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Effect of vermicompost on the growth and nutrient status in groundnut (*Arachishypogaea*. L)

S. Mathivanan, R. Kalaikandhan, AL. A Chidambaram*, and P. Sundramoorthy

Department of Botany, Annamalai University, Annamalainagar

ABSTRACT

Vermicompost contain plant nutrients including N, P, K, Ca ,Mn ,Zn and Cu, the uptake of which has a positive effect on plant nutrition, photosynthesis ,the chlorophyll content of the leaves and improves the nutrient content of the different plant component (Root and Shoot).The highest chlorophyll, carotenoid , sugar, Amino acid and protein content were observed in the plant grown in 200g of vermicompost applied pots .The soil properties such as P^H, Ec, available nitrogen, phosphorus, potassium, iron ,zinc, copper and manganese were found to vary in the soils treated with vermicompost application. An increase in micro and macro nutrient content was observed with the 200g of vermicompost, treatment.

Key words: Vermicompost, growth, groundnut, photosynthesis, chlorophyll and Amino acid.

INTRODUCTION

The use of organic matter such as animal manures, human waste, food wastes, yard wastes, sewage sludge and composts have long been recognized in agriculture as beneficial for plant growth , yield and in the maintenance of soil fertility. Traditional composting of organic matter wastes have been known for many years. But new methods of thermophilic composting have become much more popular in organic waste treatment recently. Vermicompost has been recognized as a low cost and environmentally sound process for treatment of many organic wastes (Hoitink, 1993). Furthermore, the rapid decomposition and raised temperatures during composting produce a relatively homogeneous, odor – free, pathogen – free and easy – to – handle product (Bevacqua andMellano,1993) reported that vermicompost treated soils and lower P^Hs and increased levels of organic matter, primary nutrients, and soluble salts. (Edwards and Burrows, 1988) reported that vermicompost, especially those from animal waste sources, usually contained more mineral elements than commercial plant growth media. Many of these elements were changed to forms more that could be redily taken up by the plants, such as nitrates, exchangeable phosphorus and soluble potassium, calcium and magnesium.(Werner and Cuevas ,1996) reported that most vermicompost contained adequate amounts of macro nutrients and trace elements of various kinds but were dependent on the sources of the worm feed stock.

MATERIALS AND METHODS

Seed Materials
The seeds of groundnut (*Arachishypogaea*L.) var. VRI 2 were obtained from Regional Research Station of Tamil Nadu Agricultural University, Viruthachalam, Cuddalore District, Tamil Nadu, India.

Vermicompost
Vermicompost was obtained from the Faculty of Agriculture,Annamalai University, Annamalainagar, Tamil Nadu.

Application of vermicompost
Control : 10 kilogram soil + without vermicompost

100	:	10 kilogram soil + 100 gram vermicompost
150	:	10 kilogram soil + 150 gram vermicompost
200	:	10 kilogram soil + 200 gram vermicompost
250	:	10 kilogram Soil + 250 gram vermicompost

Total leaf area (Kalra and Dhiman, 1977)
Five plant samples were collected at various sampling days and the length and breadth of the leaf samples were measured and recorded.

Biochemical analysis
Chlorophyll (Arnon, 1949)
Five hundred mg of fresh leaf material was ground with a mortar and pestle with 10 ml of 80 percent acetone. The homogenate was centrifuged at 800 rpm for 15 minutes. The supernatant was saved and the residue was re extracted with 10 ml of 80 percent acetone. The supernatant was saved and the absorbance values were read at 645 and 663 nm in a UV-Spectrophotometer.

Estimation of Protein (Lowry *et al.*, 1951)
One ml of the extract was taken in a 10 ml test tube and 5 ml of reagent 'c' was added. The solution was mixed and kept in darkness for 10 minutes. Later, 0.5ml of Folin phenol reagent was added and the mixture was kept in dark for 30 minutes. The sample was read at 660 nm in a UV spectrophotometer.

