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## RESEARCH ARTICLE

### EFFECT OF VERMIWASH ON THE GROWTH AND DEVELOPMENT OF LEAVES AND STEM OF TOMATO PLANTS

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#### ABSTRACT

Vermiwash is the organic fertilizer obtained from units of vermiculture and vermicompost as drainage. It is used both as foliar spray and in the root zone of plant. Our study examines the effect of vermiwash on the growth and development of tomato plant. When vermiwash was sprayed on the tomato plants, it showed a significant growth of plants i.e. length of shoot as well as number of leaves per plant. Vermiwash when mixed with vermicompost increased the shoot length to  $19.61 \pm 0.18$  cm as compared to control  $17.92 \pm 0.21$  cm. when vermiwash was directly sprayed on the plants of tomato the length of shoot was recorded to be  $19.72 \pm 0.30$  cm which was higher as compared to control group  $17.92 \pm 0.21$  cm. It can be concluded that the growth of tomato plants showed much positive results when grown in vermicompost. However the results were apparent when the plants were treated with vermiwash. Hence, 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 and no any worms like leaf eaters were seen on the leaves and other parts of plants.

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#### INTRODUCTION

Due to increasing population and development of human Civilization Industrialization increased the problem of environmental degradation. The rapidly use of chemical fertilizer & pesticide destroyed the fertility of soil and also produces the harmful diseases for crops and human mankind. Vermiwash is a liquid that is collected after the passage of water through a column of worm action. It is a mixture of excretory products and mucus secretion of earthworms along with micronutrients from the soil organic molecules. It is very useful as a foliar spray. These are transported to the leaf, shoots and other parts of the plants in the natural ecosystem. Vermiwash contains various enzymes and microbes. Those are beneficial for growth and develop of plant. The vermiwash also contains enzymes and secretions of earthworms and would stimulate the growth and yield of crops. Zambare *et al.* (2008) conclude that vermiwash contains various enzymes cocktail of protease, amylase urease and phosphatase and also Microbial study of vermiwash found that nitrogen fixing bacteria like *Azotobacter sp.*, *Agrobacterium sp.*, and *Rhizobium sp.* and some phosphate solublizing bacteria. Kale (1998) reported that vermiwash as foliar spray was effective in increasing the growth and yield response of anthurium. Hatti *et al.* (2010) Reported that the seedling of *Vigna munga*, *Vigna radiate*, *Sesamum indicum*, resulted in increases of growth of

parameters lie the root length, shoot length, number of twigs and leaves and total biomass of the plant after spraying the vermiwash of *Perionyx excavates*. Vermiwash also protect the plants and crops as we use spraying method. This work is related to the influence of vermiwash on the germination of tomato plant.

#### MATERIALS AND METHODS

**Collection of Earthworm:-** The earth worms are collected from the Vermicomposting center of Charak Udyan Jiwaji University Gwalior. *Eudrilus euginae* species of Epigeic earthworm used for the preparation of vermiwash.

**Construction of vermiwash unit:-** The experiment was performed in the Vermicomposting centre, Charak Udyan, Jiwaji University, Gwalior. A vermiwash unit was designed as per Ismail (1997) with few modifications. Take a plastic container of 15 liters and hole was made at the bottom side so that a tap is fitted in the bottom to regulate the supply of water. A mixture of bricks and stone or concrete of 2-3 cm breadth was poured in the bottom of container. A layer of sand of 2-3 cm was maintained above this layer. Above to this layer, cool dung (3-4 cm) was poured and then few dried leaves of bottle palm were kept. An earthen pot (MATKA) was hanged above the container so that water comes out from the pot in to the container to keep the surface wet and moist during whole of the experiment. A pipe was fixed at bottom of the container for the collection of vermiwash. The macronutrients like Organic Nitrogen were analyzed by Kjeldahl method. The estimation of

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Potassium was done by flame photometric method involving digestion of the sample and determination of potassium. Phosphorus content of vermiwash was estimated by spectrophotometer method that also involves digestion and determination of total phosphorous in the digest.

