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EFFECT OF VERMIWASH AND VERMICOMPOST OF *EUDRILUS EUGENIAE* ON THE GROWTH AND DEVELOPMENT OF LEAVES AND STEM OF BRINJAL PLANT (*SOLANUM MELONGENA*)

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Abstract: Vermiwash is an excellent organic liquid fertilizer which can be used as a foliar spray for protecting plants from insects and harmful diseases and in the root zone for the growth of plants. This study was conducted to find out the effect of vermicompost and vermiwash on the growth and development of leaves and shoot length of brinjal plants. Four combinations were prepared from vermicompost, vermiwash, dung and soil for comparative study. Different combinations such as soil and dung (500g+500g) as control, S+VC+VW (500g +500g+foliar spray on leaves daily not in roots), S+VC (500g+500g), S+VW (1kg+foliar spray on leaves and 200 ml in roots with water in 1:1 ratio daily) as test treatments (TR-1, TR-2 and TR-3) were made. Each treatment was carried out in triplicate to reduce the variations. Experiments were of four weeks. Mean shoot length of plants were observed 4.51±0.07 cm, 4.57±0.10 cm and 4.59±0.10 cm in TR-1, TR-2 and TR-3 treatments respectively, while in control only 4.23±0.08 cm growth was obtained. Hence it can be concluded that the effect of vermiwash and vermicompost on the growth and development of leaves and stem of brinjal plants is more significant in comparison to control (soil and dung only).

Keywords: Earthworm, Organic waste, *Solanum melonge*na, Vermiwash, Vermicompost.

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INTRODUCTION

Nowadays, advent of chemical fertilizers is increasing in agriculture day by day which ultimately destroys the fertility of soil upon long term use. Organic fertilizers may be used as alternative source to control the hazardous effect of chemical fertilizer. In this way, vermicompost and vermiwash may be used for better yielding of crops. Vermiwash protect the environment from various chemical fertilizers. Vermiwash is a liquid extract of organic waste material, which is collected after the passage of water through the different layers of earthworm culture units. Vermiwash is used as a liquid major nutritive and enzymatic element for promoting growth of all green plants. Vermiwash , the extracted body fluid of earthworms is also nutrient rich with components promoting good plant growth (Abdullah and Kumar Sukhraj, 2010; Murali, *et al*., 2010; Gorakh Nath, *et al*., 2009; Khaing *et al*., 2008). Very few researches are available in favour of vermiwash and its influence on the growth and development of plants. Earthworm has an efficiency to consume all types of wastage *viz,* that kitchen waste, temple waste, animal house waste, industrial waste, hospital waste and other organic wastes etc. Earthworms play a vital role in converting organic wastes to useful vemicompost. Satchell (1967) calculated that the dead worm's tissue discharges nitrogen in form of nitrates-25%, ammonia 45%, organic soluble compound 3%

and uncalculated material 27%. These materials improve the nutrient quality of vermiwash. Kale (1998) reported that vermiwash as foliar spray was effective in increasing the growth and yield response of anthurium. Karmegam *et al.,* (1999) estimated the growth and yield of *Phaseolus aures.* Karmegam and Daniel (2000d) calculated the Manorial value of vermicompost and its effect on the growth and yield of *Vigna unguiculeta* on 30, 60 and 90 day. Vermiwash also help to accelerate the degradation process. Gorakh Nath *et al*., (2009) evaluated the potential of an epigeic earthworm *Eisenia foetida* to convert the different combination of variety of wastes into rich nutrient vermicomposts/vermiwash and pre and post chemical analysis of feed mixtures. Hatti *et al.,* (2010) estimated the effect of Perionyx excavatus vermiwash on the growth, root length, shoot length, number of twig and leaves of plant seedling of *Vigna munga*, *Vigna radiate* and *Sesamum indicum.* Gopal *et al.* (2010) indicated that CLV must be used in graded doses. Its application increased the crop production capacities of soil by (i) enhancing the organic carbon contents in the soil and (ii) increasing the populations of the soil microorganisms, particularly plant beneficial ones, and their activities which would have facilitated increased uptake of the nutrients by the plants resulting in higher growth and yield. Rajan and Murugesan (2012) reported the effect of different concentrations of vermiwash spray on germination shoot and root length and vigor index of Cow Pea *Vigna* and Rice *Oryza sativa*.

