International Research Journal of Natural and Applied Sciences
Vol. 3, Issue 7, July 2016 IF- 3.827 ISSN: (2349-4077)
© Associated Asia Research Foundation (AARF)
Website: www.aarf.asia Email : editor@aarf.asia , editoraarf@gmail.com

ENRICHMENT OF SOIL FERTILITY AND GROWTH AND YIELD OF *CAPSICUM ANNUM* BY VERMICOMPOSTAPPLICATION

Dr. J. Shifa Vanmathi,

Asst .professor,

Department of Animal Science, M.S.University, Tirunelveli, 627011. Tamilnadu,India.

ABSTRACT

The experiment was conducted to evaluate the effect of vermicompost, farmyard manure and urea on the soil fertility and growth and yield of the vegetable plant, Capsicum annum. The soil samples were taken on 30^{th} day and 60^{th} day for soil analysis. The physical parameters like pH and electrical conductivity of the soil and the chemical parameters of the soil like nitrogen, phosphorous and potassium content of the soil were analyzed to assess the fertility of the soil. The germination percentage, shoot length, bud formation and flowering of the plants were recorded on 20^{th}, 40^{th}, 60^{th} and 80^{th} days.There were significant influence of vermicompost on plant height were 21.14cm, on germination percentage of 76.67%, Number of flowers per plant and were significantly influenced by 16.23 respectively compared to control. The highest flowering and bud formation of Capsicum annum was found in vermicompost treatment (T-1) followed by farmyard manure (T-2), urea (T-3) and lowest was found in control.It concluded through our study, application of vermicompost increased the vegetative growth and yield of Capsicum annum .It is also suggested that vermicompost is more favourable for better yield of Capsicum annum plant and maintenance of soil environment and it can be economically and also environmentally suitable.

Key words: Soil fertility, growth and yield of *Capsicum annum*,vermicompost

1. Introduction

In today‘s era, heavy doses of chemical fertilizers and pesticides are being used by the farmers to get a better yield of various field crops. These chemical fertilizers and pesticides decreased soil fertility and caused health problems to the consumers. Due to adverse effects of chemical fertilizers, interest has been stimulated feet were prepared for the use of organic manures (Follet *et al.*, 1981). Vermicompost is a nutrient-rich organic fertilizer and soil conditioner in a form that is relatively easy for plants to absorb (Coyne *et al*., 2008).

Vermicompost is made up primarily of C, H and O, and contains nutrients such as NO_3, PO_4, Ca, K, Mg, S and micronutrients which exhibit similar effects on plant growth and yield as inorganic fertilizers applied to soil (Singh *et al.*, 2008). Edwards and Burrows (1988) reported that vermicompost could promote early and vigorous growth of seedlings. Vermicompost has found to effectively enhance the root formation, elongation of stem and production of biomass, vegetables, and ornamental plants. Several studies have reported that vermicompost can increase the growth and yield of some medicinal plants such as basil (Anwar *et al*., 2001), garlic fennel and chamomile (Azizi *et al.*, 2009). Vermicopmpost had a positive effect on flower yield and essential oil of roman chamomile (Darzi *et al.*, 2007).

Vermi compost plays a major role in improving growth and yield of different field crops, including vegetables, flowers and fruit crops. In a study involving a wide range of vegetable and ornamental seedlings, result showed earlier and better germination in a vermi compost compared with control (Edwards, 1998; Gutierrez- Miceli *et al.*, 2007). Kale and Bano (1988) in summer paddy revealed that the vegetable growth was influenced by the application of vermicompost in a better way than chemical fertilizers. While, the seed weight increased significantly with the application of vermicompost over other treatments in sunflower.

The fresh and dry matter yields of cowpea (*Vigna unguiculata*) were higher when soil was amended with vermicompost than with biodigested slurry (Karmegam and Daniel 2000). The fruits, flowers, and vegetables and other plant products grown using vermicompost are reported to have better keeping quality. The vermi casting containing nutrients is rich manure for the plants (Golchin *et al*., 2006)

In our present study, to improve the soil fertility by the addition of organic fertilizer – Vermi compost, Farmyard manure and inorganic fertilizer – Urea and analysis of the physical parameters and chemical parameters of the soil. Germination percentage ,Shoot length , Flowering and Bud formation of *Capsicum annum* was also observed.

