OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

# IMPACT OF VERMICOMPOST ENGINEERED FROM WATER HYACINTH WEED ON GROWTH ATTRIBUTES OF CHILLI (*CAPSICUM ANNUM*) PLANT

**Madikhambe Sujata Kallappa[1], K. R. Rao[2]**

*Department of Zoology, Walchand College of Arts and Science, Solapur, Maharashtra, India.[1,2]*
*sujatamadikhambe@gmail.com*

---

***Abstract:*** ***Water hyacinth is a fast growing aquatic plant. It spreads on the surface of water bodies and cause damages to aquatic bodies. Sambhaji tank, in Solapur is located in the center of the city remains covered by water hyacinth. This aquatic weed collected and recycled in to vermicompost by using earthworm species, Eudrilus euginae. Vermicomposting was carried out by heap method. This vermicompost have tested for the observation of growth of Chilli plant. The pot experiments were carried out for the duration of three months. Plants were observed for growth at an interval of 30 days, 60 days and 90 days. The growth of the plants was measured in term of height of the plants and number of leaves, number of flowers and number of pods. Vermicompost treated Chilli plants showed enhanced growth activity when compared with control group. This indicates that this bio- fertiliser has the capacity to enhance growth of the plants.***

***Keywords:*** *Water hyacinth, Vermicomposting, Eudrilus euginae, Chilli*

----------∴ ∴ ∴----------

## I INTRODUCTION

Vermitechnology is becoming very popular application for the proper and safe recycling of organic waste. It is the eco-friendly method of solid waste management (Kulkarni, 2017) [11]. Different types of organic wastes including agricultural waste, garden waste, vegetable market waste, sewage waste, aquatic weed waste etc. are used as organic raw material and nutrient rich vermicompost and vermi wash is produced with the help of the earthworms (Gajalakshmi, 2001; Gajalakshmi and Abbasi,2002) [6,7]. Vermicomposting is the technique of conversion of waste into wealth (Hemlatha, 2012) [9]. The earthworm and soil microorganisms play an essential role in degradation of these waste and convert it into bio fertilizer. This bio fertilizer acts as plant growth promoter by enriching the soil with essential nutrients (Kaur and Babbar, 2015) [10].

Water hyacinth is an aquatic macrophyte plant. Because of its fast growing capacity it spreads and covers the surface of the water bodies by forming dense mat or blanket like structure (Sadanandan, 2018; Dwiwedi and Dwivedi, 2018) [15,5]. Sambhaji tank, is a fresh water body located in the center of the Solapur city. In the Sambhaji tank there is a mat of water hyacinth plant is formed due to fast and uncontrolled growth of this weed plant.

Because of the nuisance value, the water hyacinth plants are removed from this tank periodically and dumped on the road side which creates accumulation of large heaps of water hyacinth waste and causes pollution problem. Recycling of this weed waste is very essential for the environment. There are various methods for recycling of the water hyacinth but vermicomposting is the best method because it is cost efficient and eco- friendly method of solid waste management.

Chilli plant is the most important vegetable plant belonging to family Solanaceae. It is major crop in India as it is largely cultivated (Ankaram, 2013) [2]. Since long year back the chilli was used as spice in day to day vegetable curry preparation. Chilli contains many essential nutrients like proteins, vitamins like vitamin A and C. It is a very good source of various minerals like calcium, iron, phosphorous etc. (Bose et al., 1993) [4]. It is consumed both as a fresh fruit and as dried chilli powder. Its pungent nature is due to its major ingredient,

'Capsaicin' and other related Capsainoids (Samsangheile et al., 2018) [16].

Various research workers have studied the vermicomposting as the best method for recycling of wastes. Theunissen, et al., (2010) [18] studied potential of vermicompost produced from plant waste on the growth and nutrient status in vegetable production. Rao *et al*., (2011) [14] studied recycling of water hyacinth by vermicomposting with the help of earthworms *E. euginae*. Kaur *et al*., (2015) [10] studied impact of vermicompost and vermi wash on growth of vegetables. Ganesh Kumar *et al*., (2014) [8] studied the vermicomposting of aquatic weed Salvinia by using *Eudrilus euginae* and *Eisenia foetida*. Shridevi *et al*., (2016) [17] studied the bioconversion of water hyacinth into vermicompost after mixing with cow dung with the help of *Eisenia foetida* earthworms. Kulkarni, (2017) [19] stated that vermicomposing is the boon for reducing the waste and improving soil quality.

