Zoological Investigations
Contents available at Journals Home Page: www.ijzi.net
Editor-in-Chief: Prof. Ajai Kumar Srivastav
Published by: Saran Publications, Gorakhpur, India

ISSN: 2454-3055

Vemicomposting of Different Organic Matters and its Effect on Growth of Mung Bean, *Vigna radiata*

Ritu and Rani Sudesh*

Animal Behavior and Pathology Laboratory, Department of Zoology, Maharshi Dayanand University, Rohtak 124001, Haryana, India

**Corresponding Author*

Received: 24th August, 2022; **Accepted:** 22nd September, 2022; **Published online:** 4th October, 2022

https://doi.org/10.33745/ijzi.2022.v08i02.058

Abstract: Vermicomposting is an eco-friendly technique used to produce organic compost, which is rich in NPK (Nitrogen, phosphorus, and potassium) micronutrients and hence improve plant growth and reproduction. This study was carried out to produce vermicompost with five different organic wastes and observed its effect on the Mung bean crop (*Vigna radiata*). The study was designed with five treatments (T1, T2, T3, T4, T5) having Five different kinds of organic wastes in a ratio of 1:2:1, as follows: T1 (soil+manure+Neem Leaves), T2 (soil+manure+hibiscus leaves), T3 (soil+manure+autumn leaves), T4 (soil+manure+sugarcane bagasse) and T5 (soil+manure+coconut husk). Each treatment having three replicates. *Eisenia fetida* earthworm was used as an experimental animal. Ten seeds of *Vigna radiata* were put in each treatment, and observed their germination percentage and growth. The results of the present study revealed higher N, C, and P content in the vermicompost under different treatment as compared to the garden soil sample. The highest per cent (100%) germination and growth of the *Vigna radiata* were observed in T5, while the minimum was inT1. This study support that vermicomposting of organic wastes is a safe and eco-friendly method by which rich nutrients organic compost can be obtained.

Keywords: Earthworm, Growth, Organic waste, Mung bean, Vermicompost, *Eisenia fetida*

Citation: Ritu and Rani Sudesh: Vemicomposting of different organic matters and its effect on growth of mung bean, *Vigna radiate.* Intern. J. Zool. Invest. 8(2): 469-474, 2022.
https://doi.org/10.33745/ijzi.2022.v08i02.058

Introduction

The organic wastes which cause significant problems in the environment can be converted into useful organic compost by technique of Vermicomposting. This compost is successfully replacing chemical additives which are used in field for crop production. Because vermicompost improves its organic content and hence increase soil properties (Ansari and Jaikishun, 2011; Chauhan and Singh, 2013). *Eisenia fetida* is considered the main agent for breaking down solid organic wastes. They can turn these scraps into high-quality organic compost (Kumar *et al.*,

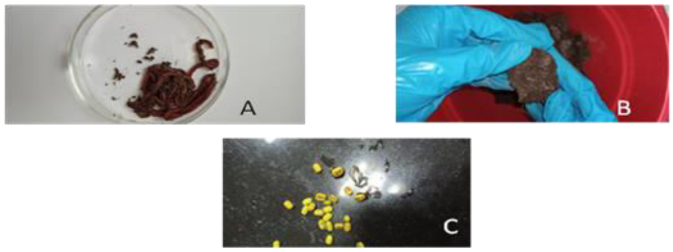

Fig. 1. A. *Eisenia fetida,* B. Manure C. *Vigna radiata*

2018). In addition to this, the vermicompost has the humic acids, significant amounts of nutrients like nitrogen, phosphorous, potassium, calcium etc. which accumulate in different body parts of plants such as the shoots, roots, and leaves (Tahiri *et al.*, 2016). Therefore, Vermicomposting is a good way to recycle organic waste and reduce the use of chemical fertilizers in the field. In addition, using large-scale organic composts is a good solution to increase organic matter in the soil, which may be helpful for their long-term fertility (Lal, 2004; Dignac *et al.*, 2017). The present study was aimed to assess the vermicomposting of different organic matters by using *Eisenia fetida* and their impact on the development of plant *Vigna radiata.*

Materials and Methods

Experimental Study Area and soil:

The experiment was conducted at the laboratory of Animal Behavior and Pathology at the Department of Zoology, Maharshi Dayanand University, Rohtak (Haryana). Garden soil (loamy soil) was collected from the garden in front of the Zoology Department, Maharshi Dayanand University, Rohtak (Haryana), India.