**Extraction of Vermiwash:-** The drops of water made the upper surface as well as different layers of sand, dung and concrete mixture wet and moist. Earthworm started decomposing the dung present in the container. Water sprinkled on the upper layer passes through the dung decomposed by the earthworm. Some coelomic fluid and excreta of earthworm gets mixed with the water which is finally called "VERMIWASH" comes out in the vermiwash collection container directly through the pipe. Thus vermiwash was collected in the separate clean containers for finally use. The effect of vermiwash was observed on the various plant species.

## RESULTS

Vermiwash was chemically analyzed for various parameters i.e., total nitrogen (TN), Total phosphorus (TAP), Total sodium (TNa), pH. Total nitrogen percentage in vermiwash was found to be 3.1 which was higher than dung i.e. 0.80. The analysis was carried out to determine the total potassium percentage in the prepared vermiwash. It was found to be 2.55. Total phosphorous percentage in the vermiwash was recorded to be 1.4.

### EFFECT OF DIFFERENT TREATMENTS ON THE SHOOT LENGTH OF TOMATO (*Lycopersicon*) PLANTS:

**Treatment 1:** Treatment 1 was composed of half kg soil, half kg vermicompost, vermiwash showed a significant increase in the length of shoot. Initially the length of shoot was recorded to be 8cm on 1<sup>st</sup> day of the experiment. After seven days interval, the length was again measured and recorded to be 8.64±0.21 cm. Again an increase was observed in the length of shoot i.e. 11.7±0.44 cm, 16.49±0.68 cm as on 14<sup>th</sup> and 21<sup>st</sup> day of the experiment. The length of shoot was recorded to be 19.61±0.18 cm at the end of the experiment that was significantly higher than the control group 17.92±0.21 cm (Table 2).

**Treatment 2:** Treatment 2 was composed of 1\2kg soil, 1\2kg vermicompost and water showed a significant increase in the length of shoot. Initially the length of shoot was recorded to be 8 cm on 1<sup>st</sup> day of the experiment. After seven days interval, the length was again measured and recorded to be 8.7±0.23 cm. Again an increase was observed in the length of shoot i.e. 12.93±0.63 cm, 18.43±0.55 cm as on 14<sup>th</sup> and 21<sup>st</sup> day of the experiment. The length of shoot was recorded to be 21.65±0.36 cm at the end of the experiment that was significantly higher than the control 17.92±0.21 cm (Table 2).

**Treatment 3:** Treatment 3 was composed of 1\2kg soil and vermiwash spray showed a significant increase in the length of shoot. Initially the length of shoot was recorded to be 7.9 cm on 1<sup>st</sup> day of the experiment. After seven days interval, the length was again measured and recorded to be 9.28±0.34 cm. Again an increase was observed in the length of shoot i.e. 14.36±0.74 cm, 17.84±0.25 cm as on 14<sup>th</sup> and 21<sup>st</sup> day of the

experiment. The length of shoot was recorded to be 19.72±0.30 cm at the end of the experiment that was significantly higher than the control group 17.92±0.21 cm (Table 2).

**Table 1. Showing Biochemical parameters of Vermiwash and dung**

Samples Analyzed	Parameters analyzed			pH
	Total Nitrogen	Total phosphorous	Total Potassium	
Vermiwash	3.1	1.4	2.55	7.4
Dung	0.80	0.74	0.62	7.8

**Table 2. Effect of treatments on shoot length of tomato plants in a period of one month**

	SHOOT LENGTH: TOMATO ( <i>Lycopersicon</i> ) in cm.			
	WEEK 1	WEEK 2	WEEK 3	WEEK 4
TR 1 (S+VC+VW)	8.64±0.21	11.78±0.44	16.49±0.68	19.61±0.18
TR 2 (S+VC)	8.74±0.23	15.93±0.63	18.43±0.55	21.65±0.36
TR 3 (S+VW)	9.28±0.34	14.36±0.74	17.84±0.25	19.72±0.21
Control (S+D)	8.54±0.20	12.00±0.45	16.14±0.41	17.92±0.21