Estimation of amino acids (Moore and Stein, 1948)
One ml of the extract was pipette out into a test tube. A drop of methyl red indicator was added. The sample was neutralizedwith 1 ml of 0.1 N sodium hydroxide. To this, 1ml of ninhydrin reagent was added and mixed thoroughly. The content of the test tube was heated for 20 minutes in a boiling water bath. Five ml of the diluents solution was added and heated in water bath for 10 minutes. The test tubes were cooled under the running water and the contents were mixedthoroughly. Blank was prepared with 1ml of distilled water (or) ethanol. The absorbance was read at 570 nm in a UV – Spectrophotometer.

Estimation of sugars (Nelson, 1949)
To One ml of extract taken in a 25 ml marked test tube 1 ml of reagent 'C' was added. Then the mixture was heated for20 minutes at 100°C in boiling water bath, cooled and 1 ml ofarsenomolybdate reagent was added. The solution was thoroughly mixed and diluted to 20 ml with distilled water. The sample was read at 520 nm in a UV spectrophotometer.

Soil analyses
The soil samples were collected from each pot before sowing and after harvesting and labelled separately. Their physico-chemical properties such as pH, Electrical conductivity, nitrogen, phosphorus, potassium, copper, zinc, iron and manganese were estimatedand recorded.

P^H
Twenty grams of soil sample was air dried and 50 ml of distilled water was added. The samples were taken in beaker and the pH of the soil sample was recorded by using pHmeter with electrode.

Electrical conductivity (dS m^{-1})
Twenty grams of dried soil sample was taken and dissolved in 50 ml of distilled water and mixed .The solution was used to measure the conductivity with the help of an electrical conductivity meter.

Available Nitrogen (Subbiah and Asija, 1976)
Twenty grams of the soil sample was taken in a flask and 20 ml of distilled water, 100 ml of freshly prepared 0.32 percent potassium permanganate, solution and 100 ml of 2.5 percent sodium hydroxide were added. The flask was heated and 30 ml of distillate was collected in 50 ml of N/50 sulphuric acid. The excess acid was titrated against N/50 NaoH solution using methyl red indicator.

Available phosphorus (Jackson, 1958)
One gram of the soil was suspended in 200 ml of 0.002 N sulphuricacid, shaken well and then filtered through Whatman No. 42filter paper. To 10 ml of filtrate, three drops of 0.02 percent 2, 4-dinitrophenol indicator was added. Whenever the solution became yellow; 2N sulphuric acid was added till the disappearance of the yellow colour. If the solution was colorless after adding the indicator. 4N sodium carbonate was added till it became colorless. To that solution, 2 ml of sulphomolybdic acid, ammonium molybdate 25 g in 200 ml; 275 ml con H_2SO_4

diluted to 700 ml both were cooled mixed and made up to 1000 ml) add 0.5 ml of chlorostannous acid (25 g SnCl $2H_2O$ in 50 ml of concentrated HCl diluted to 500 ml with water and made up to one liter with 1.2 N HCl) were added and made up to 50 ml. The solution was shaken well and read in a UV spectrophotometer at 660 nm. After 5 minutes, standard graph was prepared using potassiumdihydrogen phosphate.

Available Potassium (Jackson, 1958)

Ten grams of soil was taken in 250 ml conical flask and 100 ml of ammonium acetate was added to it. The flask was stoppershaken intermittently for 10 minutes and filtered by suction. Additional increments of ammonium acetate were poured to the soil to get a volume of 250 ml and then evaporated to dryness. Dried samples were ashed in a multle furnace at 700 – 800°C for 20-30 minutes. To the residue, 50 ml 0.1 N HCL was added and warned gently and the extract was fed to flame photometer. Potassium chloride was used to prepare the standard solution.

Available Calcium (Yoshida et al 1972)

Five grams of soil was extracted with 50 ml of IN ammonium acetate. Two ml of the extract was mixed with 2 ml of 5 percent lanthanum oxide solution and diluted with 10 ml of 1N HCl. The solution was fed into an Atomic Absorption Spectrophotometer at 211.9 nm. Standard solution was prepared using calcium chloride.

Available Magnesium (Jackson, 1958)

Ten gram of soil sample was extracted with 50 ml of 1 N ammonium acetate and the extract was filtered and used for the determination of magnesium. The determination procedure was adopted as in the case of calcium. The amount of magnesium was estimated by using Atomic Absorption Spectrophotometer. Magnesium chloride was used for the standard preparation.