EXPERIMENTAL

Collection of earthworm: The *Eudrilus euginae* species of Earthworm's were collected from the Vermicomposting Center of Charak Udyan Jiwaji University Gwalior (M.P).

Construction of experiment*:* Experiment was conducted in Charak Udyan Jiwaji University Gwalior. Vermiwash and Vermicompost were prepared at Vermicomposting center. We selected a circular earthen pot containing 2kg capacity for the conducting experiment. Experiment conducted in triplicate form to reduce error. Vermicompost and vermiwash were prepared and selected the different proportion of materials for the experiment. In first combination, Vermicompost + Vermiwash + Soil were used in (1:1). In Second Combination, Vermicompost + Soil were in (1:1). In Third Combination, Vermiwash + Soil were used. In fourth case, dung + soil (1:1) were used as a control. Weekly measured length of shoot and No of leaves. Experiment was completed in four week.

Chemical analysis: pH of vermiwash and dung was measured by digital pH meter. Total nitrogen was calculated by the Kjeldal method. Total phosphorous was analyzed by Spectrophotometer. Total Potassium was calculated by flame photometer.

RESULTS AND DISCUSSION

Nitrogen percentage in vermiwash was observed 1.15, which was higher than controlled (dung) i.e. 0.80. The total potassium percentage in vermiwash was found 1.55. Total phosphorus percentage in the vermiwash was recorded 1.40**.**

Table 1. Showing Biochemical parameters of Vermiwash and dung

Biochemical Parameters analysis (%)				
Treatments	**Total-N**	**Total-P**	**Total-K**	**pH**
Vermiwash	1.15	1.40	1.55	7.4
Dung	0.80	0.74	0.62	7.8

EFFECT OF DUNG, VERMIWASH AND VERMICOMPOST ON THE SHOOT LENGTH OF BRINJAL (*Solanum melonge*na) PLANTS

TR- 1: Treatment 1 was composed of 1/2 kg soil, 1/2 kg Vermicompost, Vermiwash and water showed a significant increase in the length of shoot. Initially the length of shoot was recorded to be 2.00 cm on 1st day of the experiment. After seven days interval, the length was again measured and recorded to be 2.26±0.09 cm. Again an increase was observed in the length of shoot i.e. 2.96±0.06cm, 3.89±0.07 cm as on 14th and 21st day of the experiment. The length of shoot was recorded to be 4.51±0.07 cm at the end of the experiment (Table 2).

TR- 2: It was composed of 1\2 kg soil, 1\2 kg Vermicompost and water showed a significant increase in the length of shoot. Initially the length of shoot was recorded to be 2.00 cm on

1st day of the experiment. After seven days interval, the length was again measured and recorded to be 2.19±0.10 cm. Again an increase was observed in the length of shoot i.e. 3.07±0.10 cm, 3.75±0.09 cm as on 14th and 21st day of the experiment. The length of shoot was recorded to be 4.57±0.10 cm at the end of the experiment (Table 2).

TR-3: It was composed of 1kg soil and vermiwash spray showed a significant increase in the length of shoot. Initially the length of shoot was recorded to be 2.00 cm on 1st day of the experiment. After seven days interval, the length was again measured and recorded to be 2.45±0.12 cm. Again an increase was observed in the length of shoot *i.e.* 3.10±0.09 cm, 3.83±0.09 cm as on 14th on 1st day of the experiment. After seven days the number of leaves was counted and recorded as and 21st day of the experiment. The length of shoot was recorded to be 4.59±0.10 cm at the end of the experiment (Table 2).

EFFECT OF VARIOUS COMBINATION ON THE NUMBER OF LEAVES OF BRINJAL (*Solanum melonge*na) PLANTS

TR- 1: The number of leaves in the plants treated with half kg soil, half kg vermicompost, vermiwash and water was found to be 4 on 1st day of the experiment. After seven days the number of leaves were counted and recorded as 4.14± 0.14. Further increase was recorded in the number of leaves 6.14±0.14 on 21st day of the experiment. At the end of the experiment, the total number of leaves was found to be 7.28±0.18 (Table 3).

