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Research Article

Effect of vermicompost on tuber yield status of radish plant *Raphanus sativus* L.

M.Ramamurthy, S. Umavathi*, Y. Thangam and R. Mathivanan

PG & Research Department of Zoology, J.K.K.Nataraja College of Arts and Science, Kumarapalayam, Namakkal (Dt)-638 183, Tamil Nadu.
*Corresponding author

Abstract

The influence of different percentages of vermicompost (25%, 50%, 75% and 100%) on the tuber length, width, circumference and weight of the radish plant (*Raphanus sativus* L.) was carried out at different period of exposures (30, 60 and 90 days). The maximum tuber length (20.67, 23.67 and 27.55cm) and weight (189.31, 215.31 and 244.64gm) were noticed in 75% of vermicompost concentration at 30, 60 and 90 days respectively except tuber width and circumference. During 60 and 90 days of exposure the maximum width and circumference were noticed in 50% of vermicompost and thereafter both width and circumference decreased in commensurate with increasing vermicompost concentration. The study reveals the 75% concentration of the vermicompost influence the tuber yield status of Radish plant.

Keywords: *Eudrilus eugeniae*, Vermicompost, radish.

Introduction

Soil organic matter has an important function in improving the soil for plant growth. Soil organic matter supplies available nutrients through its decomposition. But farmers add chemical fertilizers to improve soil fertility and to increase the yield of their crop (Stewart *et al.,* 2005) and maximum value of growth (Badr and Ferky, 1998; Arisa and Bardisi, 1999; Dauda *et al.,* 2008). So inorganic fertilizer is considered a major source of plant nutrients (Adediran *et al.,* 2004 and Naeem *et al.,* 2006). However, the excess use of inorganic fertilizer alone may cause problems for human health and the environment (Arisha and Bardisi, 1999). Those chemicals may undergo decomposition and may be leached down in soil to the ground water and lakes (Al-samarraie, 1978). Alternative practice to chemicals fertilizer is organic fertilizer added directly to the soil either before or later on after planting.

Organic fertilizer such as, animal manure, green manure, compost and sewage sludge may add to cultivated soil (Splitstosser, 1990). This kind of fertilization that may improve the physical and biological properties of the soil (Bin, 1983 and Dauda *et al.,* 2008), may serve as a source of mineral nutrients (Gupta *et al.,* 1988; Wong *et al.,* and Naeem *et al.,* 2006) and microbial biomass (Suresh *et al.,* 2004). Therefore, utilization of locally produced manures by vegetable production operation may increase crop yield with less use of chemical fertilizer. In recent times, consumers are demanding higher quality, safer food and highly interested in organic products.

In recent years, earthworms are used to breakdown of organic residues, including sewage, animal manures, crop residues, weed plants and industrial refuse, to produce vermicomposts on the rates of growth of a variety of crop including, vegetables and ornamentals have assessed in the greenhouse and some field crop (Atiyeh *et al.,* 1999, 2000). Earthworms have a critical influence on soil structure, forming aggregates and improving the physical conditions for plant growth and nutrient uptake. They also improve soil fertility by accelerating decomposition of plant litter and organic matter and consequently, releasing nutrients in the form that are available for uptake by plants.

Vermitechnology is the use of surface and subsurface local varieties of earthworm in composting and management of soil (Ismail, 2005). Earthworms along with other animals have played an important role in the regulating soil processes, maintaining soil fertility and in bringing about nutrient cycling (Ismail, 1997). The Earthworm fragments the organic waste substrate, stimulate microbial activity greatly and increase rates of mineralization. During vermicomposting earthworms eat, grind and digest organic wastes with the help of aerobic and some anaerobic microflora, converting them into a much finer, humified and microbial active material. The generated product is stable and homogeneous; having desirable aesthetics such as reduced levels of contaminants and this converted product can be as a fertilizer or a source of nitrogen for microbial population which can be beneficial to plant growth (Ravindran *et al.,* (2008). Sugar factory waste (Lakshmi and Vijayalakshmi, 2000) pig waste (Dominguez and Edwards, 1997) and sludge (Alididi *et al.,* 2005 and Parvaresh *et al.,* 2004) could all be converted into good quality soil addition along with the biomass production of earthworms.
The benefits of the use of vermicomposts as organic amendments in agriculture, ranging from their biological properties include a slow release source of nutrient that supply the plants with nutrients when they are needed (Chaoui *et al*., 2003), improvement of soil and potting substrate, physical properties and microbial activity (Kahsnitz 1992; Hidalgo *et al.,* 2006). 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 aggregate of soil particles for desired porosity to sustain plant growth (Tisdale and Oades, 1982). Hence in the present study an attempt has been made to assess the growth of radish plant in different concentrations of vermicompost for 90 days.