Zinc, Copper, Iron and Manganese (Piper, 1966)

Fifty grams of soil was extracted with 100 ml of extraction solution diethyllenetriaminepenta acetic acid DPTA) and shaken thoroughly for 2 hrs. The solution was filtered through Whatman No. 42 filter paper. The filtrate was read at 568 nm for iron, 324.6 for copper, 214 nm for zinc 530 nm for manganese and 540 nm by using the appropriate hollow cathode lamps, in Atomic Absorption Spectrophotometer.

RESULTS

Total leaf area (cm^2/plant)

The result on the effect of different dose of vermicompost fertilizer on total leaf area (cm^2/plant) of groundnut at various stages of its growth (25, 50, 75 and 100 DAS) is shown in Table 1. The highest total leaf area (5.768, 8.234, 11.675 and 14.322 cm^2/plant) was recorded in groundnut crop grown in 200 g of vermicompost treatment. The lowest total leaf area (4.514, 6.246, 8.243 and 10.22 cm^2/plant) was recorded at various stages of its growth (25, 50, 75 and 100 DAS) in the crops grown without vermicompost treatment.

Table 1. Effect of application of various doses of vermicompost on total leaf area (cm^2/plant) of groundnut (*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	**50**	**75**	**100**
Control (**T_0**)	4.514 ± 0.225	6.246 ± 0.312	8.243 ± 0.412	10.22 ± 0.511
Soil + vermicompost (100 g/pot) (**T_1**)	4.712 ± 0.235	6.322 ± 0.316	9.081 ± 0.454	10.312 ± 0.515
Soil + vermicompost (150 g/pot) (**T_2**)	5.266 ± 0.263	6.956 ± 0.347	9.622 ± 0.481	13.605 ± 0.680
Soil + vermicompost (200 g/pot) (**T_3**)	5.768 ± 0.288	8.234 ± 0.411	11.675 ± 0.583	14.322 ± 0.719
Soil + vermicompost (250 g/pot) (**T_4**)	4.979 ± 0.248	6.679 ± 0.333	9.187 ± 0.459	11.761 ± 0.588

± Standard deviation

Photosynthetic pigments

The result on the effect of various dose of vermicompost on photosynthetic pigments content of groundnut at various stages of its growth 25, 50, 75 and 100 DAS are shown in Tables 2-5. The highest chlorophyll ‘a’, chlorophyll ‘b andtotal chlorophyll content (0.846, 0.755 and 1.601 mg/g fr. wt.) basis were recorded in 75 days old crop plants grown with application of 200 g of vermicompost. The lowest chlorophyll ‘a’, chlorophyll ‘b’, and total chlorophyllcontent (0.497, 0.300 and 0.797 mg/g fr. wt.) were recorded in 100 days crop grown without vermicompost application.

Table 2. Effect of application of various dose of vermicompost on chlorophyll 'a' content(mg/g fr. wt.) of groundnut (*Arachishypogaea*(L.)

Treatments	Age of the plant in days			
	25	50	75	100
Control (**T_0**)	0.531 ± 0.026	0.606 ± 0.030	0.708 ± 0.035	0.497 ± 0.024
Soil + vermicompost (100 g/pot) (**T_1**)	0.575 ± 0.028	0.651 ± 0.032	0.730 ± 0.036	0.538 ± 0.026
Soil + vermicompost (150 g/pot) (**T_2**)	0.611 ± 0.030	0.764 ± 0.037	0.796 ± 0.039	0.589 ± 0.029
Soil + vermicompost (200 g/pot) (**T_3**)	0.725 ± 0.036	0.800 ± 0.04	0.846 ± 0.042	0.635 ± 0.031
Soil + vermicompost (250 g/pot) (**T_4**)	0.597 ± 0.029	0.711 ± 0.035	0.752 ± 0.037	0.562 ± 0.028

Table 3. Effect of application of various dose of vermicompost on chlorophyll 'b' content(mg/gfr. wt.) of groundnut (*Arachishypogaea*(L.)