2.Materials and methods

2.1. Experimental design:

The experiment was carried out to evaluate the effect of vermicompost on the growth and yield of *Capsicum annum* .There were 4 treatments viz., control, vermicompost, farmyard manure and urea. About Twelve pots were taken and each pot was filled with 5 kg of red soil. The raw materials used for vermicompost were leaf litter. The earthworm species used for vermicomposting was *Lampito mauritii*. On 1^{st} day,1/2kg of vermicompost anf farmyard manure was added with 5kg of red soil. On 40^{th} day 1 kg and 80^{th} day 11/2kg of manure was added to the experiment 1 and 2.The inorganic fertilizer,1gm,2gm and 3gm was added to experiment 3 respectively. Control was maintained without treatment. (Tharmaraj *et al.,* 2011).

The seeds of the *Capsicum annum* were counted and introduced into the respective pots in the following pattern that is 10 seeds of *Capsicum annum* for each pot respectively. Sufficient moisture was maintained by adding water regularly. The manure was added once in 40 days and the experiment was carried out for 4 months. Three replications were maintained for each treatment (Nagavallemma *et al.,* 2004).During this period, Physical and chemical parameters of the soil, Plant Growth, buds and flowering of *Capsicum annum* was observed *(*Olaniyi and Ajibola 2008).

2.2.PHYSICAL PARAMETERS OF THE SOIL:

To determine soil physical and chemical properties, the soil samples were taken on 30^{th} and 60^{th} days after germination. Physical and chemical properties of soil were determined according to Tyler *et al*. (1993) and Atiyeh *et al.* (1999).

a) p^H of the soil :

20 gms of dried and powered soil was taken and weighed accurately and it was transferred to a 100ml beaker to which 50ml distilled water was added. The beaker was

stirred well. After 30 minutes the P^H of the supernatant solution was measured by using the P^H meter (Tylers *et al.,* 1993).

b) Electrical conductivity of the soil

To 20gms of soil in a beaker, 50 ml of distilled water was added and contents were stirred well. The conductivity cell was immersed and the reading of the conductance was noted .It‘s expressed as milli m hos /cm or micro m hos/cm as a large unit (Dewies and Freitas, 1977).

2.3. CHEMICAL PARAMETERS OF THE SOIL.

a) Estimation of available nitrogen in soil :(Alkaline permanganate method)

To the 20g of soil in a distillation flask, 20 ml of distilled water was added. A beaker containing 2ml of 2% boric acid with one or two drops of methyl red and bromocresol green indicator was placed below delivery end, of the distillation unit. Then 100ml of freshly prepared 0.32% $Kmno_4$ solution and 100 ml of 2.5%NaoH were added to the contents of the distillation flask, and the flask was tightly closed. The contents were boiled. The distillate was collected in the standard acid until the distillation was free from ammonia. It was indicated by the red litmus paper. The red litmus paper did not change to blue after the distillation was over. Then the content of the beaker was titrated against 0.02 N sulphuric acids until a pink colour was obtained. (Jadhav *et al.,* 1997)

% of nitrogen = Titre value × 0.00028×100mg/kg.

b) Estimation of available phosphorous in soil- (Oslen method using $NAHCO_3$).

To 5g soils, 25 ml of Oslen‘s reagent and about 1g of Dargo G60 activated carbon were added and contents were kept in mechanical shaker for 30 minutes. Then it was filtered through Whatman no.1 filter paper. 5ml filtrate was pipetted out to a 25 ml volumetric flask and 5ml of molybdate reagent and 1ml of stannouschloride were added to it. The volume was made up to 50 ml with distilled water. The absorbance was measured immediately in 660nm (Zhang *et al*., 2002).

c) Estimation of available potassium in soil - (Flame Photometry method).

To 50mgs of soil in a polythene container 25 ml of ammonium acetate extract was added. The contents were shaken for five minutes in mechanical shakers. The oil suspension was filtered using whatman No.1 filter paper, the filtrate was collected in a beaker. The potassium content in the filtrate was measured by using flame photometer.