Materials and Methods

Collection and culturing of earthworms

The earthworm, *Eudrilus eugeniae* was collected from worm farm were acclimatized under the laboratory condition for a period of three months by providing predecomposed cow dung as feeding material in the cement tank. The water was sprinkled on alternate days to maintain the optimum (60-70%) moisture content and temperature ranges between 25ºC to 30ºC by using hygrometer and thermometer respectively. Care was taken to avoid the entry of natural enemies. At the end of 75 days vermicompost was collected and stored in the shadow place.

Different percentages of vermicompost (25%, 50%, 75% and 100%) were prepared by mixing red soil (w/w in plots (2m length x 50cm breadth x 30cm height) for the Radish plant (*Raphanus sativus* L). 20 Radish plants were cultivated in each plot in two rows (30cm distance row to row) with 15cm inter-plant distance at 30, 60 and 90 days period of exposures. The control plant was also grown in the red soil alone separately for a period of 90 days. The plants were watered daily and at the end of 30, 60 and 90 days the plants grown in the above-mentioned percentages of vermicompost were harvested and the width tubers were collected. The length, width and circumference of tuber were measured using scale and the values were expressed as cm. Similarly, the tuber was weighed and the values were expressed as gram. The experiment was repeated six times. The result of the influence of different percentages of vermicompost on tuber parameters were analyzed by employing Duncan's multiple range test (DMRT) at p0.01% level.

Results and Discussion

The study on the influence of vermicompost on tuber length, width, circumference and weight of radish plant revealed that tuber length and weight were noticed higher in 75% vermicompost concentration at 30 (20.67 cm and 189.31g respectively), 60 (23.67cm; 215.31g respectively) and 90 days (27.55cm; 244.64g respectively) period of exposures. At the same time, tuber length was lower in 100% vermicompost concentration at 60 (14.05 cm) and 90 (15.26cm) days period of exposures. However, the minimum tuber weight (29.71. 71.85 and 100.76 g) was noticed in control plants tested at 30, 60 and 90 days period of exposures. The maximum tuber width (3.33cm) was noticed in 50% vermicompost concentration at 30 days period of exposure whereas at 60 days period of exposure the maximum tuber width was noticed in 75% (3.82 cm) as well as 75% (3.58cm) vermicompost concentration. However, at 90 days period of exposures the maximum tuber width (5.63cm) was noticed in 75% vermicompost concentration. The similar trend of observation was noticed in the tuber circumference as like of that of tuber width. However, the tuber was not appeared in control and 100% vermicompost concentration at 30 days period of exposure. Statistically the values were found to be significant at 1% level (Table 1).

Table 1. Effect of vermicompost on Tuber Length, Width, Circumference (cm) and Weight (gm) in Radish plant (*Raphanus sativus* L.)

