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RESEARCH ARTICLE

STUDIES ON THE APPLICATION OF VERMICOMPOST AND BIO-MANURE ON GROWTH AND PRODUCTIVITY OF CHILLI PLANTS (*CAPSICUM ANNUM*) BY POT CULTURE METHOD

***Siva, T. and Serfoji, P.**

Department of Zoology, Government Arts College (Autonomous), Kumbakonam – 612 002, India

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ABSTRACT

Environment pollution is one of the most important environment challenges worldwide. The implementation of solid waste management practices benefits both public health and environmental quality directly and substantially. This can be solved by combination effective technologies like bio dung composting and vermitechnology. The aim of the present studies was to investigate the effects of vermicompost and Bio compost on agronomic parameter and yield components under normal condition in chilli (*Capsicum annum*) plants. The results of this study indicated that application of vermicompost has positive effects on growth and yield related parameters of chilli.

Key words: Vermicompost, biodegradation, Bio-manure, parameters, Chilli (Capsicum annum)

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INTRODUCTION

Earthworms are well-known soil-Inhabiting animals, having a cylindrical body and marked external and internal metameric segmentation. They do not have any appendages or suckers but have a few hooks like chaetae for gaining hold onto the substratum. Hence they are called Oligochaeta (oligo = few; chaetae = hair) and belong to the phylum Annelida. Earthworms are hermaphrodites and sexually matured worms have a distinctive epidermal ring-shaped clitellum, which has gland cells that secrete materials to form the cocoon (Edwards and Lofty 1977; Edwards and Bohlen 1996; Gajalakshmi and Abbasi 2004). Earthworms are major components of the soil fauna in a wide variety of soils and climates and are involved directly or indirectly in biodegradation, stabilization through humus formation, and various soil processes (Edwards and Bohlen 1996; Lavelle and Spain 2001). Solid Waste management leading to the production of bio-fertilizers through vermiculture has a bright future. However, it is essential to select suitable species of earthworms capable of consuming organic-rich matter, that are efficient decomposers and stress-resistant so as to sustain adverse environmental conditions, and have high fecundity rates (Satchell 1971; Edwards and lofty 1977; Mohammad 1993). Earthworms can be fed all forms of biodegradable waste. As feed passes through the earthworms gut, the material is mineralized and plant nutrients are made available, which is called vermicompost (Sinha *et al*., 2009). Vermicompost is usually a finely divided peat -like with excellent structure, porosity, aeration, drainage and moisture holding capacity (Edwards, 1982, 1988). Whereas vermiwash is a watery extract of vermicompost and the wash of earthworms present in the medium. (Ismail, 1997). When they added to the soil enhances crop growth and yield, promote humification and increase microbial activity and enzyme production. This result the aggregate stability of soil particles and better aeration, (Lalitha, Fathima and Ismail, 2000). From different species of earthworm, *Eudrilus eugeniae* found to be the best choice due to its wide temperature and moisture tolerance and because it is a strong worm, easy to handle it out compares to other species, (Edwards and Bates, 1992). The greatest plant growth responses and yields have occurred usually when vermicompost constituted a relatively small proportion of the volume of the plant growth medium in which they are incorporated. Therefore, the aim of the present studies was to investigate the effects of vermicompost and Bio compost on agronomic parameter, yield and yield components under Normal condition in chili *(Capsicum annum*). Chili is one of the most important vegetables constituting the Bhutanese diet. Although it is grown widely throughout Bhutan, a substantial amount is still imported from India to fulfill the requirement of the Bhutanese people. Field experiences suggest low soil fertility status to be an important constraint in chili production. Chili is the favored cash for most farmers as the potential returns per unit area are high which can be achieved in one season. Until recent times, chilies were mainly grown on

Corresponding author: **Siva, T.**
Research, Department of Zoology, Government Arts College (Autonomous), Kumbakonam – 612 002. India.

kitchen garden scale with little or no external nutrient input. Some farmers in places like Punakha and Paro have now started growing chilies on a commercial scale (Bajo, 2001). Vermicompost and Bio-compost manures are the two suitable manures; it is possible to meet the nutritional requirement from the organic sources only. The potentialities of organic source are very limited to afford higher crop production due to slow release of plant nutrients from organic matter. Only one fifth to half of the nutrient supplied from manure was recovered and reminder was released any by 24 hours per annum (Miah, 1994). This may be concern for fertility maintenance but is obviously barrier for higher plant nutrition uptake. To overcome this problem application of organic manures in combination with inorganic fertilizers, called integrated nutrient management, can play important role in chili cultivation. Composting is a biological process in which organic biodegradable waste are converted into hygienic, humus rich product (compost) for use as a soil conditioner and an organic fertilizer (Popkin, 1995). These are also used to provide biological control against various plant pathogens (Hoitink and Grebus). Aqueous extracts of compost have also been suggested to replace synthetic fungicides (Zhang *et al*., 1998). The addition of municipal solid waste compost to agricultural soil has beneficial effects on crop development and yield by improving soil physical and biological properties (Zheljazkov and Warman, 2004). Vermicomposting involves using epigeic earthworms to increase the microbial population in vermicast and helps to produce high quality compost from different organic wastes in a lesser period of time (Edwards and lofty, 1972). Vermicompost owing to its surplus nutritive content, it enhances beneficial soil micro flora and increase plant growth since. It is cost effective it can recommend as best fertilizers for the cultivars to get the maximum Yield (Manonmani and Anand, 2002).

MATERIALS AND METHODS

Study Area

The experiment was carried out from Vermicompost Unit of PG and Research Department of zoology, Government Arts College (Autonomous), Kumbakonam.

