CONSEQUENCES OF VERMIWASH ON ROOT-SHOOT LENGTH, RATIO AND VIGOR INDEX ON GRAM SEED, *CICER ARITINUM* L.

Anant J. Dhembare and Sonali V. Dengale
Dept. Of Zoology, Padmashri Vikhe Patil College of Arts, Science and Commerce,
Pravaranagar- 413 713, Ahmednagar, Maharashtra, India
(Affiliated to Savitribai Phule Pune University, Pune. MS.)

ABSTRACT

The aim of the present investigation was to known the consequence of vermiwash on root, shoot lengthand ration with vigor index on the Gram seed, Cicer aritinum L. *The vermiwash was collected and diluted 10 times with distilled water and ten treatments were prepared. All the set was kept at indoor laboratory conditions under diffused light. After 48 hours soaking root and shoot length was measured. The data were recorded on 2, 4, 6, and 8 days. The results revealed that the root length was highest at 8th day at T-3 (11.6 cm), followed by 6th days at T-3 (9.8 cm) and 4th days at T-8 (9.6 cm). The highest shoot length was reported from T-4 (27.0 cm), T-5 (24.1 cm) and T-1 (21.8) at 8th days. The vigor index was also evaluated. The study confirms thatvermin wash can be easily used as liquid fertilizer for better growth of plants which are eco-friendly and easily available.*

Keywords: *Vermiwash, root-shoot length, vigor index, Cicer aritinum* L.

INTRODUTION

Most of the cropsrequired native range, supplements in the form of fertilizer. It includes additional nitrogen for growth, phosphorous for production and potassium for resistance. The fertilizers must be applied carefully to ensure there are no harmful effects. Excess fertilizer can kill plants and damage the soil health. The fertilizers arecarefully monitored to be ensuring the correct level with soil health. Even organic fertilizers can be toxic if sprayed in excess.Chemical fertilizers are toxic to humans and pets. The chemical fertilizers have the several ways to cause environmental damageinto non-target areas. However today, their increasing dose level causes several problems such as, increasing prices, soil health deterioration, changing

soil structure, microbe thrives, reduced soil fertility, imbalance nutrient balance, damage plants, ensure plant pathogens and pests, short term benefits, etc. However, it is not possible to supply all the nutrient requirements of crops wholly through organic manures. So by taking into consideration the above facts, integrated plant nutrient management system has been developed.

Earthworms contributedin the soil fertility improvement, plant growth and play a key role in converting organic matter and composting garbage in to humus [1]. There are about 3627 species of terrestrial earthworms in the world [2, 3].Which are the most important soil dwelling annelids involved in the process of soil formation, decomposition of organic matter and soil health [4].Vermicompostgenerated from animal dung is universally believed to be beneficial solid and liquid fertilizers [5,6]. Vermicomposts acts as an organic source of plant nutrients contains a higher percentage of various nutrients in readily available forms [7]. Diluted vermin wash content is also better fertilizer and insecticides [8]. The aim of this present investigation is focused on the impact of vermin wash on the growth of root and shoot also vigor index on short duration gram seeds, which are eco-friendly, economically feasible and easily available.

MATERIALS AND METHODS

2.1. Collection of waste and earthworm: Animal wastes were harvested from local farming. Partially decomposed mixtures of animals, agro, kitchen wastes were used for enhancement of vermiculation efficiency. Earthworm (*Eisenia foetida* L.) was procured from Mahatma Phule Agriculture University, Rahuri. The collected specimens were produced under laboratory conditions.

2.2. Vermiwash collection: After 20 days the liquid was collected in the vessel which was kept below the barrel. The Vermiwash stored in the bottle for further use.

2.3. Properties of vermiwash: The physico-chemical properties of vermiwash were detected as Temperature, pH, EC, Total carbon content, calcium, magnesium, and potassium with the help of standard methods [9].

2.4. Dilution of vermiwash: Vermiwash a bio fertilizer was produced by epigenic earthworm (*Eisenia foetida*). About one litter of vermiwash was collected and used for the experiments and prepared in three

dilutions. The vermiwash diluted 10 times with distilled water which was a 10% concentration and represented as similarlyT-1, T-2, T-3, T-4, T-5, T-6, T-7, T-8, T-9 and T-10 and control (T-O) also were prepared respectively.

