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Effect of three different composts on the growth rate of wheat (*Triticum aestivum*)

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SUMMARY

Composted organic material can be used as a source of important nutrients for sustainable crop productivity. This paper examines the growth rate effect of three different composts *i.e.* vermicompost, cowdung compost and moss compost on wheat crop at the concentrations of 10, 20, 30, 40, 50 and 60 % of compost in soil matrix. Six plots for each compost sample at above concentrations and one common control were prepared. Monitoring of wheat growth was done with respect to the height, width, number of spikelets, roots and shoots for an interval of 5, 10, 15 and 20 day's period. For vermicompost and moss compost 50 % concentration whereas for cowdung 40 % concentrations were suitable for height, width and spikelet growth. Vermicompost at 30 % concentration, cowdung compost at 60 % concentration and moss compost at 50 % concentration showed higher growth of roots. Chlorophyll content estimated in wheat crop was highest in cowdung compost plot at 40 % concentration. These findings imply that the use of cowdung compost could be more effective and economical to increase the yield of crops on sustainable basis.

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Key words : Compost, Wheat crop, Growth monitoring

Wheat crop enjoys the privileged position amongst food grain crops in the world in general and particularly in India where it serves as a staple food for the majority of the population. Now-a-days composting is becoming an increasingly important element of environmentally sound sustainable agriculture in an Indian context. Application of biofertilizer is considered today as a promising alternative for mineral fertilizers and supports an effective tool for desert agriculture development under less polluted environments, decreasing agricultural costs, maximizing crop yield due to providing them with an available nitrogen source and growth promoting substances (Hegazi *et al.*, 1998; Amer *et al.*, 2002). The various forms of organic manures are also being used in the fields for sustainable crop yield. Many studies have shown that the application of immature composts to soil causes severe damage to plant growth (Jimenez and Garcia,1989).

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The organic manures and compost are important in sustaining farming by providing plant N-supply (Korsaeth *et al.,* 2002). Alternative to chemical fertilizers, locally available organic wastes of anthropogenic and natural products were used as biofertilizers after employing earthworm as decomposers, for degradation and recycling to enhance the production of crops which are free from pollution and health hazard (Bakthvathsalam and Ramakrishnan, 2004). Vermiculture is the science of rearing of earthworms for mass propagation on organic wastes under semi-natural conditions and vermicomposting is the bioconversion of organic waste materials through earthwormic way (Senapati, 1992). They provide many benefits to agricultural soil, including increased ability to retain moisture, better nutrient-holding capacity, better soil structure and higher levels of microbial activity. A combination of organic and inorganic sources of nutrients might be helpful to obtain a good economic return with good soil health for the subsequent crop yield. The cost of inorganic fertilizers is very high and sometimes it is not available in the market for which the farmers fail to apply the inorganic fertilizers to the crop field in optimum time. The presence of heavy metals represents a limiting factor of the compost quality and of its use in agriculture, also because the concentration of heavy metals changes as a function of the starting residues, of

geographical differences, of crops and seasonal fluctuations (Giusquiani *et al.*, 1992).

The aim of the study was to investigate the effect of cowdung compost, vermicompost and moss compost on the growth rate of wheat crop in different concentrations of dose applied to each plot. The growth monitoring was performed by measuring the physical parameters like height, width, number of spikelets, and growth of roots and shoots at a regular interval.