Earthworm:

E. fetida is an exotic species which was collected from Bhoojeevan Organics Farm (Najafgarh, Delhi) (Fig. 1A).

Manure or cow dung:

Nearly one month old cow dung (urine free and dry) was collected in a plastic bag from the Plants Research Garden, Maharshi Dayanand University, Rohtak (Fig. 1B).

Vigna radiata:

Mung beans were collected from the organic seed shop, Rohtak (Fig. 1C).

Organic wastes:

Five types of organic wastes (China rose leaves- *Hibiscus rosa-sinensis*, Neem leaves- *Azadirachta indica*, Sugarcane bagasse- *Saccharum officinarum*, autumn leaves, and coconut husk- *Cocos nucifera*) were collected from different destinations from Rohtak, Haryana.

Experimental design:

Five treatments (T1, T2, T3, T4, T5) (Table 1), having three replicates, were designed with all five organic wastes in plastic pots. These pots have two holes at the bottom side for passing the air. A thin plastic film was placed at the bottom of each pot to protect earthworms from escaping and on the upper part to protect them from direct contact with the environment.

In each treatment, 15 earthworms were introduced after weighing and left the set-up for one week; only moisture content was checked regularly in each treatment. After one week, ten seeds of *V. radiata* (prior soaked in water for 3 h) were placed at the uppermost layer of each treatment.

Physico-chemical Parameters:

Five samples from each experimental vermicompost pot were taken consequently for the analysis of physical and chemical parameters for evaluation of the nutrients (N, C, P, and K) availability in the vermicompost by following the method of Al Jawaher (2020) and made a

Table 1: Experimental design for treatments

Treatments Name	Type of Organic waste (leaf litters)	Number of the(*V. radiata*) seeds planted in treatment	Ratio of soil, Manure and organic wastes	Number of the Earthworms placed in treatment
T1	*Azadirachta indica* , Neem	10	1:2:1	15
T2	*Hibiscus rosa-sinensis,* China rose	10	1:2:1	15
T3	Autumn leaves	10	1:2:1	15
T4	*Saccharum officinarum,* Sugarcane bagasse	10	1:2:1	15
T5	*Cocos nucifera,* Coconut husk	10	1:2:1	15

Table 2: Comparison of Elements (%) in vermicompost and soil sample

S. No.	Parameters	Soil	Vermi compost in T1	Vermi compost in T2	Vermi compost in T3	Vermi compost in T4	Vermi compost in T5
1	Nitrogen	0.08±0.01	0.30±0.07	1.83±0.09	1.94±0.08	1.64±0.07	2.47±0.06
2	Carbon	0.11±0.01	2.13 ±0.15	6.23±0.27	7.67 ±0.02	4.97 ±0.20	8.20±0.12
3	Potassium	2.31±0.12	2.00±0.09	1.22±0.06	0.87±0.08	1.95±0.09	0.58±0.06
4	phosphorous	1.05±0.04	0.42±0.04	1.05±0.41	1.10±0.19	0.86±0.15	1.45±0.14

All the values are Mean ±S.E. The results are significant at $p < 0.05$

comparison of these with garden soil. Moisture content, temperature, and pH were also measured during the experimental period.

Germination percentage (*GP*):

The following equation calculated GP in all five treatments (Abdel-Haleem, 2015):

GP = seeds germinated/total seeds x 100

Measurement of Height (*in*) *of V. radiata*:

The seedling length was measured using a ruler (Abdel-Haleem, 2015)

Statistical analysis:

Data was analyzed by One Way ANOVA test including Tukey HSD.