2.5. Treatment Application: Germination study was conducted at the Department of Zoology, P. V. P. College, Pravaranagar from September 2018 to March 2019. Experiment was arranged in a complete randomized design (CRD) with three replications. The treatments are enumerated asfollows:TO = Control, T1 = 10 % VT, T2 = 20 % VT, T3 = 30 % VT, T4 = 40 % VT, T5 = 50 % VT, T6 = 60 % VT, T7 = 70 % VT, T8 = 80 % VT, T9 = 90 % VT, and T10 = 100 % VT.

2.6. Morphological study: To study the effect of vermiwash on the germination of seed was investigated, the seed were allowed to germinate in the rolled blotting paper and treatments were applied accordingly as per table 2 for the experimental seeds. A respective treatment was soaked with respective dilution and a control was soaked in distilled and was maintainedfor the purpose of comparison. All the set was kept at indoor laboratory conditions under diffused light. After 48 hours root length and shoot length were measured with scale. The data were recorded to 2, 4, 6, and 8 days respectively at early in the morning (9.00 to 10.00 am). The length of root and height of shoot up to internode (cm) were recorded.

2.7. Vigor index*:* The data were collected from each treatment from randomly selected from each treatment per replication. Regular methods of recording data were used in taking the germination percentage,shoot length, and root length. The vigor index of the seedlings was determined by following the formula [10].

Vigor index = [mean of root length (cm) + mean of shoot length (cm)] × percentage of seed germinations. The root-shoot ratio was also calculated for the representation of biomass vigor of plant.

2.8. Statistical Analysis: The data on morphological parameter was subjected to statistical analysis. All data expressed for mean, vigor index and root-shoot ration and the differences amongtreatment means were compared for significance difference at 5% level.

RESULTS AND DISCUSSION

The present study shows that application of vermiwash enhanced the germination response of *Cicer aritinum* L. seed at different concentration of vermiwash in the laboratory condition. Result showed that seed germination response of gram seed were affected by the vermiwash as a growth enhancer.

The temperature, pH and EC value of vermiwash of were 23^0C, 7.2 and 0.205 mΩ respectively during the study period(Table 1). The total carbon, calcium, magnesium and potassium were6.59 mg/l, 87.53 mg/l, 88.57 mg/l and 49.24 mgm respectively. The amount of micronutrients like iron and manganese was higher in *L. mauritii* except zinc and copper. The pH of worm casts *E. eugeniae* and *L. mauritii* was found to be lower than that of non-ingested control soil [11]. The EC value was higher in the casts of *E. eugeniae* and *L. mauritii* than the control [11]. The NPK content of both the casts was higher than that of the control soil. The micronutrients (Zn, Mn and Cu) were also found to be higher in the casts than the control soil but Fe content was more in control soil [11].

Organic formulation could be potent source to move forward soil fertility [12]. Combination of vermicomposts and vermiwash recorded a significant effect on biochemical characteristics of the soil with marketed improvement in soil micronutrients and better quantitative improvement in the physical and chemical properties of the soil [13].A report showed that soil treated with mixture of vermicomposts and vermiwash had significantly improved soil physico-chemical properties comparison to unlamented soil [14]. It is strong agreement to those of above worker.

Root length: The results presented in Table 2 had demonstrated that the shoot and shoot length of gram seed significantly influenced by the application of vermiwash at the control, 2, 4, 6, and 8th day of the treatments. The root length was highest at 8th day at T-3 (11.6 cm), followed by 6th days at T-3 (9.8 cm) and 4th days at T-4 (9.6 cm) respectively (Fig. 1).

Shoot length: As compared to control and plant seeds treated with vermiwash of significantly increased at the end of experimental days (table 2). Over the entire shoot length was highest at 8th day followed by 6th days and 4th days respectively. The highest shoot length was reported from T-4 (24.9 cm), T-5 (24.1 cm) and T-1 (23.9) at 8th days.