Exposure period (in days)	Percentage of vermicompost	Tuber parameters			
		Length (cm)	Width (cm)	Circumference (cm)	Weight (gm)
30	**Control**	10.10 ± 0.44	1.96 ± 0.08	6.85± 0.05	29.71 ± 0.58
	25	16.48 ± 0.71	2.55 ± 0.15	9.66 ± 0.42	157.54 ± 1.16
	50	15.63 ± 0.81	**3.33 ± 0.06**	**14.95 ± 0.15**	173.24 ± 1.56
	75	**20.67 ± 1.45**	2.84 ± 0.05	10.84 ± 0.10	**189.31 ± 1.79**
	100	12.60 ± 0.75	0.68 ± 0.06	2.63 ± 0.05	45.15 ± 1.16
60	**Control**	13.81 ± 0.73	2.28 ± 0.10	9.41 ± 0.04	71.85 ± 1.41
	25	23.21 ± 0.97	3.56 ± 0.16	16.44 ± 0.40	180.99 ± 1.56
	50	21.38 ± 0.95	**3.82 ± 0.02**	**19.82 ± 0.16**	192.61 ± 1.41
	75	**23.67 ± 1.45**	3.58 ± 0.05	18.83 ± 0.21	**215.31 ± 1.08**
	100	14.05 ± 0,46	1.43 ± 0.09	4.61 ± 0.08	74.82 ± 0.84
90	**Control**	15.14 ± 0.52	2.53 ± 0.27	11.57 ± 0.05	100.70 ± 1.76
	25	27.68 ± 1.01	4.65 ± 0.05	19.85 ± 0.16	194.93 ± 1.18
	50	24.96 ± 1.04	5.50 ± 0.18	21.74 ± 0.20	226.31 ± 1.91
	75	**27.55 ± 0.68**	**5.63 ± 0.19**	**22.91 ± 0.13**	**244.64 ± 1.90**
	100	15.26 ± 0.84	2.84 ± 0.11	6.39 ± 0.16	121.58 ± 1.27
CD (p<0.01)		**1.02**	**0.135**	**0.583**	**1.956**

The result of the present study proved that the maximum tuber length and weight were noticed in 50% vermicompost concentration but at the same time the maximum tuber width and circumference were noticed in 50% as well as 75% vermicompost concentrations. It could be suggested that the better tuber yield in radish plant exposed to particular concentration of vermicompost may be due to the influence of combined effect of various ingredients of vermicompost such as macro (N, P, K) and micro (Ca, Mg, Mn, Iron, sulfur, Zinc and Copper) nutrients, plant growth hormones (Indole acetic acid, Indole butyric acid, Naphthalene acetic acid and Gibberellic acid), vitamins (Vitamin A, B_1, B_2, B_3, C and E), enzymes, and many beneficial microbes such as Nitrogen fixation bacteria and hormones synthesizing microbes such as *Azospirillum brasilence*(Kolb and Martin, 1985; Kucey, 1988; Molla, 2001),*Azospirillum lipoferum*(Lee, 1988), *Azotobacter paspali* (Barea and Brown, 1974)and *Pseudomonas putida*(Glick, 1986; Caron,1995; Xie, 1996).

Positive influence on the growth of radish could be seen in the present study by using vermicompost compared to control. Similar reports had been reported in beans (Spain *et al.*, 1992) and Amaranthus (Uma and Malathi, 2009). Furthermore, organic manure activation may be due to the presence of living organisms, which release phytohormones and may stimulate the plant growth and absorption of nutrients (Arisha *et al*., (2003).Buckerfied *et al*., (1999) reported similar increased germination trends of radish in 0-100% mixture of vermicompost and sand, although some vermicompost application rate tended to inhibit germination initially. The beneficial effects of vermicompost on crop like maize (Gutierrez-Miceli *et al.,* 2008), Wheat (Sharma and Madan, 1988), strawberry (Singh *et al.,* 2008), petunias (Aracon*et al.,* 2008), marigold, cornflower, tomato (Bach man and Metzger, 2008), blackgram (Parthasarathi *et al.,* 2008) and pepper (Aracon *et al.,* 2004) have already been reported.

Values are expressed by mean ± SD of six samples

Vermicompost being a stable fine granular organic matter, when added to clay soil loosens the soil and improve the passage for the entry of air. The mucus associated with the cast being hydroscopic absorbs water and prevents water logging and improves water-holding capacity. The organic carbon in vermicompost releases the nutrients slowly and steadily into the system and enables the plant to absorb these nutrients. The soil enriched with vermicompost provides additional substances that are not found in chemical fertilizer (Kale, 1998). Moreover, beneficial effects of compost or vermicompost on plant growth under water deficit conditions may be due to better aeration to the plant roots, increasing amount of readily available water, induction of N, P and K exchange there by resulting better growth of the plants (Papafotiou*et al.,* 2005).

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