Treatments	Age of the plant in days			
	25	50	75	100
Control (**T_0**)	0.345 ± 0.017	0.514 ± 0.025	0.620 ± 0.031	0.300 ± 0.015
Soil + vermicompost (100 g/pot) (**T_1**)	0.410 ± 0.020	0.602 ± 0.030	0.650 ± 0.032	0.331 ± 0.016
Soil + vermicompost (150 g/pot) (**T_2**)	0.480 ± 0.024	0.693 ± 0.034	0.723 ± 0.036	0.361 ± 0.018
Soil + vermicompost (200 g/pot) (**T_3**)	0.501 ± 0.025	0.743 ± 0.037	0.755 ± 0.037	0.432 ± 0.021
Soil + vermicompost (250 g/pot) (**T_4**)	0.477 ± 0.023	0.658 ± 0.032	0.689 ± 0.034	0.351 ± 0.017

± Standard deviation

Table 4. Effect of application of various dose of vermicompost ontotal chlorophyll content (mg/g fr. wt.) of groundnut(*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	50	75	100
Control (**T_0**)	0.876 ± 0.043	1.120 ± 0.056	1.328 ± 0.066	0.797 ± 0.039
Soil + vermicompost (100 g/pot) (**T_1**)	0.985 ± 0.049	1.253 ± 0.062	1.380 ± 0.069	0.869 ± 0.043
Soil + vermicompost (150 g/pot) (**T_2**)	1.091 ± 0.054	1.439 ± 0.071	1.519 ± 0.075	0.950 ± 0.047
Soil + vermicompost (200 g/pot) (**T_3**)	1.226 ± 0.061	1.543 ± 0.077	1.601 ± 0.080	1.067 ± 0.050
Soil + vermicompost (250 g/pot) (**T_4**)	1.074 ± 0.053	1.369 ± 0.068	1.441 ± 0.072	0.913 ± 0.045

± Standard deviation

Table 5. Effect of application of various doses of vermicompost on protein content (mg/g fr. wt.) in root of groundnut (*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	50	75	100
Control (**T_0**)	10.05 ± 0.50	11.50 ± 0.57	12.78 ± 0.63	13.32 ± 0.66
Soil + vermicompost (100 g/pot) (**T_1**)	10.50 ± 0.52	12.06 ± 0.60	13.35 ± 0.66	14.33 ± 0.71
Soil + vermicompost (150 g/pot) (**T_2**)	11.28 ± 0.56	12.77 ± 0.63	14.36 ± 0.71	15.54 ± 0.77
Soil + vermicompost (200 g/pot) (**T_3**)	11.74 ± 0.58	13.80 ± 0.69	15.19 ± 0.75	16.69 ± 0.83
Soil + vermicompost (250 g/pot) (**T_4**)	10.84 ± 0.54	12.54 ± 0.62	13.80 ± 0.69	14.91 ± 0.74

± Standard deviation

Protein

The results on the effect of various dose of vermicompost on protein content in root and leaf portion of groundnut at 25, 50, 75 and 100 DAS are shown in Tables 6 and 7. The highest protein 16.74, 17.03, 18.05 and 20.17 mg/g fr. wt. at 25, 50, 75 and 100 DAS were recorded in leaf portion of groundnut grown with 200 g of vermicompost. The lowest protein contents 10.05, 11.50, 12.78 and 13.32 mg/g fr. wt. at 25, 50, 75 and 100 DAS were recorded in the root portion of groundnut crop grown without vermicompost application.

Table 6. Effect of application of various doses of vermicompost on proteincontent (mg/g fr. wt.) in leaf of groundnut (*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	**50**	**75**	**100**
Control (**T_0**)	13.10 ± 0.65	13.97 ± 0.69	15.06 ± 0.75	16.62 ± 0.83
Soil + vermicompost (100 g/pot) (**T_1**)	14.89 ± 0.74	15.34 ± 0.76	16.09 ± 0.80	17.04 ± 0.85
Soil + vermicompost (150 g/pot) (**T_2**)	15.54 ± 0.77	16.12 ± 0.80	17.50 ± 0.87	18.52 ± 0.92
Soil + vermicompost (200 g/pot) (**T_3**)	16.74 ± 0.83	17.03 ± 0.85	18.05 ± 0.89	20.17 ± 1.00
Soil + vermicompost (250 g/pot) (**T_4**)	15.07 ± 0.75	15.89 ± 0.79	16.58 ± 0.82	17.97 ± 0.89