The longest root and shoot length of *C. olitorios* was observed in 10% VT. This result may contribute to higher germination percentage of *C. olitorios* applied with lower concentration of VT. This result was similar with findings, that vermin tea exhibited growth promoting effects on the exomorphological characters such as plant height and length of shoot [15]. In addition, vermin compost tea was able to supply balanced nutrients to plant roots and stimulate growth; increase organic matter content of

the compost including the humic substances that affect nutrient accumulation and promote root growth [16]. Root initiation, increased root biomass, enhanced plant growth and development and sometimes, alterations in plant morphology are among the most frequently claimed effects of vermicomposts treatment[17]. Thus, 10% of vermicomposts tea was able to improve the root and shoot length of *C. olitorius*. However, it was observed that higher concentration of VT was not able to improve the germination response of *C. olitorios.* This result support the findings, who reported that the effects of the application of humic acids on plants, in which growth of marigolds decreased when grown in a soilless media that contained a combination of 10 µM IAA and 500 mg·kg-1 humic acids from food waste vermicomposts [18].

The present study shows that application of vermiwash enhanced the growth percentage in Bengalgram (*Cicer arietinum* L.) var. RSG-896. This confirms the earlier observations [12, 13, 14, 15, 16].Vermicomposts enhanced plant production, mineral nutrients and total carotenoids, and this effect was mostprominent under organic fertilization [17]. Application of vermicomposts was reported by [18, 19, 20, 21, 22] reported that the vermicomposts treated plants exhibit faster and higher growth rate and productivitythan the control plants.

Vigor index: Result shows that the lower concentration of vermin wash treatment obtained the highest vigor index among treatments which indicates that application of T-10 vermiwash treatment promotes healthy and vigorous seedling response to other vermiwash treatments (Table 3 and Fig 2). This result shows that vermiwash could promote early and vigorous growth of seedlings. Thus, lower concentration of vermiwash treatment was able to produced healthy and vigorous seedling for seedling establishment in the field.

With the global trend moving towards the production of organic food crops, organic waste material processed by the naturally occurring earthworm should be used to produce vermicompostwhich will supply nutrients and other soil stimulants for plant growth and improve soil quality. Vermiculture provides the best answer for ecological agriculture, which is synonymous with sustainable agriculture.The present investigation recommend in exploring the effects of vermiwash treatments in physiological level of plant that will contribute to higher germination rating and vigor index and to try the different concentration of vermiwashtreatments acts as a seed germinator to various indigenous vegetables and high valued crops.

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Table 1. Concentrations of different nutrients in the vermiwash.

Sr. No.	Parameters	Observations
1	Temperature	23
2	pH	7.2
3	EC (mΩ)	0.205

4	Total Carbon (%)	6.59
5	Calcium (mg/l)	87.53
6	Magnesium (mg/l)	88.47
7	Phosphrous (mgm)	49.24

Table 2.Effect of vermiwash on Root-shoot length (cm) of *Ciceraritinum*L.

Sr. No.	Treatments	2 days		4 days		6 days		8 days	
		Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
1	T-O	1.6	1.3	9.5	7.4	7.1	15.8	7.4	16.8
2	T-1	1.3	1.0	7.3	14.0	5.9	16.3	7.6	17.9
3	T-2	1.6	0.55	4.0	6.7	5.6	13.3	6.9	18.0
4	T-3	2.6	0.28	7.42	8.6	9.8	10.9	11.6	17.9
5	T-4	3.7	1.12	5.5	14.1	8.2	21.0	9.6	24.9
6	T-5	2.2	3.7	5.5	7.3	5.6	12.5	7.2	24.1
7	T-6	2.6	0.9	6.8	8.3	7.8	12.1	7.9	23.9
8	T-7	2.9	1.3	4.6	10.4	4.46	12.8	4.6	19.3
9	T-8	3.7	1.2	7.1	7.2	7.4	7.9	7.5	8.9
10	T-9	3.2	2.6	4.1	5.0	5.5	7.0	4.3	7.5
11	T-10	2.2	1.6	2.1	3.2	3.5	3.0	2.7	7.4

Table3.Effect of vermiwash on root-shoot ratio and vigor index of *Ciceraritinum*L.

Sr. No.	Treatments	2 days		4 days		6 days		8 days	
		Root-shoot ratio	Vigor index	Root-shoot ratio	Vigor index	Root-shoot ratio	Vigor index	Root-shoot ratio	Vigor index
1	T-O	1:0.8	232	1:0.7	352	1:2.2	1832	1:2.9	2344
2	T-1	1:0.7	184	1:1.9	1704	1:2.7	1752	1:2.8	2352
3	T-2	1:0.3	186	1:1.6	856	1:2.3	1512	1:2.6	2520
4	T-3	1:0.07	262	1:1.1	1600	1:1.1	2070	1:1.5	2950