Results

Organic waste management is well thought-out in developing sustainable agriculture to manage the natural balance of soil nutrients. The physical and chemical analysis of vermicompost generated from five treatments had varied nutrient values between garden soil. The maximum amount of total Nitrogen content was observed in vermicompost obtained from T5, followed by T3, T2, T4, and T1, respectively. These values differed significantly ($p < 0.05$) from the soil's nitrogen content. The same pattern of results was observed in the case of carbon. A significantly decreased ($p<0.05$) potassium content was observed in vermicomposts than in the soil sample. The

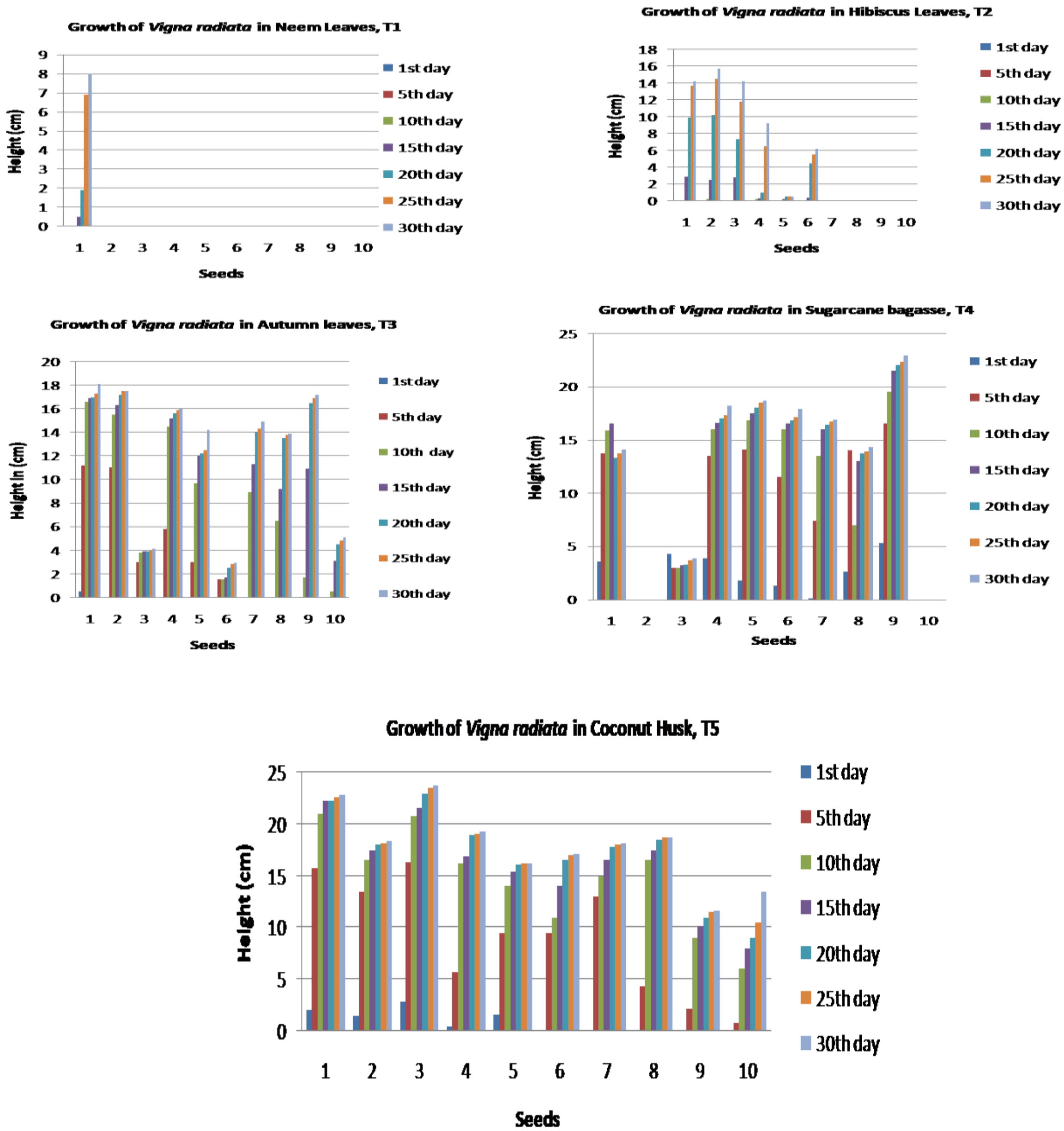

Fig. 2: Growth of *Vigna radiata* in different treatment.

phosphorous content in the vermicompost T5 was recorded as a significant increase over that in the soil sample. At the same time, there was no significant difference in the percentage of P in the vermicompost of T2, T3, T4, and soil sample (Table 2).