Collection of earthworm (Eudrillus eugeniae)

The exotic breeds of earthworm species *Eudrillus eugeniae* were collected from Periyar Maniyammai University in Vallam, Thanjavur (Dist). The worms were kept in large trays with substrate medium of 50% organic manure and 50% partial decomposed cow dung and maintained under the laboratory condition [temperature 30 ± 2ºC] for 20 days. Care was taken to see that the worms collected from the site, which did not experience any pesticide treatment. Adult worms with the size of 11 to13 cm in length and 2.5 to 3 mg in weight were selected for the present study.

Collection of organic wastes

The partial decomposed organic waste and cow dung were collected from farm yard at Palakkarai in kumbakonam. They were raised in worm bin until the required amount of earthworm was achieved for the experiment. Organic waste was collected from the College campus. And then it was chopped and mixed with air dried cow dung in ratio of 1:5 and left in commented tank for 20 days, during which watered twice in 10 days interval to facilitate the kumbakonam pre-composting process. The pre–composted material was filled into wooden-box the bottom and top were covered with a metal screen of mesh size 1.3 mm in order to allow good aeration and to prevent worm and vermicompost from falling out. The adult earthworms were introduced, gently moistened with water for two months and fresh vermicompost was collected, sieved, dried and used for the experiment. Solid compost prepared from remain stocks high in C, such as yard waste, wood chips, straw, or dry stalks, mixed with materials high in N, such as manure, freshly cut grass, plant residues or food wastes. The experiments were laid out in completely randomized in three pots. Pot A - contain Soil only, B pots contain soil with Bio-manure, and C pots contain soil with vermicompost. They add before planting chilli seedlings. The chili seedling bought from Mercury agency kumbakonam were used in all trials. Seedling was planted at a distance of 30 cm by 5cm depth and each pot therefore accommodated 5 seedlings.

Growth Parameters

The experiment pots were kept in open terrace direct sunlight. The pots were regularly poured with sufficient water to ensure proper growth values showing measured the plant height, no. of leaves, no. of flowers and fruits of Chili plant cultivation for 45 days. The growth studies were observed in chilli *(Capsicum annum)*, plants at 15, 25, 45 days old plant include leaf length, shoot length, numbers of flowers, fruits calculated from the A, B, C pot cultured plants.

RESULT AND DISCUSSION

The effect of vermicompost showed highly significant increase of the yield chilli width, length, shoot weight, and root weight significant increase of control the comparison of mean between vermicompost application levels showed that the highest in all studied parameters of the plant were obtained vermicompost application. The lowest were found from the control (without vermicompost). Similarly, previous studies indicated improved growth, yield and yield component in different crop due to application of vermicompost (Narkhede *et al.,* 2011). Study on effect of chemical fertilizer and vermicompost on growth of chilli plant (*Capsicum annum*). The vermicompost treatment had also significant effect on growth trend of plant height (PH) of leaves (LN) at different growth stages. The highest Plant height (34cm) and Number of Leaves (37) were obtained at the highest level of vermicompost (7.5 t/ha) and the lowest Plant height (17cm) and number of leaves (13) was observed from control plot at 45 days after sowing. It was observed that the application of vermicompost and Bio- compost fertilizers solely or combined had a great influence on the vegetative growth of the crop. The highest number of branches plant was recorded from the treatment C containing vermicompost. Whereas, the lowest branching and leaves were found with A control-soil. Only Bio-compost could not increase the vegetative growth of plants and the reason may be that they released nutrients at a slower rate. On the other hand, the only application of control-soil was also less effective than the combined application. These results were in conformity with the findings of Rahman *et al.,* (1998) who found that the vegetative growth and yield of berry was the highest with the combined application of manures and fertilizers. From the data it appeared that flowering and fruiting of chilli were positively influenced by sources of applied.

Table 1. Growth Parameters of Control and Experiment in 15 th, 25th and 45 days

S.NO	Parameters	A- Soil Control			B- Bio manure			C-Vermicompost		
		15 Days	25 days	45 days	15 days	25 days	45 days	15 days	25 days	45 days
1.	Shoot length (in cm)	7	13	17	9	17	21	8	25	34
2.	No. of leaves	5	9	13	7	13	19	10	18	37
3.	No. of flowers	-	5	08	-	09	11	-	12	18
4.	No. of fruits	-	-	04	-	-	09	-	-	13

Fig. 1. Experimental plant culture

The maximum number of flowers plant was produced by C treatment. The maximum number of fruits plant was also noted with C (combined treatment). In both the cases the lowest value was obtained from the treatment a (soil only). The maximum length of stem and the maximum no. of fruit were recorded with the combined treatment. The maximum fruit weight was also obtained from vermicompost treatment. The results were such that although the application of only vermicompost maintained the good health of they were slow to release adequate nutrient timely. From the other side, only Bio-manure application could affect the soil health, which in turn may affect flowering and fruiting. So the combined application of manures and vermicompost may supply the nutrients timely and also maintain the suitable condition for flowering, fruiting and their growth. The finding is supported by Shelke *et al., (*1999). Jablonska (1990) and Hosmani (1993) also reported that the combined use of organic manures and nitrogen resulted in higher yields of tomato, eggplant, pepper and chilli than either N fertilizer or organic sources used alone (Fig:1 and Table: 1).

Conclusion

The results of this study indicated that application of vermicompost has positive effects on growth and yield related parameters of chilli. The highest growth and yield component traits obtained at the highest level of vermicompost. However, to determine the optimum crop response and treatment level, further investigation is recommended with the consideration of more than 7.5 t/ha levels of vermicompost. Application of vermicompost produced by biodegradable waste could be one of the most economical and attractive methods of solving the problems like waste disposal and the requirement to increase the organic matter content of soil.

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