MATERIALS AND METHODS

Vermicompost was collected from University garden department, cowdung compost was from feedlot of animals and moss compost was purchased from private nursery. Samples were collected in polythene bags. Physicochemical analysis of compost samples was done in the University laboratory and parameters like pH, conductivity, organic matter, nitrogen, potassium, phosphorous, chlorides, TVC, bulk density, specific gravity, sodium, sulphate etc. were determined as per the standard methods described in APHA (1995).Suspension of 1g compost with 5 ml distilled water was made for physicochemical analysis of compost. Heavy metals like Cu, Fe, Mg, Mn, Ni, and Zn were analyzed on Atomic Absorption Spectrophotometer. Total nineteen plots were prepared by mixing compost and soil in various proportions. Six plots were prepared for each compost sample and one was common control. A mixture with a ratio of 250 g soil + 25 g compost sample gave 10 % concentration plot. Likewise, plots were prepared for 20, 30, 40, 50 and 60 % concentrations of the compost. For remaining two compost samples the same method was used to prepare the different concentration plots. 20 seeds of wheat (*Triticum aestivum*) were planted per plot and the plots were kept in semi sun rays condition with proper aeration. Watering was done twice a day and 60 ml of water was sprinkled at a time on each plot.

Monitoring was done within 5-20 days interval period. Plants height, width and number of spikelets were measured at 5, 10, 15, and 20 day's interval period. On 21st day all wheat plants were uprooted to study its roots and shoots structures. A comparative data was prepared between each level concentration of 10, 20, 30, 40, 50, and 60 % on plants grown in each plot for three composts. Chlorophyll content was estimated on spectrophotometer (Shimadzu, model S series).

RESULTS AND DISCUSSION

pH of vermicompost and moss compost were near about neutral, whereas in cowdung compost, alkaline pH was observed. The Nitrogen content in the vermicompost, cowdung compost and moss compost was 1.6, 2.3, and 1.9 %, respectively. It is observed that compost application affects nitrogen mineralization processes in soil (Debosz *et al.*, 2002). In vermicompost, cowdung compost and moss compost potassium content estimated was 2.7, 3.8, and 3.6 %, respectively, whereas phosphorus content was 4.3, 5.8, and 5.2 %, respectively (Table 1). The heavy metals such as cadmium, lead and nickel were very trace in all three compost samples and they were below detectable level of the measuring system used. In vermicompost, cowdung compost and moss compost copper concentration was 0.026, 0.029 and 0.021 mg/l, respectively. In cowdung and moss compost the zinc concentration was 0.04 mg/l and 0.02 mg/l, respectively, while in vermicompost it was not detectable. The

Table 1: Physicochemical characteristics of compost samples

Sr. No.	Parameter	Vermi compost	Cowdung compost	Moss compost
1.	pH	7.0	8.1	7.1
2.	Conductivity (mmhos)	0.57	0.55	1.92
3.	Chloride (%)	8.4	4.2	5.7
4.	Organic matter (%)	43.60	20.43	42.09
5.	Moisture (%)	22.0	35.0	30.0
6.	Bulk Density (g/cm^3)	1.10	1.00	3.90
7.	Specific Gravity (g)	1.283	0.955	0.285
8.	Sodium (%)	0.7	1.0	1.0
9.	Sulphate (%)	0.06	0.05	0.02
10.	Nitrogen (%)	1.6	2.3	1.9
11.	Potassium (%)	2.7	3.8	3.6
13.	Phosphorus (%)	4.3	5.8	5.2
14.	Temperature (^{o}C)	30.5	30.2	29.6
15.	TVC (CFu/ml)	57023 x 10^2	32380 x 10^2	30032 x 10^2

manganese concentration in vermicompost, cowdung compost and moss compost was 0.23, 0.19 and 0.44 Mg/l, respectively. The Magnesium concentration in vermicompost, cowdung compost and moss compost, was 4.88, 4.87 and 4.50 Mg/l, respectively. In cowdung and moss composts the iron concentration was not detectable while it was in traces in vermicompost (Fig.1).