2.4. GROWTH AND YIELD OF *CAPSICUM ANNUM*:

a) Germination of *Capsicum annum*

The selected plant of *Capsicum annum* seeds variety were purchased from local market at Tirunelveli and were used in this experiment. A total of 10 *Capsicum annum* seeds with spacing of 3cm were sown at a depth of 3cm in each pot. Hence, a total of 120 seeds were sown in a 12 pots of each treatment. Germination percentage was determined in each of the three treatments were calculated on 10^{th}, 15^{th}, 20^{th} and 25^{th} days (Rokesh Joshi *et al*., 2010).

$$\% \text{ of germination} = \frac{\text{No of seed germinated}}{\text{Total no of seeds}} \times 100$$

b) Growth and yield of *Capsicum annum*.

Various growth and yield parameters like average height of the plant, average number of flowers, and yield, were recorded based on 10 plants randomly selected from each pot once in three days from 3^{rd} day to 4 months. The average shoot length was calculated on 20^{th}, 40^{th}, 60^{th} and 80^{th} days calculated on the respective days. The average plant height was recorded using scale. The number of flowering and bud formation in plants were noticed (Narkhede *et al.,* 2011).

Statistical methods -The e x p e r i m e n t data was expressed as Mean ±S.D. The mean difference is significant of the p< 005 level.

3. Results and discussion

The physical parameters of the soil analysis were P^H and electrical conductivity, and the chemical parameters of the soil like nitrogen content, phosphorous content and potassium content were analyzed in control, as well as in experimental pots. Control pots contain only red soil. The effect of vermicompost and inorganic fertilizers application on the growth and yield of the *Capsicum annum* was studied.

3.1. Physical parameters of the soil.

a) pH of the soil and electrical conductivity of the soil.

The pH of the soil in control Treatment 1 (Vermicompost), Treatment 2 (farmyard manure) and Treatment 3 (Urea) for the plants was measured on 30^{th} and 60^{th} days. The control showed a pH value of 8.20±0.1 and 8.43±0.11.In Treatment 1, the P^H was noted as 8.30±0 and 8.67±0.05.In Treatment 2 the P^H value were reported as, 8.27±0.05 and 8.50±0. In treatment 3, the P^H value were reported as, 7.90±0.1 and 8.30±0.06 (Table 1). The ideal P^H range for most agricultural soils and plant growth is 5 to 8.5.In this present study, the P^H range is between 7.90 to 8.67. The optimum P^H for plant growth was noted in Treatment 1 (Vermicompost).

Electrical conductivity of the soil was observed in control and Treatment 1 and 2 on the 30^{th} and 60^{th} days. In control, it was found to be 0.30±0.03 and 0.28±0.03. In Treatment 1, the value was 0.69±0.06 and 0.58±0.06. In Treatment 2, the value was 0.60±0.03 and 0.16±0.03. In Treatment 3, the value was 0.61±0.02 and 0.14±0.01 (Table 1). In the entire medium taken for our study, vermicompost seems to be maintained the physical and chemical parameter for the soil which is ideal for growth of the plant. It is understood that electrical conductivity of the soil is means to determine the changes in soil moisture. The fertility of the soil and growth of plants are greatly affected by increase in electrical conductivity (Ayers and Haywards 1949). It is revealed that earth worm costing may influence the P^H of the medium favourable of the plant growth. The soil treated with vermicompost has significantly more electrical conductivity (EC) and near neutral P^H (Tiwari *et al.*, 1989).

b) Chemical parameters of the soil.

Nitrogen, phosphorous and potassium content of the soil

The percentage of nitrogen values in control and Treatment 1, 2 and 3 were observed on 30^{th} and 60^{th} day of the study period. In control pot of *Capsicum annum*, the percentage of nitrogen was reported as 59.67±26.88 and 66.00±9.07. In Treatment 1, the nitrogen value was found to be 94.00±24.94 and 95.00±0.26.In Treatment 2, the value was 73.00±6.11 and 56.33±14.17. In Treatment 3, the nitrogen value was found to be 85.67±6.02 and 56.00±13.89 (Table 2).