± Standard deviation

Table 7. Effect of application of various doses of vermicompost on amino acid (mg/g fr. wt.) in root of groundnut (*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	**50**	**75**	**100**
Control (**T_0**)	3.00 ± 0.15	3.22 ± 0.16	3.69 ± 0.18	3.94 ± 0.19
Soil + vermicompost (100 g/pot) (**T_1**)	3.72 ± 0.18	4.17 ± 0.20	4.53 ± 0.22	4.96 ± 0.24
Soil + vermicompost (150 g/pot) (**T_2**)	4.47 ± 0.22	4.96 ± 0.24	5.26 ± 0.26	5.73 ± 0.28
Soil + vermicompost (200 g/pot) (**T_3**)	5.04 ± 0.25	5.62 ± 0.28	5.93 ± 0.29	6.12 ± 0.30
Soil + vermicompost (250 g/pot) (**T_4**)	4.11 ± 0.20	4.57 ± 0.22	4.91 ± 0.24	5.36 ± 0.26

± Standard deviation

Table 8. Effect of application of various doses of vermicompost on amino acid content (mg/g fr. wt.) in leaf of groundnut(*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	**50**	**75**	**100**
Control (**T_0**)	4.03 ± 0.20	4.31 ± 0.21	4.60 ± 0.23	4.95 ± 0.24
Soil + vermicompost (100 g/pot) (**T_1**)	4.76 ± 0.23	5.04 ± 0.25	5.22 ± 0.26	5.53 ± 0.27
Soil + vermicompost (150 g/pot) (**T_2**)	5.35 ± 0.26	5.78 ± 0.28	6.02 ± 0.30	6.23 ± 0.31
Soil + vermicompost (200 g/pot) (**T_3**)	6.01 ± 0.30	6.29 ± 0.31	6.59 ± 0.32	6.83 ± 0.34
Soil + vermicompost (250 g/pot) (**T_4**)	5.11 ± 0.25	5.53 ± 0.27	5.82 ± 0.29	6.01 ± 0.30

± Standard deviation

Table 9. Effect of application of various doses of vermicompost on sugar content (mg/g fr. wt.) in root of groundnut (*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	**50**	**75**	**100**
Control (**T_0**)	2.15 ± 0.10	3.28 ± 0.16	3.89 ± 0.19	4.36 ± 0.21
Soil + vermicompost (100 g/pot) (**T_1**)	2.66 ± 0.13	3.72 ± 0.18	4.22 ± 0.21	4.97 ± 0.24
Soil + vermicompost (150 g/pot) (**T_2**)	3.00 ± 0.15	4.22 ± 0.21	4.74 ± 0.23	5.54 ± 0.27
Soil + vermicompost (200 g/pot) (**T_3**)	3.67 ± 0.18	4.87 ± 0.24	5.41 ± 0.27	6.04 ± 0.30
Soil + vermicompost (250 g/pot) (**T_4**)	2.82 ± 0.14	4.02 ± 0.20	4.52 ± 0.22	5.10 ± 0.25

± Standard deviation

Amino acid

The result on the effect of application of various dose of vermicompost on amino acid content in root and leaf portion of groundnut at various stages of growth are shown in Tables 8 and 9. The highest amino acids contents (6.01, 6.29, 6.59 and 6.83 mg/g fr. wt. at 25, 50, 75 and 100 DAS) were recorded in the leaf samples of groundnut growth with 200 g of vermicompost application. The lowest amino acid contents (3.09, 3.22, 3.69 and 3.94 mg/g fr.

wt.at 25, 50, 75 and 100 DAS) were recorded in root portion of groundnut crop grown without vermicompost application.

Table .10. Effect of application of various doses of vermicompost on sugar content (mg/g fr. wt.) in leaf of groundnut (*Arachishypogaea*L.)