The organic manure and compost significantly increased the plant height, number of spikelets, width size etc. over untreated control. The difference in nutrient absorption greatly influences growth and yield potential (Ahmad *et al*., 2008). Initially in 5 days of monitoring period vermicompost at 50 % concentration showed the height of wheat plant increased up to 14 cm (Table 2). It was comparatively higher than the other two samples concentration plots.. In cowdung compost at 50 % concentration width size of plant was 2.6 mm higher than other two compost samples (Table 3). In 10 days distinct time interval vermicompost at 50 % concentration, shows the height of plant as 19 cm (Table 2). Comparatively in cowdung and moss compost at 50 % concentration, the height was 17.6 cm in both the cases (Table 3 and 4). At 60 % concentration in moss compost the width size was 5.0 mm higher among other two compost samples (Table 4). Not much more difference was observed in width size of wheat plant and number of spikelet at 20th day. In vermicompost, at 50 % concentration the chlorophyll content estimated was 1.89 % (Fig. 2). In case of cowdung compost at 40 % concentration plot, it was 2.5 %. In moss compost it was 1.89 % at 40 % concentrations

Table 2 : Wheat growth monitoring in vermicompost plots

Sr. No.	Observation	10%	20%	30%	40%	50%	60%	Control	Days
1.	Width (mm)	2	2	2	2	2.1	2	1	
2.	Height (cm)	7.0	7.2	12	12.2	14	12.9	7	After 5 days
3.	Spikelets (no.)	-	-	-	-	-	-	-	
1.	Width (mm)	4	4	4	4	4.2	4	2	
2.	Height (cm)	14	16	17.4	17	19	16.5	17.5	After 10 days
3.	Spikelets (no.)	3	3	3	3	3	2	2	
1.	Width (mm)	4.3	4	4	2	4.9	4	4	
2.	Height (cm)	20.8	23.4	25.2	26.6	29.2	25.9	23	After 15 days
3.	Spikelets (no.)	5	4	5	5	6	4	3	
1.	Width (mm)	4.4	4	4	3	4.3	4	4	
2.	Height (cm)	26.2	30	30	32	31	28	23	
3.	Spikelets (no.)	6	6	6	6	6	6	4	After 20 days
4.	Roots (no.)	2	4	6	3	3	2	4	
5.	Shoots (cm)	1.5	3.5	3.5	3.3	3	3.5	3.2	

Table: 3: Wheat growth monitoring in cowdung compost plots

Sr. No.	Observation	10%	20%	30%	40%	50%	60%	Control	Days
1.	Width (mm)	1.5	1.5	2.5	2.9	2.6	2	1	
2.	Height (cm)	5.8	8.5	8.5	9	8.5	8	7	After 5 days
3.	Spikelets (no.)	-	-	-	-	-	-	-	
1.	Width (mm)	3	3	4	4.4	4.1	4	2	
2.	Height (cm)	16	17	16.5	17.8	17.6	17	17	After 10 days
3.	Spikelets (no.)	3	2	2	4	3	2	2	
1.	Width (mm)	4.3	4	4	4.5	4	4	4	
2.	Height (cm)	23.3	25.4	25.2	26.4	26.2	26	23	After 15 days
3.	Spikelets (no.)	4	4	4	5	5	5	4	
1.	Width (mm)	3.9	4	4	4.2	4.2	4	4	
2.	Height (cm)	28.1	28.2	28.2	32.5	28.2	27.5	23	
3.	Spikelets (no.)	5	5	6	6	6	5	4	After 20 days
4.	Roots (no.)	3	3	4	5	6	7	4	
5.	Shoots (cm)	2.5	2.5	3	4.5	4.3	4	4	

Table 4 : Wheat growth monitoring in moss compost plots

Sr. No.	Observation	10%	20%	30%	40%	50%	60%	Control	Days
1.	Width (mm)	1.5	2	2	2	2.2	2	1	
2.	Height (cm)	7.5	8.2	8.3	8.4	8.8	8	7	After 5 days
3.	Spikelets (no.)	-	-	-	-	-	-	-	
1.	Width (mm)	3	3	4	4	4.2	4	2	
2.	Height (cm)	16	17	16.5	17.5	17.6	17	16.2	After 10 days
3.	Spikelets (no.)	3	4	3	3	4	3	2	
1.	Width (mm)	4.3	3	3.5	4	5	4	4	
2.	Height (cm)	23.1	27	26.5	27	29.5	26.5	23	After 15 days
3.	Spikelets (no.)	5	4	4	4	6	5	4	
1.	Width (mm)	3	3	3	4	4	5	4	
2.	Height (cm)	29	30	30.4	30	33.5	32.5	23	
3.	Spikelets (no.)	7	6	6	5	7	6	4	After 20 days
4.	Roots (no.)	4	4	5	5	6	5	4	
5.	Shoots (cm)	2.1	2.2	2.4	2.5	3.2	3	2.2	