TR-2: The number of leaves in the plants treated with of half kg soil, half kg vermicompost, vermiwash and water was found to be 6 on 1st day of the experiment. After seven days the number of leaves were counted and recorded as 6.28±0.18. Further increase was recorded in the number of leaves 8.14±0.14 on 21st day of the experiment. At the end of the experiment, the total number of leaves was found 9.42±0.20 (Table 3).

TR-3: The number of leaves in the plants treated with of 1 Kg soil, vermiwash and water was found 5.85±0.40. Further increase was recorded as 9.42±0.20 in the number of leaves on 21st day of the experiment. At the end of the experiment, the total number of leaves was found to be 11.14±0.40 (Table 3).

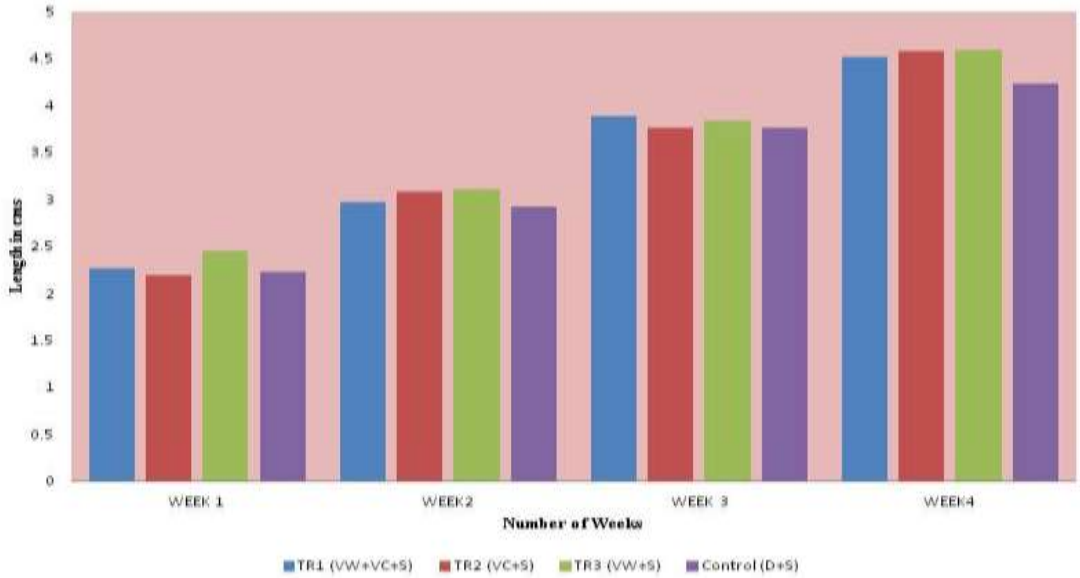

Figure 1: Week wise Shoot Length of Brinjal Plants

Table 2: Effect of vermiwash on the shoot length of Brinjal plants in a period of one month

Treatment Period	WEEK 1	WEEK 2	WEEK 3	WEEK 4
TR 1 (S+VC+VW)	2.26±0.09	2.96±0.06	3.89±0.07	4.51±0.07

TR 2 (S+VC)	2.19±0.10	3.07±0.10	3.75±0.09	4.57±0.10
TR 3 (S+VW)	2.45±0.12	3.10±0.09	3.83±0.09	4.59±0.10
Control (S+D)	2.22±0.06	2.92±0.02	3.76±0.12	4.23±0.08

(S= Soil, D=Dung, C=Vermicompost, VW=Vermiwash)

Table 3: Effect of vermiwash (in different ratios) on the number of leaves in Brinjal plants in period of one month

(S= Soil, D=Dung, VC=Vermicompost, VW=Vermiwash)

Treatment Period	Week 1	Week2	Week 3	Week4
TR 1 (S+VC+VW)	4.14±0.14	5.14±0.14	6.14±0.14	7.28±0.18
TR 2 (S+VC)	6.28±0.18	7.57±0.20	8.14±0.14	9.42±0.20
TR 3 (S+VW)	5.85±0.40	7.85±0.40	9.42±0.20	11.14±0.40
Control (S+D)	4.00±0.0	4.00±0.0	5.28±0.18	6.57±0.20

