

Effect of *Eisenia fetida* vermiwash on the growth of plants

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Abstract- Earthworms are known for their excellent contribution in increasing the soil fertility and promoting the plant growth through their body secretion and castings. Therefore, present experiment is designed to study the effect of vermiwash of *Eisenia fetida* which is commonly used in vermiculture farm of farmers on the growth of plants *Vigna mungo*, *Vigna radiata* and *Sesamum indicum*. The root length, shoot length, number of twigs, leaves, flowers, pods, grains and biomass were increased significantly compared to that of control in all the plants treated with vermiwash. The analysis of vermiwash showed high level of macro and micro nutrients like Ca, K, S, P, organic carbon, Fe, Mn, Cu and Zn. Therefore, it may be concluded that significant increase in the growth of vermiwash treated plants and their grain yield is due to high level of macro and micronutrients available in the vermiwash.

Key words: *Vigna mungo*, *Vigna radiata*, *Sesamum indicum*, *Eisenia fetida*, Vermiwash

INTRODUCTION

Vermiwash has excellent growth promoting compound besides serving as biopesticide. In recent days the vermiwash is used as liquid manure. Even though much work has been done on vermicomposting, very few reports are available related to vermiwash and its impact on the plant growth. It is *Eisenia fetida* epigeic earthworm species commonly used in vermiculture forms by farmers of North Karnataka, contributing much in increasing the soil fertility. Therefore, it is of our interest to study the vermiwash of on *Eisenia fetida* commonly growing plants like *Vigna mungo*, *Vigna radiata* and *Sesamum indicum*. It is also aimed to study the physicochemical contents of vermiwash.

MATERIALS AND METHODS

Method of collection of vermiwash

The plastic vessel measuring about fifteen liters capacity was taken and a hole was made at the bottom of vessel. The hole of vessel was sealed with paraffin wax. The vessel was filled with pebbles, sand and over this microbial infested old dampened cow dung was added. Ten adult *Eisenia fetida* earthworms were introduced. The setup was left undisturbed for about 20 days. The water was sprayed every day to maintain moisture required for the worm bed. On the twenty first day 1 liter of distilled water was poured over the worm bed and the liquid was collected by opening the seal at the bottom of the vessel. The collected vermiwash was stored in tightly closed 500ml bottle. A part of it was taken for physicochemical analysis and rest is used for experiment. The macronutrients like Organic Carbon were estimated by acid digestion method as described by Walkely and Black (1934). The available Nitrogen was estimated by alkaline potassium permanganate method (Subbaiah and Asija 1956). Available Phosphorous by Colorimetric method (Molybdenum-blue) as described by Jackson (1958). The Potassium and Calcium content were estimated by Mehlich method (1956) using Photometry and available Sulphur were estimated by Turbidometric method (Trivedi and Goel, 1986). The micronutrients like Copper, Zinc, Iron, and Manganese were estimated by using spectrophotometer (Christian and Feldman, 1970). Other parameters like hydrogen ion concentration was measured by using Elico pH meter (Sorenson 1909) and Electric conductivity was measured by using Systronics electrical conductivity meter (Trivedi and Goel, 1986) (Table-1).

Effect of *Eisenia fetida* vermiwash on (a) *Vigna mungo* (Black gram) (b) *Vigna radiata* (Green gram) (c) *Sesamum indicum* (Til)

The pots were filled with air-dried, macro and micronutrient tested soil. Quality seeds of *Vigna mungo*, *Vigna radiata* and *Sesamum indicum* proven having 80 to 90% germination were brought from Government recognized Seed Corporation. The pots were divided into six groups containing six pots in each group for experimentation.

Group 1a: This group consists of six earthen pots with tested soil and 20 *Vigna mungo* seeds. After germination the seedlings were sprayed with water as foliar spray every day and this group was served as control for group 1b.

Group 1b: This group consists of six earthen pots with tested soil and 20 *Vigna mungo* seeds. After germination the seedlings were sprayed with dilute concentration of *Eisenia fetida* vermiwash.

Group 2a: This group consists of six earthen pots with tested soil and 20 *Vigna radiata* seeds. After germination the seedlings were sprayed with water as foliar spray every day and this group was served as control for group 2b.