5	T-4	1:0.2	384	1:2.5	1960	1:2.5	2336	1:2.8	2928
6	T-5	1:1.6	354	1:1.3	1624	1:2.2	1086	1:3.4	1878
7	T-6	1:1.6	280	1:1.2	604	1:1.5	1592	1:1.9	1856
8	T-7	1:0.9	336	1:2.2	900	1:2.9	1032	1:4.1	1434
9	T-8	1:0.3	392	1:0.1	1144	1:1.2	978	1:1.1	984
10	T-9	1:1.1	384	1:2.3	632	1:3.0	900	1:2.7	808
11	T-10	1:0.4	288	1:0.8	396	1:1.1	312	1:1.2	588

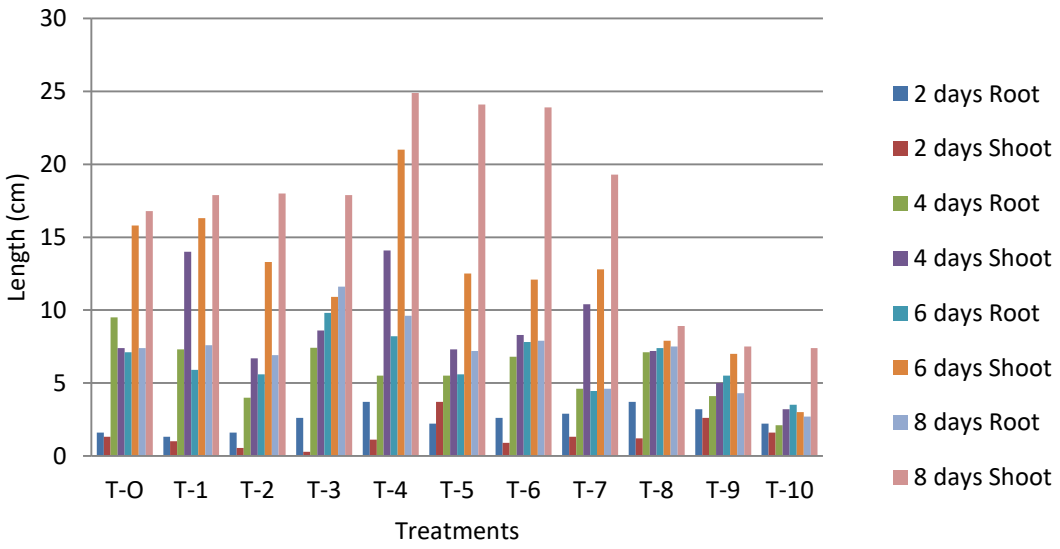

Fig.1. Showing effect of vermiwash on root-shoot length of *C. aritinum*.

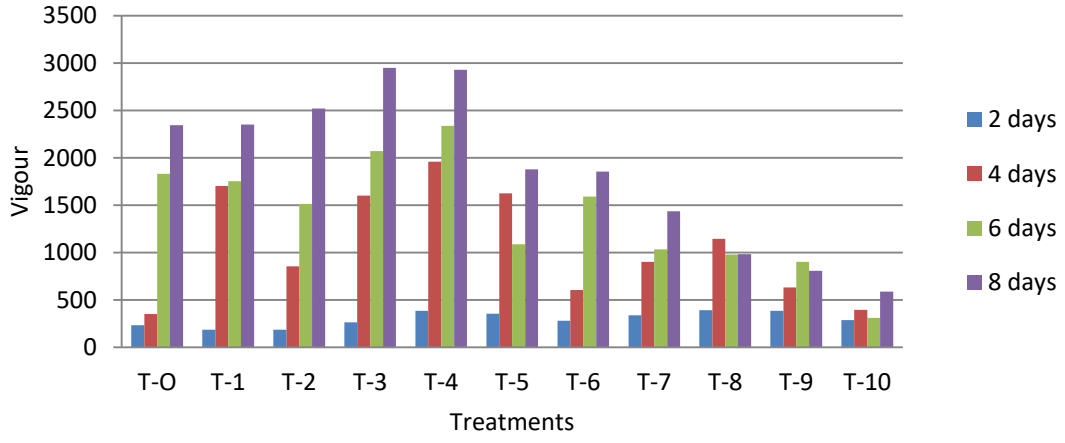

Fig.2. Showing effect of vermiwash on vigor indx of *C. aritinum* .