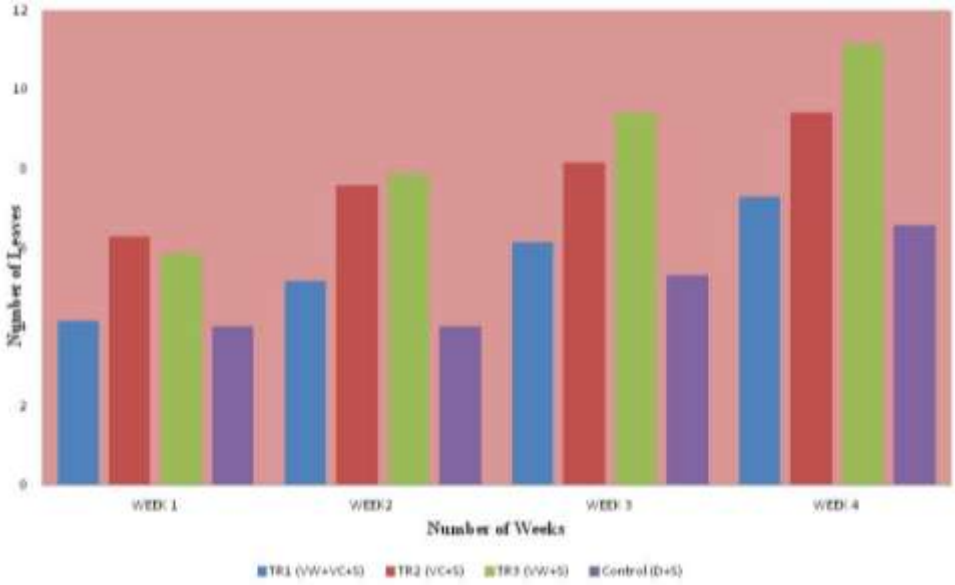

Figure 2: Number of Leaves in Brinjal Plant (*Solanum melongena*)

These experiments were conducted to assess the impact of vermicompost and vermiwash on the brinjal plants. (Lalitha *et al*., 2000; Raviv *et al*., 1998; Singh *et al*., 1998; Subler *et al*., 1998) reported that for the better growth of plants and higher yield by slow release of nutrients for absorption with additional nutrients like gibberellins, cytokinin and auxins, by the application of organic inputs like vermicompost in combination with vermiwash. Lalitha *et al*., (2000) studied that the organic manure like vermicompost and vermiwash, when added to soil, augment crop growth and yield. (Cook *et al*., 1980; Tiwari *et al*., 1989) observed that the yields of spinach and onion in response to diluted vermiwash along with vermicompost was highly significant which may be due to increased availability of more exchangeable nutrients in the soil by the application of vermiwash along with vermicompost. (Tisdale *et al*., 1982; Dong *et al*., 1983; Haynes *et al*., 1990; Perucci 1990) reported that the organic amendments like vermicompost and vermiwash promote humification, increased microbial activity and enzyme production, which, in turn, bring about the aggregate stability of soil particles, resulting in better aeration. Haynes (1986) informed that the organic matter has a property of binding mineral particles like calcium, magnesium and potassium in the form of colloids of humus and clay, facilitating stable aggregates of soil particles for desired porosity to sustain plant growth. The assessment of vermiwash indicated the presence of micronutrients in significant quantity (Kale, 1998; Ismail, 2005). The plant growth in vermiwash and vermicompost may be due to the impact of microbes in bio-fertilizers. Use of vermiwash and vermicompost may attribute the significant increase in nitrogen of the soil due to the presence of nitrogen fixing bacteria, which increase the nitrogen content of the soil (Lalitha