Group 2b: This group consists of six earthen pots with tested soil and 20 *Vigna radiata* seeds. After germination the seedlings were sprayed with dilute concentration of *Eisenia fetida* vermiwash.

Group 3a: This group consists of six earthen pots with tested soil and 20 *Sesamum indicum* seeds. After germination the seedlings were sprayed with water as foliar spray every day and this group was served as control for group 3b.

Group 3(b): This group consists of earthen pots with tested soil and 20 *Sesamum indicum* seeds. After germination the seedlings were sprayed with dilute concentration of *Eisenia fetida* vermiwash.

All the foliar spray was given by using hand spray every alternate day morning between 9.00 to 10 AM for 20 days. Another set of similar experiment was conducted with the duration of 40 days.

RESULTS AND DISCUSSION

The presence of earthworm in the soil and the soil condition affects plant parameters [1]. The influence of vermicast on the growth promotion of the wheat seedlings was examined [2]. The vermicompost resulted from the ability of earthworms to consume wide range of organic residues such as sewage sludge, animal wastes, crop residues and industrial waste. This becomes valuable manure which is rich in macro- and micronutrients, plant growth promoters, hormones, vitamins, and microorganisms [3, 4, 5 & 6]. Though lot of information is available on the effect of vermicompost on plant growth, there is a paucity of information on effect of vermiwash on the growth of plants. The present investigation carried in this direction. The seedlings of *Vigna mungo*, *Vigna radiata*, *Sesamum indicum*, resulted in increase of growth parameters like the root length, shoot length, number of twigs and leaves and total biomass of the plant after spraying the vermiwash of *Eisenia fetida* Table (1-4)

Effect of earthworm vermiwash on *Vigna mungo* (Black gram)

The root and shoot length of *Vigna mungo* plants are increased non-significantly after the treatment of vermiwash for either 20 or 40 days. The number of leaves, and twigs are increased significantly ($P < 0.01$) and highly significantly ($P < 0.001$) after respective spray of vermiwash for 20 and 40 days. The flowers, pods and grains which were not seen earlier have been appeared after 40 days vermiwash treatment. The biomass was increased highly significantly ($P < 0.001$) in both treated groups, compared to their respective controls (**Table 1**).

Effect of earthworm vermiwash on *Vigna radiata* (Green gram)

Non-significant increase in the root and shoot length is observed in the group treated with vermiwash for 20 days, but it is significant ($P < 0.01$) after the treatment of vermiwash for 40 days. Number of twigs was increased significantly ($P < 0.01$) with 20 days treatment and highly significant ($P < 0.001$) with 40 days treatment. The vermiwash spraying is highly effective when given for 40 days. An increase in the number of leaves, flowers, pods and grains is seen highly significant when compared to their respective control. The biomass is also increased highly significantly ($P < 0.001$) in both the treated groups (**Table 2**).

Effect of earthworm vermiwash on *Sesamum indicum* (Til).

The foliar spray of vermiwash of *Eisenia fetida* has increased the root length of *Sesamum indicum* non-significantly. But significant increase in root length ($P < 0.01$) and highly significant ($P < 0.001$) increase in shoot length was seen when vermiwash was sprayed for 20 and 40 days respectively. The number of twigs were increased significantly ($P < 0.01$) when compared to respective controls in both the groups. The number of leaves and biomass was increased in highly significantly in ($P < 0.001$) both the durational groups compared to their respective controls. The flowers made their appearance only in the group treated with vermiwash for 40 days (**Table 3**). It is of interest to note that the foliar spray of *Eisenia fetida* vermiwash has not only increased the vegetative growth but also effective in causing the origin of bud and flowers, pods and grains in all the three plants. The results of these experiments indicate that vermiwash increases the growth of pulses like *Vigna mungo*, and *Vigna radiata* and millet like *Sesamum indicum*. It also brings the early flowering which will result in early yield of grains. Similar results have been observed by Graft and Mackeshchin [7] as plants treated with worm excreta influenced the growth and yield of plant. It has observed the liquid fertilizer has assumed considerable importance because of its plant nutrients [8].