The percentage of phosphorous value was observed in control, Treatment 1, 2 and 3 on 30^{th} and 60^{th} days. In control pot of *Capsicum annum*, the percentage of phosphorous value was observed as 18.00±4.16and 14.50±6.26. In Treatment 1, it was noted as 78.00±15.46 and 70.00±14. In Treatment 2, the value was 66.67±13.89 and 60.00±47.22. In treatment 3, it was noted as 68.33±13.31 and 68.00±44.56.

The percentage value of potassium was measured on $30^{th}$and 60^{th} days in control, Treatment 1, 2 and 3. In control the percentage value was 158.33±24.66 and 185±75.71 .In Treatment 1, it was 380.83±0 and 500±206.4.In Treatment 2, it was found to be 236.67±0 and 500±55.07. In Treatment 3, it was 248.33±12.35 and 488±51.05 (Table 2).

The data represented in Table 2 reveals that the pot containing Vermi compost have higher percentage of NPK values almost throughout the study period of 60 days.

Ushakumari (1999) reported that treatment with enriched vermicompost was superior to other treatments for the uptake of N, P, K, Ca and Mg by cowpea (*Vigna unguiculata* L. Walp) and Mn in shoot tissues of red clover and cucumber. Soil analysis was made after the vermicompost applications showed marked improvements in the overall physical and chemical properties of the soil. Plant available Nitrogen, Phosphorus and Potassium were higher in plots supplied with both vermicompost and NPK fertilizers (Senthilkumar *et al.*, 2004).

3.2. EFFECT OF VERMICOMPOST ON GROWTH AND YIELD OF *CAPSICUM ANNUM*

The average plant height, the percentage of germination and number of flowers and average yield of *Capsicum annum* treated with organic and inorganic fertilizers application was observed.

a) Germination o f *Capsicum annum*

The germination percentage was observed On 10^{th}, 15^{th},20^{th} and 25^{th} days, in control and treatment 1 , treatment 2 and treatment 3. On 10^{th} day, the germination percentage of *Capsicum annum* in Control and experiment 1, 2 and 3, it was noted as 0%, 6.6%,6.6%, and 6.6% respectively. On 15^{th} day, it was noted as 0%, 13.2%, 10% and 10% respectively. On 20^{th} day, it was noted as 10%, 50%, 42.9% and 40% respectively. On 25^{th} day, the germination percentage of *Capsicum annum* in control and experiment 1, 2 and 3, it was noted as 16.5%, 75.9%, 70% and 66%.

The present study stated that the germination percentage was higher in vermi compost treatment when compared to Farmyard manure,urea and control. From the above data, it is a clear evidence to support that the Vermicompost medium promote and enhanced the germination process of the *Capsicum annum*. The application of vermicompost gave higher germination of mung bean (*Vigna radiata*) compared to the control. The growth and yield of mung bean was also significantly higher with vermicompost application (Karmegam *et al.* 1999).

b) Shoot length of *Capsicum annum*

The plant height is the major important yield contributing parameter of all plants. In this present study in the shoot length of the *Capsicum annum* was, measured on 20^{th}, 40^{th}, 60^{th} and 80^{th} days in control and Treatment 1,Treatment 2 and Treatment 3.The plant height ranged from 0.05±0.04cm recorded in the control, 1.92±0.51cm, 1.55±0.39 cm and 1.44±0.34cm recorded in the treatment1,2 and 3 was observed on 20^{th} day. On 40^{th}day, the shoot length was observed in control from 0.09±0.056 cm in treatment 1, 6.42±2.45cm, treatment 2, 5.15±1.92 cm and treatment 3, 5.02±1.28 cm.On 60^{th}day, the plant height was observed in control 4.7±1.05, in treatment 1,

12.8±3.94 cm, treatment 2, 10.86 ±2.22 cm and treatment 3, 10.73±2.06 cm respectively. On 80th day, the plant height was observed in control 8.3 ±2.08 cm, in treatment 1, 21.14±5.84 cm, treatment 2, 19.04±3.87 cm and treatment 3, 18.12±3.14 cm. (Table 4).

In this present study, application of vermicompost alone recorded higher shoot length, over the control.Vermicompost applied at a rate of 25% improved stem length by 11 mm and diameter by 40 mm in chili plants compared with the control plants (Atiyeh *et al.*,2002). The amount of vermicompost had a significant effect on not only growth and flowering of the Marigold plants, but also on the plant shoot and root biomass, plant height and diameter of the flowers(Pritam *etal.*,2010).