et al., 2000; Ansari, 2008a;b). According to Lalitha *et al*., (2000), applications of organic fertilizers have an emphatic effect on plant growth and production. The soil enriched with vermicompost provides additional substances that are not found in chemical fertilizers (kale, 1998; Ansari and Ismail, 2008). Data clearly indicate a better performance of Okra using the combination of vermiwash and vermicompost. Present results are in agreement with those obtained by earlier workers (Lalitha *et al*., 2000; Ismail, 2005; Ansari, 2008a; b; Ansari and Ismail, 2008). It was observed that the yield of Okro increased to 64.27% as compared to control group. The vermiwash may contain cytokinins, auxin, amino acid, and vitamins, enzymes possibly derived from microbes associated with earthworms. Kale, (1993) concluded that the vermicompost is not only a rich organic manure but also a very good quality soil additive. It is aerobically degraded organic manure that has undergone chemical disintegration by the enzyme activity in the gut of earthworms and enzymes of the microbial populations. Shobha and Kale (2006) have shown that vermiwash (coelomic body fluid) is having antibacterial property. Surendra *et al*., (2005) reported vermiwash very much useful in growth of legumes plants. Karmegam and Daniel (2000d) have reported the manorial value of vermicompost and its effect on the growth and yield of plant Vigna unguiculata on 30th, 60th, and 90th day of pot culture studies. Similar results have been observed on the application of vermiwash also. Karmegam *et al*., (1999) studied the growth and yield of *Phaseolus aures.* It was observed that during the experiment, vermiwash when sprayed on the plants of brinjal showed a significant effect on the growth of plants. Vermiwash when mixed with vermicompost increases the shoot length upto 4.51±0.07cm as compared to control 4.23±0.08 cm. When vermiwash was directly sprayed on the plants of brinjal, the length of shoot was recorded 4.59±0.10 cm which was higher as compared to control group 4.23±0.08 cm. The results were observed and recorded for the increase in number of leaves of both type of plants. The number of leaves in the brinjal plants given treatment 1 was recorded to be 7.28±0.18 which was higher as compared to control 6.57±0.20 at the end of experiment. The significant increase was observed in the brinjal plants sprayed vermiwash only as the numbers of leaves were recorded to be 11.14±0.40.

CONCLUSION

The effect of vermiwash was observed on the plants of brinjal and it was found that the results obtained were almost similar to the results of vermicompost. However some deviations were observed in the number of leaves due to the interference of other climatic factors. The vermiwash proves to be an effective fertilizer which contributes the growth of plants when sprayed directly as well as mixed with a definite ratio of vermicompost. It was also observed that the plants treated with vermiwash were disease resistant. Experiment shows that vermiwash along with vermicompost can be used as a substituent of commercial fertilizers available in market however the effect of other parameters has to be analyzed. The vermicompost and vermiwash of Cattle waste acts as an excellent base for the establishment and multiplication of beneficial / symbiotic microbes.

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REFERENCES

Abdullah, A.A., Kumar, S., (2010). Effect of vermiwash and vermicompost on soil parameters and productivity of okra (*Abelmoschus esculentus*) in Guyana. *Afr. J. of Agri. Res.,* 5 14):1794-1798.

Ansari A.A (2008a). Effect of Vermicompost and Vermiwash on the Productivity of Spinach (Spinacia oleracea), Onion (*Allium cepa*) and Potato (*Solanum tuberosum*). *World J. Agric. Sci.*, 4(5):554-557.

Ansari A.A, Ismail SA (2008). Reclamation of sodic soils through vermitechnology. *Pakistan J. Agric. Res.*, 21(1-4): 92-97.

Ansari AA (2008b). Effect of Vermicompost on the productivity of Potato (*Solanum tuberosum*), Spinach (*Spinach oleracea*) and Turnip (*Brassica campestris*). *World J.*

Agric. Sci., 4(3): 333-336.

Cook, A.G., B.R. Critchley and U. Critchley, (1980). Effects of cultivation and DDT on earthworm activity in a forest soil in the sub-humid tropics. *J. Appl. Ecol.,* 17:21-29.

Dong, A., G. Chester and G.V. Simsiman, (1983). Soil dispersibility. *J. Soil Sci.,* 136: 208.

Gopal, M. Alka Gupta, C. Palaniswami, R. Dhanapal and George V. Thomas (2010). Coconut leaf vermiwash: a bio-liquid from coconut leaf vermicompost for improving the crop production capacities of soil. *Current Science,* 98(9):1202-1210

Gorakh, N., Keshav, S., Singh, D.K., (2009).Chemical analysis of vermicompost/vermiwash of different combination of animal, agro and kitchen wastes. *Aus. J. Bas. & Appl. Sci*. 3(4):3672-3676.