Physicochemical analyses of vermiwash

It has shown in Table 4 the physicochemical analysis of vermiwash. During the preparation of vermiwash all the physico-chemically active components soluble in water were extracted. They contain high amount of micro- and macronutrients. According to Barley and Jennings [9] non-available nitrogen is ingested by the worms is excreted in the form available nitrogen to plants. The vermiwash becomes alkaline because of high PH. The micro- and macronutrients present in the vermiwash may become essential source of nutrients easily available to the plants. Therefore the vermiwash may be used as good substance in inducing the plant growth (**Table 4**).

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Table 1:- Analysis of Physical and Chemical Parameters of Vermiwash

parameter	value
Calcium%	0.58
Potassium%	1.65
Sulphur%	0.057
Phosphorus%	0.560
Nitrogen%	10.24
Organic carbon%	4.62
pH	9.19
ECE	6.38×10^{12}
Fe(ppm)	3.193
Mn(ppm)	0.1593
Zn(ppm)	0.4980
Cu(ppm)	0.0626

Table 2- the effect of *Eisenia fetida* vermiwash on the growth of *Vigna mungo* (black gram)

Groups	No. Of Days	Root Length (In inches)	Shoot Length (In inches)	No. Of twigs	No. of Leaves	No. Of Flowers	No. Of Pods	No. Of Grains	Biomass (In grams)
Control	20	4.60±0.10	10.46±0.08	4.00±0.50	08.00±0.58	—	—	—	1.43±0.30
vermiwash	20	5.23±0.06	10.63±0.30	5.80±0.05**	11.53±0.17***	—	—	—	2.50±0.05***
Control	40	5.20±0.50	12.37±0.07	5.41±0.05	14.21±0.50	—	—	—	2.66±0.89
vermiwash	40	6.50±0.16	12.87±0.06	8.80±0.04***	18.20±0.17***	0.50±0.29	0.20±0.06	0.6±0.5	3.92±0.09***

C=CONTROL EF=*EISENIA FETIDA*, M ± SE=MEAN ± STANDARD ERROR

Table 3- the effect of *Eisenia fetida* vermiwash on the growth of *Vigna radiata* [green gram]

Group s	No. Of Days	Root Length (In inches)	Shoot Length (In inches)	No. Of twigs	No. Of Leaves	No. Of Flowers	No. Of Pods	No. Of Grains	Biomass (In grams)
Control	20	4.50±0.10	10.47±0.75	2.80±0.05	07.40±0.05	—	—	—	1.30±0.20
vermi wash	20	5.30±0.58	10.83±0.54	3.74±0.07**	08.40±0.03	—	—	—	2.60±0.58***
Control	40	4.50±0.60	10.75±0.75	5.46±0.12	08.80±0.12	0.4±0.05	—	—	2.90±0.06
vermi wash	40	5.23±0.03**	12.26±0.08**	8.91±0.05** [*]	16.53±0.58***	2.2±0.12***	0.7±0.05	0.8±0.05	4.10±0.06***

C=CONTROL EF= *EISENIA FETIDA* M ± SE=MEAN ± STANDARD ERRORTable 4- the effect of *Eisenia foetida* vermiwash on the growth of *Sesamum indicum*

Group s	No. Of Days	Root Length (In inches)	Shoot Length (In inches)	No. Of twigs	No. Of Leaves	No. Of Flowers	No. Of Pods	No. Of Grains	Biomass (In grams)
Control	20	1.20±0.05	4.90±0.05	2.17±0.06	5.80±0.50	—	—	—	0.37±0.05
vermi wash	20	1.40±0.05	5.66±0.58**	3.00±0.05**	6.13±0.58**	—	—	—	0.81±0.04** [*]
Control	40	1.21±0.05	6.35±0.07	3.80±0.58	7.60±0.50	—	—	—	0.52±0.05
vermi wash	40	1.42±0.05	8.46±0.53** [*]	5.09±0.58**	9.16±0.44***	—	—	—	0.92±0.05** [*]

C= CONTROL EF= *EISENIA FETIDA*