Treatments	Age of the plant in days			
	25	**50**	**75**	**100**
Control (**T_0**)	5.10 ± 0.25	5.42 ± 0.27	5.83 ± 0.29	6.42 ± 0.32
Soil + vermicompost (100 g/pot) (**T_1**)	5.41 ± 0.27	5.71 ± 0.28	6.08 ± 0.30	6.93 ± 0.34
Soil + vermicompost (150 g/pot) (**T_2**)	5.74 ± 0.28	6.01 ± 0.30	6.65 ± 0.33	7.43 ± 0.37
Soil + vermicompost (200 g/pot) (**T_3**)	6.04 ± 0.30	6.42 ± 0.31	7.11 ± 0.35	8.08 ± 0.40
Soil + vermicompost (250 g/pot) (**T_4**)	5.53 ± 0.27	5.88 ± 0.29	6.26 ± 0.31	7.22 ± 0.36

± Standard deviation

Table 11.Physico-chemical analysis of experimental soil (before sowing and after harvesting)

Treatment	pH	EC (dSm^{-1})	Available N (mg/kg)	Available P (mg/kg)	Available K (mg/kg)	Available Zn (mg/kg)	Available Cu (mg/kg)	Available Fe (mg/kg)	Available Mn (mg/kg)
Before sowing									
T_0	7.0	0.56	25	18	56	5.8	4.1	85	85
T_1	6.5	0.63	28	18	58	6.4	4.3	89	83
T_2	6.3	0.66	38	19	60	7.2	4.4	88	88
T_3	6.1	0.71	41	22	63	7.8	4.4	89	98
T_4	6.0	0.75	47	20	65	8.0	4.8	86	98
After Harvesting									
T_0	8.0	0.37	34	12.5	47	3.6	1.9	57	52
T_1	8.2	0.25	41	13.5	47	4.7	2.2	59	51
T_2	8.1	0.29	44	15.5	45	4.9	2.5	61	53
T_3	8.0	0.51	50	15.5	47	5.3	2.7	63	63
T_4	8.1	0.41	42	12.5	50	5.1	2.7	60	59

Sugar

The result on the effect of application of various dose of vermicompost on reducing sugar content in root and leaf portion of groundnut at various stages of its growth (25, 50, 75 and 100 DAS) are shown in Tables 10 and 11. The highest reducing sugar content (6.04, 6.42, 7.11 and 8.08 mg/g fr. wt. at 25, 50, 75 and 100 DAS) were recorded in leaf portion of groundnut grown with 200 g vermicompost application. The lowest reducing sugar contents (2.15, 3.28, 3.89 and 4.36 mg/g fr. wt. at 25, 50, 75 and 100 DAS) were recorded in root portion of groundnut crop grown without vermicompost application.

Soil properties

The results on the effect of application of various dose of vermicompost on physico-chemical analysis of soil due to various dose of vermicompost application are shown in Table 12. The control soil has the pH value of 7.09 and EC values of 0.56 dS/m. The macronutrients such as available N (25 mg/kg), available P (18 mg/kg) and available K (56 mg/kg) were recorded. The values of micronutrients such as available Zn (5.8 mg/kg), Cu, (4.1 mg/kg), Fe (80 mg/kg) and Mn (85 mg/kg) were recorded. The pH values of soil (8.0) showed the variation among the fertilizer applied soil. The highest values of EC 0.51 dSm^{-1} available N 50 kg/acre, P (15.5 kg/acre), K (47 kg/acre), Zn (53 kg/acre), Cu (27 kg/acre), Fe (63 kg/acre) and Mn (63 kg/acre) were recorded in the mixed with 200 g of vermicompost application.