Hatti S.S., Londonkar R.L., Patil S.B., Gangawane A.K. and Patil C.S. (2010). Effect of Perionyx excavatus vermiwash on the growth of plants. *Journal of Crop Science,* 1(1): 01-05.

Haynes, R.J. and R.S. Swift, (1990). Stability of soil aggregates in relation to organic constituents and soil water content. *J. Soil Sci*., 41: 73.

Haynes, R.J., (1986). The Decomposition Process Mineralization, Immobilization, Humus Formation and Degradation. *In*: Mineral Nitrogen in the Plant-Soil System (Haynes, R.J., Ed.), Academic Press, New York.

Ismail, S.A., (2005). The Earthworm Book. Other India Press, apusa, Goa, pp: 101.

Kale, R.D. (1998). Earthworms. Nature's gift for utilization of organic wastes. *In* earthworm's ecology. Edwards, C.A (Ed.) CRC Press LLC. BOCCA. Raton, Florida.pp.355-376.

Karmegam, N and Daniel, T. (2000d). Utilization of some weeds as substrates for vermicompost preparation using an epigeic earthworm *Eudrilus eugeniae*. *Asian J. Microbio. Biotech. Environ. Sci*., 2(1): 63–66.

Karmegam, N., K. Alagumalai and Daniel, T. (1999). Effect of vermicompost on the growth and yield of green gram (*Phaseolus aureus Roxb*.) *Trop. Agri*., 76(2): 143–146.

Khaing N. S., Aye, A. K., Khin, S.A., Zaw, K. O., (2008). Inter. Confe. On Sus. Dev.: Iss. Pros. For the GMS. , GMSARN, 1-3.

Lalitha, R., K. Fathima and S.A. Ismail, (2000). Impact of biopesticides and microbial fertilizers on productivity and growth of Abelmoschus esculentus. Vasundhara the Earth, 1 and 2: 4-9.

Nath, G. Singh, Keshav; Singh, D. K (2009). Chemical Analysis of Vermicomposts / Vermiwash of Different Combinations of Animal, Agro and Kitchen Wastes. *Australian Journal of Basic and Applied Sciences*, 3(4): 3671-3676.

Perucci, P., (1990). Effect of the addition of municipal solid-waste compost on microbial biomass and enzyme activities in soil. *Biol. Fertil. Soils,* 10: 221.

Rajan, M.R. and Murugesan P. (2012). Influence of Vermiwash on Germination and Growth of Cow Pea Vigna Ungiculata and Rice *Oryza sativa*. *IOSR Journal of Pharmacy*, 2(6):31-34.

Raviv, M., B.Z. Zaidman and Y. Kapulnik, (1998). Compost Science and Utilization, 6: 46-52.

Satchell, J.E. (1967): Lumbricidae *In*: Soil Biology. (A. Burges and F. Raw, Eds) 259-322. Academic Press. London.

Shobha, S.V., Kale, R.D., (2006). Antimicrobial potency of *Eudrilus eugeniae* extract on certain plant pathogens. 7th Inter. Sym. on Earth. Eco. , Krakow, Poland.

Singh, A.K., A.K. Sharma and R. Gouraha, (1998). Environ. Ecology, 16: 669-75. Subler, S., C.A. Edwards and *J. Metzer Biocycle*, 39: 63-66.

Surendra Suthar, Choyal R.R, Sushma Singh and Sudesh. (2005). Stimulatory effect of earthworm coelomic fluid (vermiwash) on seed germination and seedling growth of two legumes. *J Phytological Research* 18(2):291-222.

Tisdale, J.M. and J.M. Oades, (1982). Organic matter and water-stable aggregates in soil. J. Soil Sci., 33: 141. Tiwari, S.C., B.K. Tiwari and R.R. Mishra, (1989). Microbial populations, enzyme activities and nitrogen- phosphorus-potassium enrichments in earthworm casts and in the surrounding soil of a pineapple plantation. *Biol. Fertile. Soils*, 8: 178-182.

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