In each treatment, the growth of the seeds was observed daily. Maximum germination and healthiest plants were observed in T5, attained a height of up to 24 cm. T1 had germinated only one seed. In T2, only six seedlings were sprouted out of ten. In T4, eight seeds were grown, and the plant height was recorded as above 20 cm (Fig. 2).

Fluctuations in pH and temperature were observed in all treatments. Most pH was near neutral or basic. The most basic pH was observed in the treatment T2, than in treatment T1.

Discussion

Treatment of organic waste requires low-cost technology (Hand *et al.*, 1988) and vermicompost fulfills the requirements of the macro- and micronutrients, which are needed for the growth of the plant (Harris *et al*., 1990). Vermicompost was harvested after one month and was Dark-brown in color, similar to that described by Domínguez and Edwards (2011). Microorganisms generate heat during organic matter decomposition. A temperature between 20 and 35℃ is considered sufficient to facilitate vermicompost production in a tank. In the present study, an increase in temperature (up to 30.1^{0}C) was observed in treatments, and this ensures the activation of microorganisms for the degradation of organic wastes. The average moisture content was 75-85 in all the treatments, nearly similar to that reported by Domínguez and Edwards (2011). A high percentage of phosphorous was observed in Treatment T5 (2.47±0.06), which was almost the same as recorded by Marlin and Rajeshkumar (2012) (2.68-3.61%) in vermicompost. Phosphates activity in the gut of earthworms plays an essential role in the release of P during vermicomposting. In the worm casts P-solubilizing microorganisms are present, convert P and make this available to the plants in much acceptable form (Suthar, 2009; Goswami *et al.*, 2013). A higher percentage of potassium (6.27%) was recorded by Oluseyi *et al.* (2016) than in the current study. Rautela *et al.* (2019) observed that organic waste (sugarcane straw) is rich in potassium, and it can inhibit the absorption of nutrients, nitrogen, calcium and others. In the present study, eight seeds of *Vigna radiata* were germinated in T4, but their growth remained poor. This is because there may lead to a reduction in soil nutrients due to the high amount of K and it shows visibly impact the plants' physiology. Vermicompost usually contains plenty of micronutrients and macronutrients (Edwards *et al.*, 2011), and it also has enough microbial along with enzyme activities and growth regulators (Karmegam and Daniel, 2009; Prakash and Karmegam, 2010), which help plant to grow healthy. Organic wastes accepted globally for successful production of vermicompost are leaf litter (Nagar *et al.*, 2017), rice straw (Sharma and Gar 2018), municipal solid waste (Singh *et al.* 2012), paper waste (Basheer and Agrawal, 2013) and silkworm litter (Kalaiyarasan *et al.*, 2015).

Conclusion

In the present study, vermicompost harvested under different treatments had more important nutrients required for plant growth compared to the garden soil sample, and hence these have direct impact on the growth of mung bean. This study confirmed that vermicompost could be considered an eco-friendly method for the safe conversion of organic wastes into a useful one.

Acknowledgements

The authors thank the Head, Department of Zoology, Maharshi Dayanand University, Rohtak, Haryana, for providing facilities to carry out this study.

References

Abdel-Haleem El-Shaieny AH. (2015) Seed germination percentage and early seedling establishment of five *(Vigna unguiculata* L. (Walp) genotypes under salt stress. European J Exp Biol. 5(2): 22-32

Al Jawaher ABD. (2020) Vermicomposting of organic waste with *Eisenia fetida* increases the content of exchangeable nutrients in soil. Pakistan J Biol Sci. 23(4): 501-509.

Ansari AA and Jaikishun S. (2011) Vermicomposting of sugarcane bagasse and rice straw and its impact on the cultivation of *Phaseolus vulgaris* L. in Guyana, South America. J Agric Technol. 7: 225-234.

Basheer M and Agrawal OP. (2013) Management of paper waste by Vermicomposting using epigeic earthworm, *Eudrilus eugeniae* in Gwalior, India. Int J Curr Microbiol Appl Res. 2: 42-47.