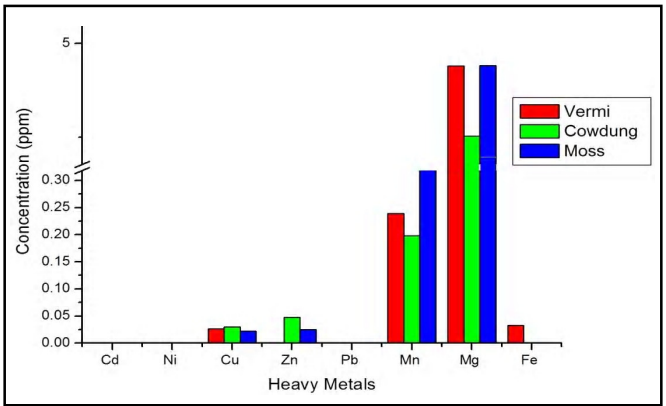

Fig. 1 : Heavy metal contaminants in three compost samples

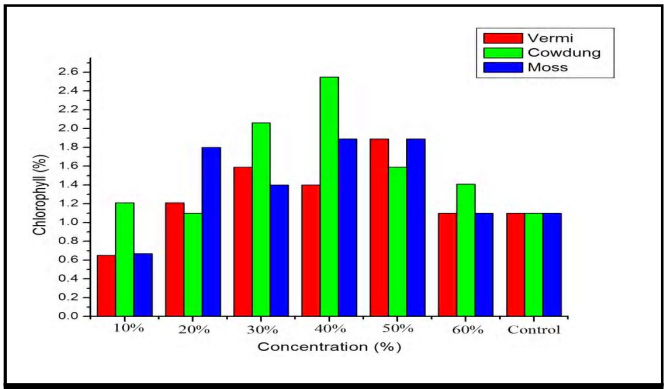

Fig. 2 : Chlorophyll content of wheat for three composts at various concentrations

plots, respectively (Fig. 2). Number of roots was higher in cowdung compost at 60 % concentration compared to the other two samples (Table 3). Shoot size was more in cowdung compost at 50 % concentration (Table 3). Vermicompost at 50%, cowdung at 40% and moss at 50% of concentration was beneficial for enhancing the growth of wheat plant (Table 2, 3 and 4). The difference in grain yield among different levels of manure and compost was also significant. The difference in nutrient absorption greatly influences growth and yield potential (Ahmad *et al*., 2008). These findings are in support of findings of previous researchers (Bajpai *et al.,* 2002; Pooran *et al*., 2002) who concluded that compost application improved all the growth parameters. Addition of various levels of organic manure and compost to wheat compensates for chemical fertilizer, which might give a substitution under field conditions (Rekhi *et al.,* 2000). The use of three different compost in the experiment indicates the efficiency of wheat crop depend on the type of treatment given in agricultural field for the higher yield as well as faster the growth of crop can be possible if proper compost treatment is applied at appropriate concentration of compost.

Conclusion:

– The data obtained showed all three composts under study have positive effect on growth rate of wheat.

– For vermicompost and moss compost, 50 % concentration was suitable, whereas in cowdung compost, 40 % concentration was suitable for plant height, width and spikelet numbers.

– Vermicompost at 30 %, cowdung compost at 60 % and moss compost at 50 % concentration were found to be effective for higher growth of roots in wheat plant.

– Chlorophyll content was found to be highest at 40 % concentration in cowdung compost plot as compared

to other plots.

– The present study may be elongated to know the effect of three composts and their different concentrations on yield of wheat crop to find out the most suitable compost type and its optimum concentration which gives maximum yield.

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