The present investigation is mainly focussed on recycling of water hyacinth into vermicompost and application of this vermicompost on Chilli (*Capsicum annum*) plant to observe its impact on various growth parameters.

## II MATERIALS AND METHODS:

The experiments were carried out during 2018- 2019. Water hyacinth plants were collected from Sambhaji tank, Solapur. These plants were chopped into small pieces and sun dried for about fifteen days. After that its powder was made with the help of mechanical pulveriser. Cow dung was collected from nearby cattle hut. The earthworm, Eudrilus *euginae* were collected from Parlekar Farm House, Solapur (M.S.), India.

**Experimental set up:**

Vermicomposting was carried out by heap method. Heaps of size 1 x 2 x 0.5 m size were prepared. Experiments were performed in triplicates. For the sake of convenience, the decomposing mixtures were divided into 3 different sets as follows.

A- Control- Organic Raw Material (ORM- Dry powder of water hyacinth)

B- Compost- ORM 50 % + Cow dung 50 %

C- Vermicompost- ORM 50% + Cow dung 50% + *Eudrilus euginae*

The above mixtures were decomposed for 90 days by maintaining optimum moisture content. After 90 days, physicochemical parameters were analysed by using standard method. Pot experimentation were carried out with Chilli (*Capsicum annum*) plant to study the impact of vermicompost on various growth parameters of plant. Following are the treatment group for pot experimentation which include

T1- Control (100% Soil)

T2- Soil (50%) + Compost produced by water hyacinth (50%).

T3- Soil (50%) + Vermicompost produced by water hyacinth (50%).

## III RESULTS:

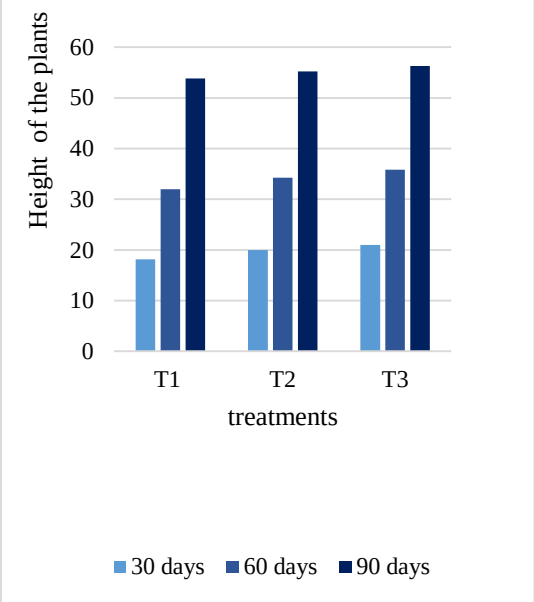
**Table 1: Physicochemical parameters of water hyacinth Vermicompost.**

| Sr. No. | Parameters | ORM | Water hyacinth Compost | Water hyacinth Vermicompost |
|---|---|---|---|---|
| 1. | pH | 6.89 | 7.92 | 8.41 |
| 2. | Electrical conductivity (mmhos/cm) | 2.97 | 3.62 | 4.13 |
| 3. | Organic carbon (%) | 29.0 | 26.11 | 23.89 |
| 4. | C:N ratio | 25.43 | 20.55 | 12.37 |
| 5. | Nitrogen (%) | 1.14 | 1.27 | 1.93 |
| 6. | Phosphorous(%) | 0.49 | 0.76 | 1.28 |
| 7. | Potassium(%) | 0.85 | 0.93 | 1.36 |

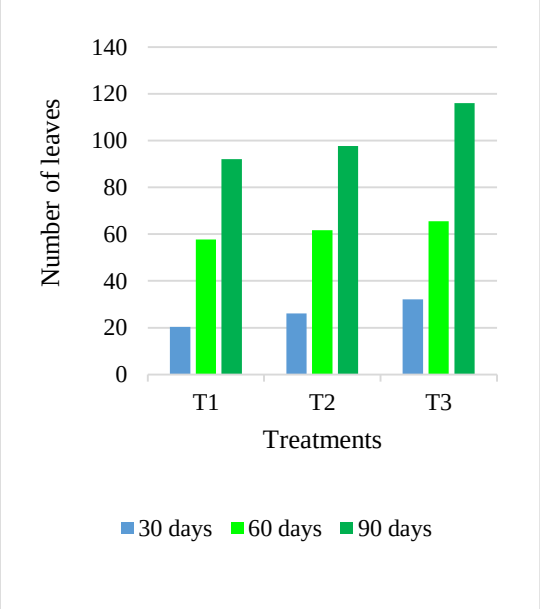
**Table 2: Effect of vermicompost on growth parameters of Chilli plant.**