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

**Table 3. Effect of vermiwash (in different ratios) on the number of leaves in tomato plants in a period of one month**

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

Treatment Period	NUMBER OF LEAVES: TOMATO PLANT ( <i>Lycopersicon</i> )			
	WEEK 1	WEEK 2	WEEK 3	WEEK 4
TR 1 (S+VC+VW)	15.61±0.69	25.09±1.64	44.14±2.67	65.57±2.18
TR 2 (S+VC)	16.47±0.64	25.61±1.56	44.33±2.55	66.80±2.36
TR 3 (S+VW)	16.28±0.76	26.33±1.63	44.90±2.42	66.52±2.38
Control (S+D)	15.47±0.64	24.28±1.44	42±2.43	63.95±2.47

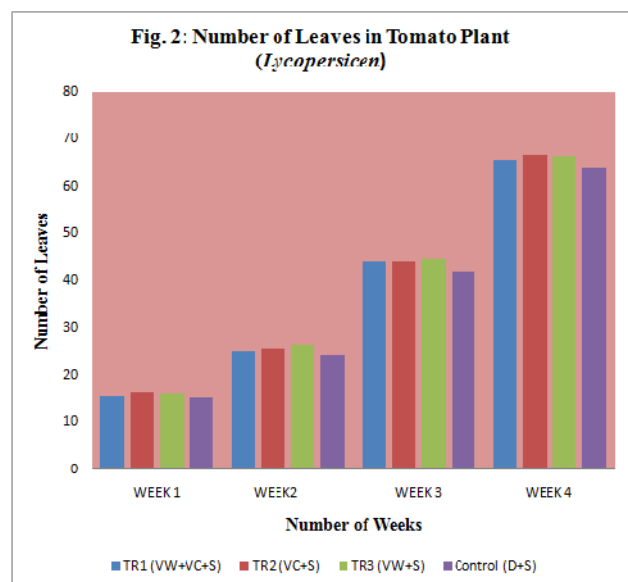
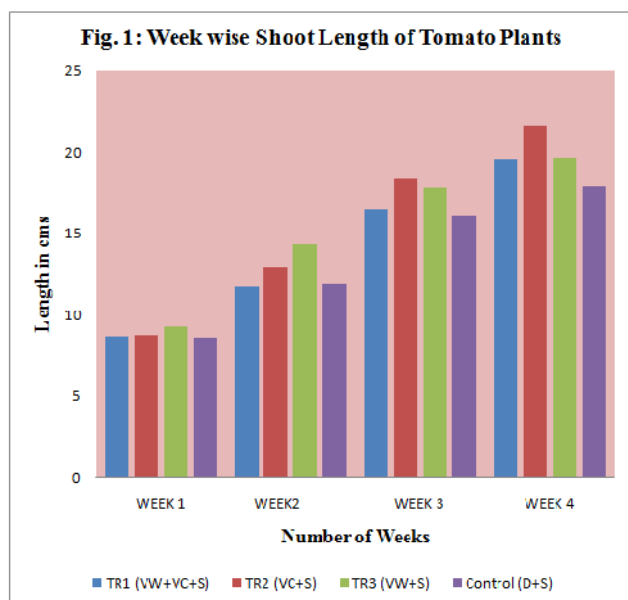
### EFFECT OF DUNG, VERMIWASH AND VERMICOMPOST ON THE NUMBER OF LEAVES IN TOMATO (*Lycopersicon*) PLANTS:

**Treatment 1:** The number of leaves in the plants treated with of half kg soil, half kg vermicompost, vermiwash and water was found to be 13 on 1<sup>st</sup> day of the experiment. After seven days the number of leaves was counted and recorded as 15.61±0.69. Further increase was recorded in the number 44.14±2.67 of leaves on 21<sup>st</sup> day of the experiment. At the end of the experiment, the total number of leaves was found to be 65.57±2.18 (Table 2).