C) Bud formation and flowering of *Capsicum annum*.

The bud formation and flowering of the *Capsicum annum* assessed in the following pattern and presented in different units like number of flowering, number of bud formation in control, treatment 1 , treatment 2 and treatment 3 are presented in Table 5.

The average number of buds was observed on 60th and 80th days in control and treatment 1, treatment 2 and treatment 3. On 60th day, the average number of buds of *Capsicum annum* in control and experiment 1, 2 and 3 it was noted as 1.02±2.15, 8.92±4.50, 2.85±3.18 and 1.62±1.84. On 80th day, it was noted as 1.67±2.08, 14.23±16.13, 8.05±9.14 and 7.40±8.38.

The average number of flowers was observed on 60th and 80th days in in all experiments.On 60th day, the average number of flowers of *Capsicum annum* in control and experiment 1, 2 and 3 like 1.05±2.77,1.25±2.14, 1.10±31.64 and 1.02±1.29 respectivly.. On 80th day, the average number of flowers of *Capsicum annum* in control and experiment 1, 2 and 3, it was noted as 1.86±2.58, 16.23±18.25, 11.05±12.18 and 9.08±10.49. The results showed that the number of flowering and bud formation in *Capsicum annum* was higher in vermicompost followed by Farmyard manure, urea and control.

Ansari and Ismail (2001) the application of chemical fertilizers over a period has resulted in poor soil health, reduction in produce, and increase in incidences of pest and disease and environmental pollution. In order to hope with these trenchant problems, the vermin-technology has become the most suitable remedial device (Edwards and Bohlen, 1998; Kumar, 2005).

Vermicompost improves soil physical structure, enriches soil with micro- organisms and improves water holding capacity. It enhances germination, plant growth and crop yield. In economic level the elimination of bio wastes from the waste stream reduces contamination of other recyclables collected in a single bin (a common problem in communities practicing single stream recycling). Creates low skill jobs at local level. Low capital investment and relatively simple technologies make vermicomposting practical for less-developed agricultural regions (Marha and Glenn 2000). The utilization of vermicompost results in several benefits to farmers, industries, environment and overall national economy.

TABLE: 1

Effect of vermicompost on physical parameters of the soil

Treatments	PH		Electrical conductivity (dsm^{-1})	
	D		D	
	3	6	3	6
Cont	8.20±0.1	8.43±0.11	0.30±0.0	0.28±0.03
Vermicompost (T1)	8.30±0	8.67±0.05	0.69±0.06	0.58±0.06
Farmyard	8.27±0.05	8.50±0	0.60±0.03	0.16±0.03
Urea (T3)	7.90±0.1	8.30±0.06	0.61±0.02	0.14±0.01

TABLE:2

Effect of vermicompost on the chemical parameters of the soil

Treatments	Nitrogen	Phosphorus	Potassium
	D	D	Days

	30	60	30	60	30	60
Control	59.67±26.88	66.00±9.07	18.00±4.16	14.50±6.26	158.33±24.66	185±75.71
Treatment 1	94.00±24.94	95.00±0.26	78.00±15.46	70.00±14	380.83±0	500±206.4
Treatment 2	73.00±6.11	56.33±14.1	66.67±13.8	60.00±47.2	236.67±0	500±55.07
Treatment 3	85.67±6.02	56.00±13.89	68.33±13.3	68.00±44.5	248.33±12.3	488±51.05

The experiment data was expressed as Mean ±S.D. The mean difference is significant of the p< 005 level.