| Duration in days | Growth parameters | T1- Control (Soil) | T2- Compost | T3-Vermicompost |
|---|---|---|---|---|
| After 30 days | Height of the plant in cm | 18.15 ± 0.18 | 20.0 ± 0.30 (10.135%). | 21.0 ± 0.25 (48.42%) |
| | Number of leaves | 20.33 ± 0.40 | 26.06 ± 0.26 (28.18%) | 32.16 ± 0.48 (58.18%) |
| After 60 days | Height of the plant in cm | 32.0 ± 0.48 | 34.26 ± 0.68 (7.06%) | 35.86 ± 0.35 (12.06%) |
| | Number of leaves. | 57.66 ± 1.15 | 61.66 ± 1.29 (6.93%) | 65.60 ± 1.51 (13.87%) |
| | Number of flowers | 11.46 ± 0.17 | 13.30 ± 1.19 (16.05%) | 15.16 ± 0.18 (31.76%) |
| | Number of pods | 7.33 ± 0.10 | 10.33 ± 1.19 (40.49%) | 12.40 ± 0.19 (69.16%) |
| After 90 days | Height of the plant in cm | 53.86 ± 0.70 | 55.23 ± 0.66 (2.54%) | 56.33 ± 1.18 (4.60%) |
| | Number of leaves | 92.03 ± 2.02 | 97.76 ± 1.56 (6.22%) | 116.01 ± 2.9 26.05%) |
| | Number of flowers | 24.0 ± 0.38 | 27.36 ± 0.57 (14%) | 28.26 ± 0.70 (17.75%) |

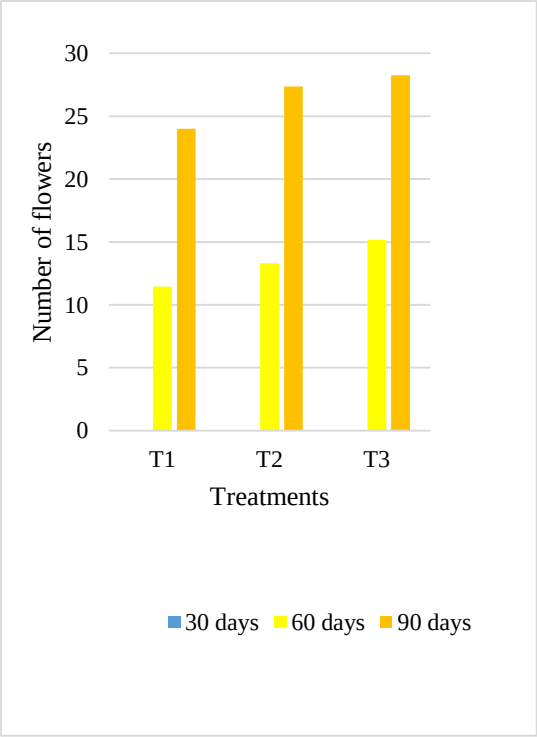
Graph 1: Effect of vermicompost on height of the Chilli plant.