**Treatment 2:** The number of leaves in the plants treated with of half kg soil, half kg vermicompost, vermiwash and water was found to be 14 on 1<sup>st</sup> day of the experiment. After seven days the number of leaves were counted and recorded as 16.47±0.64. Further increase was recorded in the number of leaves 44.33±2.55 on 21<sup>st</sup> day of the experiment. At the end of the experiment, the total number of leaves was found to be 66.80±2.36 (Table 2).

**Treatment 3:** The number of leaves in the plants treated with of half kg soil, half kg vermicompost, vermiwash and water was found to be 13 on 1<sup>st</sup> day of the experiment. After seven

days the number of leaves were counted and recorded as  $16.28 \pm 0.76$ . Further increase was recorded in the number  $44.90 \pm 2.42$  of leaves on 21<sup>st</sup> day of the experiment. At the end of the experiment, the total number of leaves was found to be  $66.52 \pm 2.38$  (Table 2).



## DISCUSSION

Earthworm processed material 'casts' contain several soil nutrients in forms which are easily available to plants (Taylor *et al.*, 2003). Earthworms rapidly convert the waste into humus-like substances with finer structure than thermophilic composts but possessing a greater and more diverse micro-bioactivity (Elvira *et al.*, 1996; Atiyeh *et al.*, 2000). A few plant growth-promoting substances have also been reported in casts (Krishnamoorthy and Vajranabhaian, 1986; Muscolo *et al.*, 1999). Krishnamoorthy and Vajranabhaian (1986) reported relatively higher ranges of plant nutrients such as ammonia, urea, oxidisable organic matter and exchangeable forms of some essential plant nutrients. They also reported plant hormones, e.g. cytokinins and auxins in earthworm casts.

Similarly, Muscolo *et al.* (1999) also found an auxin-like effect of earthworm-worked humic substances on cell growth and nitrogen metabolism in *Daucus carota*. The effect of vermiwash treated soil in which Spinach and Onion were grown, was found to be significantly higher when compared to control group. No significant effect was observed on the plants of potato (Ansari, 2008). The effect of vermiwash was observed on okro by Ansari and Kumar (2010).

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. It was observed that during the experiment, vermiwash when sprayed on the plants of tomato showed a significant effect on the growth of plants i.e. length of shoot as well as number of leaves per plant. Vermiwash when mixed with vermicompost increased the shoot length to  $19.61 \pm 0.18$  cm as compared to control  $17.92 \pm 0.21$  cm. when vermiwash was directly sprayed on the plants of tomato the length of shoot was recorded to be  $19.72 \pm 0.30$  cm which was higher as compared to control group  $17.92 \pm 0.21$  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 tomato plants given treatment 1 was recorded to be  $65.57 \pm 2.18$  which was higher as compared to control  $63.9 \pm 2.47$  at the end of experiment. The significant increase was observed in the tomato plants sprayed vermiwash only as the number of leaves were recorded to be  $66.52 \pm 2.38$ . The number of leaves in the tomato plants given treatment 1 was recorded to be  $65.57 \pm 2.18$  which was higher as compared to control  $63.9 \pm 2.47$  at the end of experiment.

## Conclusion

In the present study, the effect of vermiwash was observed on the plants of tomato 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 but that can be due to the interference of other climatic factors. However it can be conclude from the study that 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 and no any worms like leaf eaters were seen on the leaves and other parts of plants. Thus vermiwash along with vermicompost can be used as a substituent of commercial fertilizers available in market however other the effect on other parameters has yet to be analyzed.

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