Table 3

Effects of Vermi compost on the germination percentage of the *Capsicum annum*

Treatments	**Germination (%)**			
	Days			
	10	**15**	**20**	**25**
Control	0.00	0.00	10.00	16.67
Vermi compost (T1)	6.67	13.33	50.00	76.67
Farmyard manure (T2)	6.67	10.00	43.33	70.00
Urea (T3)	6.67	10.00	40.00	66.67

TABLE:

4

Effect of Vermicompost on the average shoot length (cm) of *Capsicum annum*

Treatments	Shoot length(cm)			
	Days			
	20th day	**40th day**	**60th day**	**80th day**
Control	0.05±0.04	0.09±0.56	4.71±1.05	8.3±2.08
Treatment 1	1.92±0.51	6.42±2.45	12.8±3.94	21.14±5.84
Treatment 2	1.55±0.39	5.15±1.92	10.86±2.22	19.04±3.87
Treatment 3	1.44±0.34	5.02±1.28	10.73±2.06	18.12±3.14

TABLE: 5

Effects of Vermi compost on the Bud formation of the *Capsicum annum*

Treatments	Buds formation	
	60th day	**80th day**
Control	1.02±2.15	1.67±2.08
Vermi compost (T1)	8.92+4.50	14.23+16.13
Farmyard manure (T2)	2.85±3.18	8.05±9.14

Urea (T3)	1.62±1.84	7.40±8.38

TABLE 6

Effects of Vermicompost on the Flowering of the *Capsicum annum*

Treatments	**Flowers formation**	
	60^{th} day	**80^{th} day**
Control	**1.05±2.77**	**1.86±2.58**
Vermi compost (T1)	**1.25±2.14**	**16.23±18.25**
Farmyard manure	**1.10±1.64**	**11.05±12.18**
Urea (T3)	**1.02+1.29**	**9.08+10.49**

The experiment data was expressed as Mean ±S.D. The mean difference is significant of the p< 005 level

References

Anwar MN. MS Huq, Nandy SK , Islam MS (2001) Influence of sulphur and boron on yield attributes and fruit yield if tomato in grey terrace soil. Bangladesh J Agril Res 26:226-235.

Atiyeh, R.M., Subler, S., Edwards, C.A., Bachman, G., Metzger, J. 1999. Growth of tomato plant in horticultural potting media amended with vermi compost *Pedobiologia*, 43:724-728.

Atiyeh, R.M, Lee, S., Edwards, C., Arancon, Q. Metzger, J.2002.The influence of humic acids derived from earthworm-processed organic wastes on plant growth. The growth and yield of greenhouses tomatoes. *Bioresour., Technol*,84(1):7-14

Ayers and Hayward. 1949. *Sja proc* .13:225.

Azizi M, Rezvani F, Hassan ZKM, Lekzian A, Nemati A (2009). Effects of vermicompost and irrigation on morphological traits and essential oil of chamomile. Iran. J.Med plant species Res., 24(1):82-93.

Coyne, Kelly and Erik Knutzen. 2008.The Urban Homestead: Your Guide to Self-Sufficient Living in the Heart of the City. Port Townsend: Process Self Reliance Series crop. Sci., 49(4): 305-308.

Darzi MT, Ghalavand A, Rejali F, Sephidkon F (2007). Effects of bio fertilizers application on yield and yield components in fennel (Foeniculem vulgare Mill). Iran . J. Med. Aroma plants, 22 (4):276-292.

Dewis. J . and Freitas,F. 1977.Physical and chemical methods of soil and water analysis, *Soil Bulletin* 10, FAO, Rome, 275 pp.

Edwards, C.A. and I. Burrows, 1988. The potential of earthworm composts as plant growth media in Neuhauser, C.A. (Ed.), Earthworms in Environmental and Waste Management. SPB Academic Publishing, The Hague, the Netherlands, pp: 211-220.

Edwards CA and Bohlen .1998. The use of earthworms in the breakdown and management of organic wastes. In: Earthworm Ecology. CRC Press LLC, Boca Raton, pp. 327-354.

Follet, R., R. Donahue and L. Murphy, 1981. Soil and Soil Amendments. Prentice hall :Inc., New Jersey

Golchin, A., Nadi, M., Mozaffari, V. 2006.The effects of vermicompost produced from various organic solid wastes on growth of pistachio seedlings. *Acta Hort*,726;301-306.

Gutierrez-MicelI, F.A., Santiago-Borra, J., Molinajamnafate, C.C., Abudarchila, M., Liaven mao., Rincon – R.R., Denbooven, L. 2007. Vermi compost as a soil

supplement to improve growth, yield and fruit quality of tomato(*Lycopersicum esculentum*). *Bioresour .Technol.*,98 (15):2781-2786

Jadhav AD, Talashilkar SC and Pawar AG. 1997. Influence of the conjunctive use of FYM, vermicompost and urea on growth and nutrient uptake in rice. *Journal of Maharashtra Agricultural Universities* 22(2):249–250.