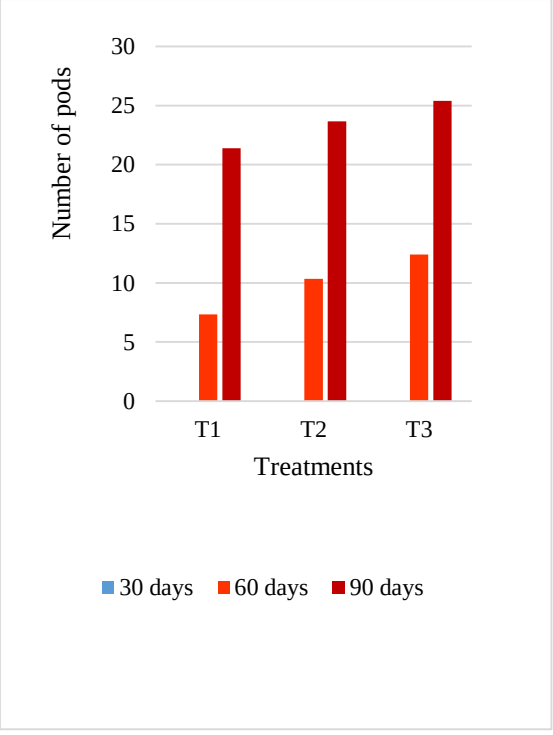

Graph 2: Effect of vermicompost on number of leaves of Chilli plant.




Graph 3: Effect of vermicompost on number of flowers of chilli plant.




Graph 4: Effect of vermicompost on number of pods of chilli plant.



1. Plant treated with compost.

2. Plant treated with vermicompost

3. Flowering in Chilli plant

4. Pods in Chilli plant.

## IV DISCUSSION:

The vermicompost produced from water hyacinth by using earthworm, *Eudrilus euginae* showed an enhanced nutrient content when compared with control. The pot experiments with Chilli plant also showed increase in growth parameters when compared with control.

Various plant parameters like height of the plant, number of leaves, number of flowers and number of pods were observed at an interval of 30 days, 60 days and 90 days duration. The Growth attributes of plants from T2 and T3 group were compared with T1 i.e. control group. After comparing with control, plants from T2 and T3 showed significant increase growth and development.

After 30 days duration, the height of the plant in T2 was increased by 10.13% and in T3 by 48.42% when compared with T1. The number of leaves were increased up to 28.18 % in T2 and 58.18% in T3. Similarly, after 60 days, the height of the plant in T2 and T3 was increase by 7.06% and 12.06% respectively. The number of leaves also increased up to 6.93% in T2 and 13.87% in T3. However, the number of flowers also increased in T2 and T3 by 16.05% and 31.76% respectively. The number of pods also increased in T2 by 40.49% but the maximum enhancement was noticed in T3 i.e. 69.16%. After 90 days interval, the increasing trend was remained same in both T2 and T3 when compared with T1. Height of

the plant was increased by 2.54 % in T2 and 4.60% in T3. In T2 group the number of leaves were increased

by 6.22% and in T3 by 26.05%.

Similarly, the number of flowers in T2 were increased by 14 % and in T3 by 17%. However, the final product i.e. number pods also showed increasing trend in T2 and T3 i.e. 10.56 % and 18.69%. From our results it was observed that all the plant growth parameters were increased in T2 and T3 but maximum increase was noticed in T3 i.e. vermicompost treated plants.

After comparing our results, it can be stated that the water hyacinth vermicompost played significant role in the enhancement of all plant parameters. This may be due to the earthworms and microorganisms. They carry out breakdown of the organic matter during decomposition. Therefore, the vermicompost makes available all the essential nutrients which results in plant growth.

Our results are also supported by some other research workers where they have reported similar types of growth and developments in plants. Nuka Lata and Dubey (2011) [13] studied response of water hyacinth manure on growth attributes and yield in *Brassica juncea* and concluded that the growth of *Brassica juncea* was more pronounced with 50% water hyacinth manure and productivity with 100% water hyacinth manure treatment.

Newton Osaro et al., (2014) [12] studied effects of water hyacinth (*Eichhornia crassipes* [Mart.] Solms) compost on growth and yield parameters of Maize (*Zea mays)* and concluded that water hyacinth compost can be used effectively as an organic soil amendment to restore soil and increase maize production. Blessy and Lakshmi Prabha (2014) [3] studied application of water hyacinth vermicompost on the growth of *Capsicum annum* and observed that vermicompost produced by water hyacinth was more efficient to increase the plant growth. Sridevi, et al., (2016) [17] studied bioconversion of water hyacinth in to enriched vermicompost and its effects on the growth and yield of Peanut and concluded that vermicompost can be used as fertilizer to increase plant growth and to improve soil fertility.

## V CONCLUSION:

In the present study recycling of water hyacinth by vermicomposting produced nutrient rich vermicompost. The present study also reveals that the addition of bio fertiliser have beneficial effect on Chilli plant. This indicates that water hyacinth vermicompost would be beneficial for growth of other vegetable as well as commercial plants. However, use of vermicompost also reduces overall usage of chemical fertilisers which has adverse effects on the soil composition and its nutrient value. Therefore, vermicomposting is the most effective method for recycling and reducing the waste generated from various sources.