Chauhan HK and Singh K. (2013) Effect of tertiary combinations of animal dung with agrowastes on the growth and development of earthworm *Eisenia fetida* during organic waste management. Int J Recycl Org Waste Agric. doi.org/10.1186/2251-7715-2-11.

Dignac MF, Derrien D and Barré P. (2017) Increasing soil carbon storage: mechanisms, effects of agricultural practices and proxies. A review. Agron Sust Dev. 37: 14.

Domínguez JJ and Edwards CA. (2011) Biology and ecology of earthworms species used for vermicomposting. In: Vermiculture Technology: Earthworms, Organic Waste and Environmental

Management, (eds.). Edwards C.A., Arancon N.Q. and Sherman R.L., CRC Press, Boca Raton, USA., pp. 27-40.

Edwards CA, Subler S and Arancon N. (2011) Quality Criteria for Vermicomposts. In: Vermiculture Technology: Earthworms, Organic Waste and Environmental Management, (eds.). Edwards C.A., Arancon N.Q. and Sherman R.L., CRC Press, Boca Raton, USA., pp. 287-301.

Goswami L, Patel AK, Dutta G, Bhattacharyya P, Gogoi N and Bhattacharya SS. (2013) Hazard remediation and recycling of tea industry and paper mill bottom ash through vermiconversion. Chemosphere 92: 708-713.

Hand P, Hayes WA, Frankland JC and Satchell JE. (1988) The vermicomposting of cow slurry. Pedobiol. 31: 199-209.

Harris GD, Platt WL and Price BC. (1990) Vermicomposting in a rural community. BioCycle 31: 48-51.

Kalaiyarasan V, Nandhini DU and Udhayakumar K. (2015) Seriwaste vermicompost- a trend of new sustainable generation-A review. Agric Rev. 36: 159-163.

Karmegam N and Daniel T. (2009) Investigating efficiency of *Lampito mauritii* (Kinberg) and *Perionyx ceylanensis* Michaelsen for vermicomposting of different types of organic substrates. Environ. 29: 287-300.

Kumar A, Prakash CHB, Brar NS and Kumar B. (2018) Potential of vermicompost for sustainable crop production and soil health improvement in different cropping systems. Int J Curr Microbiol Appl Sci. 7: 1042-1055.

Lal R. (2004) Soil carbon sequestration impacts on global climate change and food security. Science 304: 1623-1627.

Marlin CJ and Rajeshkumar KT. (2012) A study on sustainable utility of sugar mill effluent to vermicompost. Adv Appl Sci Res. 3: 1092-1097.

Nagar R, Titov A and Bhati P. (2017) Vermicomposting of leaf litters: way to convert waste in to best. Int J Curr Sci. 20: 25-30.

Oluseyi EE, Ewemoje TA and Adedeji AA. (2016) Comparative analysis of pit composting and vermicomposting in a tropical environment. Int J Agric Biol Eng. 10: 184-187.

Prakash M and Karmegam N. (2010) Vermistabilization of pressmud using *Perionyx ceylanensis* Mich. Bioresour Technol. 101: 8464-8468.

Rautela I, Rathore S, Chauhan P, Tapliyal P and Sharma DM. (2019) Vermicompost is boon to enrichment of micronutrient content in soil. World J Pharm Res. 8: 2309-2318.

Sharma K and Garg VK. (2018) Comparative analysis of vermicompost quality produced from rice straw and paper waste employing earthworm *Eisenia fetida* (Sav.). Bioresour Technol. 250: 708-715.

Singh K, Sharma S, Teixeira JADS, Satya S and Arora K. (2012) Vermicomposting of municipal solid waste employing *Eisenia fetida* together with *Penicillium* spp. and *Azotobacter bioinoculants*. Dynamic Soil Dynamic Plant 6: 89-95.

Suthar S. (2009) Bioremediation of agricultural wastes through vermicomposting. Bioremediat J. 13: 21-28.

Tahiri A, Delporte F, Muhovski Y, Ongena M, Thonart P and Druart P. (2016) Change in ATP-binding cassette B1/19, glutamine synthetase and alcohol dehydrogenase gene expression during root elongation in *Betula pendula* Roth and *Alnus glutinosa* L. Gaertn in response to leachate and leonardite humic substances. Plant Physiol Biochem. 98: 25-38.