DISCUSSION

Total leaf area

Leaf area is an important part of the plant responsible for interception and conversion of solar energy (Sarkar*et al.*, 1995). Total leaf area is the index of rate of photosynthesis which reflects the crop production. The highest total leaf area was recorded in groundnut crop in the application of 200 g of vermicompost. The lowest total leaf area was recorded in plants grown in control pots. Improves leaf expansion, axillary bud growth and shoot canopy, were application of vermicompost (Ahloowalia*et al.*, 2004)

Biochemical constituents

Chlorophyll

The presence or absence of chlorophyll in plant greatly affects the production of secondary metabolites and other essential plant constituents. The disappearance of chlorophyll is one of the most prominent phenomenons of an advanced age and rate of chlorophyll degradation. In the present study, the application of vermicompost manureon chlorophyll a, chlorophyll b, and total chlorophyll content of groundnutcrop were estimated in both the laboratory studies and field experiment at various stages of its growth (control, 25, 50, 75 and 100 DAS). The highest chlorophyll content was recorded in 200 g ofvermicompost treatment. The highest chlorophyll content was recorded in 75 days old plants when compared with all other sampling days. (Subler*et al.*, 1998) in experiments increases in chlorophyll contents in response to vermicomposts were observed at early stages of marigold growth later increases in leaf areas and significant increases in the total plant weights. (Berova and Karanatsidis,2009) observed increased photosynthetic pigments and leaf gas exchange in red chilli due to application of vermicompost.(Fernerdez-Luqueno,2010) Photosynthetic pigments and a significant increase in the ratio of chlorophyll in beans.

Sugar

Sugar is an important energy constituent needed for all living organisms. Plants manufacture this organic substance during photosynthesis and break down during respiration. The concentrations of soluble sugar indicate the physiological activity of plant organisms. The sugar content in plants grown under laboratory conditions and field environment gets varied due to different doses of vermicompost application. The sugar contents increased in 200 g of vermicompost treatment and the root portion of crop contained the higher content more than in leaves. The highest sugar content of groundnut plant was recorded at 75 days old plants and it increased up to harvest stage.(Manivanan *et al*.,2009) report that increased sugar content in beans(*Phaseolus vulgaris*) due to application of vermicompost.

Amino acid

Amino acid is (monomer of protein) the common reserve food material manufactured by plant system. An increase in amino acid and protein contents were reported in groundnut crop grown under 200 g of vermicompost application. The plants showed higher content when compared to control.(Manivanan *et al.*,2009) observed increased amino acid content in beans (*Phaseolus vulgaris*) due to application of vermicompost.

Protein

Protein is one of the reserve food material utilized by plants forthe growth of their seedling. An increase in protein content was recordedin the crop grown in 100, 150, 200, and 250 g of vermicompost treatment. Among all treatments, the highest protein content was observed in the plants grown in 200 g of vermicompost applied pots. In field experiment, the highest protein content was recorded in 75 DAS and it increased up to harvest stage. The shoot portion of crop contains higher protein content than the root. Significant increase was recorded in groundnut crop grown in 200 g vermicompost treatment.Increases in protein content were reported in wheat crop grown under vermicompost application (Channabasanagowda*et.al.*, 2008).

Soil properties

Soil is an important basic medium for growth and productivityof plant and chemical ecosystem. Soils contain a lot of beneficial microorganism *viz*., bacteria, fungi;actinomycetes etc., to enrich the microbes and microbial population thrive in the soil maintenanceof soil organic matter is very much important for the long term productivity of agro ecosystems (Gayal*et al.,* 1993). Vermicomposts have been recognized as having considerablepotentials as soil amendments. Vermicomposts are products of depredated organic matter through interactions of earthworm and microorganisms. The process accelerates the rate of decomposition of the organic matter, alters the physical and chemical properties of the material, and lowers the C: N ratio leading to a rapid humification process in which the unstable organic matter is fully oxidized and stabilized (Albanell*et al.,* 1998; Orozco *et al.,* 1996). The application of organic manures brings about structuralimprovement regeneration of soil structures increasing the aeration within. It may cause the roots to extend into a large volume of soil in addition to the increase of water retention in the soil profile (Agarwal*et al*, 1995, Alvarez*et al,* 1995). The analysis of soil applied with fertilizer showed that it has all kinds of nutrient needed for the better growth of the crop. The soil properties such as pH, EC, available nitrogen, phosphorus, potassium, iron, zinc, copper and manganese were found to vary in the soils treated with vermicompost application. An increase in micro and macronutrient content was observed with the 200 g of vermicompost treatment.

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