## ACKNOWLEDGEMENT:

The authors are thankful to the Principal, Dr. S. V. Koti, Walchand College of Arts and Science, Solapur, for support and encouragement to carry out this research work.

## REFERENCES:

1. Anand Kumar and Gupta, R. K. (2018). The effect of vermicompost on growth and yield parameters of vegetable crop Radish (Raphanus sativus). Journal of Pharmacognosy and Phytochemistry. 7 (2): 589-592.

2. Ankaram S.R. (2013). A study of eco-friendly management of water hyacinth weed from fresh water Sambhaji tank, Solapur by vermicomposting technology. Thesis, Solapur University, Solapur, India.

3. Blessy, K. and Lakshmi Prabha, M. (2014). Application of water hyacinth vermicompost on the growth of *Capsicum annum*. International Journal of Pharma Sciences and Research (IJPSR). 5(5):198-203.

4. Bose, T. K., Som, M. G. and Kabir, J. (1993). "Vegetables crops", Naya Prokash pub Co. Calcutta. P. 234.

5. Dwivedi, M. and Dwivedi, A. (2018). Valuable product from water hyacinth –Review paper. International Research Journal of Engineering and Technology. 05 (03):838-843.

6. Gajalakshmi, S. and Abbasi, S. A. (2004). Earthworm and vermicomposting. Indian Journal of Biotechnology. 3: 486-464.

7. Gajalakshmi, S., Ramasamy, E. V. and Abbasi, S. A. (2001). Potential of two epigeic and two anecic earthworm species in vermicomposting of water hyacinth. Bioresource Technology. 177-181.

8. Ganeshkumar, T., Premalatha, Gajalakshmi, S. and Abbasi, S.A. (2014). A new process for the rapid direct vermicomposting of the aquatic weed Salvinia (Salvinia molesta). Bioresources and Bioprocessing. 1:26.

9. Hemlatha, B. (2012). Vermicomposting of fruit waste and industrial sludge. International Journal of Advanced Engineering Technology. 3 (2): 60-63.

10. Kaur, P. Bhardwaj, M. and Babbar, I. (2015). Effect of vermicompost and vermiwash on growth of

vegerables. Research Journal of Animal, Veterinary and Fishery Sciencces. 3 (4): 9-12.

11. Kulkarni, S. J. (2017). Vermicomposting- A Boon for waste minimization and soil quality. International Journal of Research and Review. 4 (2): 76-81.

12. Newton O., John O. M., Alice A., Dative M., Morris M., Omwoyo O. and John M. M. (2014). Effect of water hyacinth (Eichhornia crassipes [Mart.] Solms) compost on growth and yield parameters of Maize (Zea mays). British Journal of Applied science and Technology. 4(4): 617-633.

13. Nuka Lata and Dubey V. (2011). Response of water hyacinth manure on growth attributes

and yield in Brassica juncea. Journal of Central European Agriculture. 12(2):336-343.

14. Rao, K. R., Mushan, L. C., and Ankaram, S. R. (2011). Solid waste management of Water hyacinth from Sambhaji tank, Solapur by Vermibiotechnology. International Journal of Basic and Applied Research. 01: 93-97.

15. Sadanandan, L. (2018). Comparative study in production of vermicompost using two invasive aquatic weeds Eichhornia crassipes (Mart) Solms and Pistia stratiotes L. Indian Journal of Science and Research. 20(1): 53-55.

16. Samsangheile N., Lal, S., Singh, K. R. and Singh B. T. (2018). Effect of integrated nutrient management on growth of chilli (*Capsicum annum* L.). International Journal of Chemical Studies. 6 (2): 2026-2030.

17. Sridevi S. Prabha, M. and Tamilselvi, N.G. (2016). Bioconversion of water hyacinth in to enriched vermicompost and its effect on the growth and yield of Peanut. International Journal of Current Microbiology and Applied Science.5(9): 675-681.

18. Theunissen, J., Ndakidemi, P.A. and Laubscher, C. P. (2010). Potential of

19. vermicompost produced from plant nutrient status in vegetable production. International Journal of the Physical Sciences. 5(13):1964-19