Karmegam N, Alagermalai K and Daniel T. 1999. Effect of vermicompost on the growth and yield of greengram (*Phaseolus aureus* Rob.). *Tropical Agriculture*

*7*6(2):143–146.

Karmegam N and Daniel T. 2000. Effect of biodigested slurry and vermicompost on the growth and yield of cowpea [*Vigna unguiculata* (L.)]. *Environment and Ecology* 18(2):367–370.

Kumar. H., 2005. Plant responses to drought and phosphorous deficiency: contribution of phytohormones in root related process. *J. plant Nutr. Soil. Sci,* 168(4):

531-540.

Marha and Glenn, 2000. Manual of On-farm Vermicomposting and Vermiculture; Pub. of Organic AgricultureCentre of Canada, pp: 39.

Nagavallemma KP, Wani SP, Stephane Lacroix, Padmaja VV, Vineela C, Babu Rao M and Sahrawat KL. 2004. Vermicomposting: Recycling wastes into valuable organic fertilizer. Global Theme on Agrecosystems Report no. 8. Patancheru 502 324, Andhra Pradesh, India: *International Crops Research Institute for the Semi-Arid Tropics. 2*0 pp.

Narkhede, S.B. Attarde and S.T. Ingle. Study on effect of chemical fertilizer and Vermicompost on growth of chilli pepper plant (*Capsicum annum*). *Journal of applied sciences in environmental sanitation*. Volume 6, number 3:327-332, September, 2011.

Olaniyi JO and Ajibola AT, 2008. Effects of inorganic and organic fertilizers application on the growth, fruit yield and quality of tomato. *Journal of applied Biosciences* 8(1):236-242.

Pritam, S., Garg,V.K., Kaushik, C.P. 2010. Growth and yield response of marigold to potting media containing vermi compost produced from different wastes. *Environmentalist,* 30; 123-130.

Rakesh Joshi and Adarsh Pal Vig-2010. *African Journal of Basic and Applied Sciences* 2 (3-4):117-12

Senthilkumar, S., M.V. Sriramachandrasekharan and K. Haripriya, 2004. Effect of vermicompost and fertilizer on the growth and yield of rose. *J. Interacademicia,* 8: 207-210.

Singh,R., Sarma, R., Satyendra, K., Gupta, R., Patil, R., 2008. Vermicompost substitution influence growth, physiological disorder fruit yield and quality of Strawberry (Fragaria x ananassa (Duch). *Biorecour.Technol*, 99: 8502- 8511

Temple, W. D. and Bomelle, A.A. 1989 Effect of Kelp (*Macrocystis integrifolia* and *Ekllonia maxima)* foliar application on bean crop growth. Plant and soil 117:85-92.

Tharmaraj K, Ganesh P. and Kolanjinathan K., Suresh Kumar R, Anandh A. 2011. Influence of vermicompost and vermiwash on physico chemical properties of rice cultivated soil.*Curr.Bot*. 2(3): 18-21.

Tiwari, S.C., B.K. Tiwari and R.R. Mishra, 1989. Microbial populations, enzyme activities and nitrogenphosphorus- potassium enrichment in earthworm casts and in surrounding soil of a pineapple plantation. *J. of Biology and Fertility of Soils;* 8: 178-182.

Tylers,H.H., Warren., S. L., bilder back, T. F.., and Fonteno W.C.,1993. Composted turkey litters.1st effect on physical and chemical properties of pine bark substrate . *Journals of Environmental Horticulture*,11:131-136.

Ushakumari,K,, Prabhakumari,P,, and Padmaja P.1999. Efficiency of vermi compost on growth and yield of summer crop Okra,(*Abelmoschus esculentus Moench*) *Journal of Tropical Agricultural*,37:87-88.

Zhang, F.S., Yamasaki S, Nanzyo M .2002.Wastes ashes for use in agricultural production I. Limiting effect, contents of plant nutrients and chemical characteristics of some metals. *Sci Total Environ*, 284: 215 –225.