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IMPACT OF EFFECTIVE MICRO-ORGANISM COMPOST (EM COMPOST) ON SOIL PROPERTIES AND SOIL FERTILITY

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Abstract: *In the present study, influence of Effective Micro-organisms compost on physical, chemical and biological properties of soil was evaluated. Three different treatments, namely, 100% N as EM compost, 75% N as EM compost and 50% N as EM compost were applied during the growth of Chilli. Analysis of soil samples post harvest indicated that application of EM compost increased soil organic carbon, NPK content and micronutrients (Fe, Mn, Cu and Zn). Physical properties such as pH and EC increased after EM application. Bulk density was reduced after treatment indicating better soil conditioning and increased soil aggregation. Treatment using 100% N as EM compost reported highest soil fertility and productivity. Microbial activity was measured in terms of dehydrogenase activity and it was observed that dehydrogenase activity was increased by 20%after EM compost treatment compared to that of control.*

Keywords: *EM compost, Effective Micro-organisms, soil fertility, dehydrogenase activity.*

Introduction

Organic farming is the right approach to the present day agriculture. Increase in the use of organic source of nutrients is important in the contextof organic farming and sustainable agriculture.Compost, manures and organic fertilizers are now being recommended and also utilized widely for increasing crop productivity and for improving soil and environmental quality.Effective micro-organisms (EM) are naturally occurring beneficial fermentative micro-organisms.It is reported that application of liquid EM inoculant suppresses soil borne pathogens and enhances the mineralization of soil organic matter (Piyadasa et al., 1993). The rapid proliferation of Effective Micro-organisms results in the consumption of carbon, nitrogen and other nutrients, which in turnincreases the availability of these elements for plant uptake (Fatunbi and Ncube, 2009). According to Singh and Rao (2009) organic manures are nature's best mulches and soil amendments which improve soil structure, aeration and also increase the soil's water holding capacity. Organic manure is an important source of N, P, Ca and micro-elements such as Zn, Cu, Mg which are essential to crop growth (Debosz et al., 1999). Addition of Effective Micro-organisms to organic amendments enhance nutrient elements availability thereby influences plant growth (Ni and Li, 1998). Application of organic manure and FYM improved the soil physico - chemical properties such as soil pH, soil moisture availability, organic carbon and nutrient status of the soil in twenty five years old apple orchards (Verma et al., 2009).

Organic manures also influences the microbial properties of soil. Debosz et al. (1999) reported that incorporation of organic manure into the soil increases soil biological activity.Fraser et al. (1998) opined that the dehydrogenase activity was linked with the levels of available organic carbon substrates in the soil. Monreal et al. (1998) reported that elevated enzyme activities appear to be associated with conditions promoting microbial synthesis of enzyme and such sensitivity would make soil enzyme activities as effective indicators of changes in soil quality. Application of composts amended with saw dust was found to increase the microbial population thereby increased the enzymatic activities and soil respiration (Lovieno et al., 2009).

Previous studies have highlighted the use of enriched organic manures for increased soil productivity. Battikopad*et al.* (2009) reported that application of cattle dung enriched with rock phosphate along with Effective Micro - organisms (0.5 ml kg^{-1}) improved the microbial activities and

enhanced the health and productivity of soil.Poultry manure amended paddy straw compost improved microbial biomass and different enzymatic activities responsible for nutrient cycling. It was also noticed that highest grain yield of rice may be due to improved biological parameters of soil thereby improving soil health and productivity (Gaind and Nain, 2010). According to Newsham*et al.* (1995) compost inoculated with AM fungi led to an increase in plant growth.Combined application of EM and organic material also leads to the accumulation of nitrate (Fatunbi and Ncube, 2009). Supplementing EM compost also increases the soil humus, organic carbon and available nitrogen thereby increasing the soil fertility (Anamika et al., 2017). According to Sheeba (2004), enriched vermicompost i.e., vermicompost enriched with neemcake and bone meal reduced bulk density, CN ratio and increased pH, EC and organic carbon status of the soil.Observations made by Deepa (2005) include increased P and K uptake by cowpea after the application of enriched vermicompost. Present study focused on the impact of Effective Micro-organism Compost (EM Compost) on soil properties and soil fertilityand Chilli(*Capsicum annuum* L.) was selected as the test crop for the study.

Materials and Methods

Materials

Test crop for the experimental study was Chilli variety 'VellayaniAthulya'. The soil of the experimental site was sandy clay loam belonging to the family of Loamy KaoliniticIsohyperthermicTypicKandiustult. Soil samples were taken from the experimental area before the start of the experiment and after the experiment. The air-dried samples passed through 2 mm sieve were used for the analysis of physico-chemical properties and fresh soil samples were collected for biological analysis using standard procedures.

Preparation of EM Compost

Pits of size 2.5×1×0.5 m were used for the preparation of compost and the biowastes used were banana pseudostem and dried leaves of banana as shown in Fig.1. The biowastes were collected, chopped and mixed with cowdung in the ratio of 10:1 on volume basis. Natural additive *viz.* rock dust @ 5% was added initially to the biowaste-cowdung mixture. Two weeks after filling the pit, activated EM solution was sprayed @ 2ml L^{-1} on the biowaste-cowdung mixture to moisten the mixture and mixed thoroughly. The moisture was maintained at 60-70% level and the compost was ready for fieldapplicationat 70th day.

Fig. 1: EM compost

Results and Discussion

Chemical properties of soil

Results of post harvest analysis of chemical properties of soil are presented in Table 1. Results showed that organic carbon, major and micronutrients in soil increased after the application of EM compost. Highest amounts of nutrients and organic carbon were observed for 100% N as EM compost. EM compost could be used for enhancing the nutrient uptake. Arshad and Bajwa (2011) reported that application of EM compost in organic amendments increased the plant NPK content. More (1994) reported that addition of farm waste and organic manures increased the status of organic carbon, available 'N', 'P' and 'K' of the soil. Application of vermicompost enriched with rock phosphate increased the available N, P_2O_5 and K_2O status of the soil (Sailajakumari, 1999).

Table 1: Post harvest analysis of soil for micronutrients

Treatments	Organic carbon, %	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Fe, ppm	Cu, ppm	Zn, ppm	Mn, ppm
Control	0.63	213.25	25.40	116.25	12.03	0.15	0.83	2.80
100% N as EM compost	0.93	239.91	38.46	146.16	14.70	0.53	1.50	7.25
75% N as EM compost	0.90	219.52	36.96	134.96	14.43	0.48	1.28	4.20
50% N as EM compost	0.78	216.38	37.23	126.60	13.45	0.45	1.00	3.70

The increase in available Fe, Cu, Mn and Zn upon addition of organic matter might be due to intensified microbial and chemical reduction, pH of soil and also formation of stable complexes with organic ligands. This might have decreased the susceptibility of micronutrients to adsorption, fixation or precipitation reaction in soil resulting in greater availability. Similar results were reported by other researchers. Srikanth et al. (2000) studied the direct and residual effect of enriched compost, FYM, vermicompost and fertilizers on the properties of Alfisol. According to the study, soil nutrient value was found to be high in enriched compost amended soil after the harvest of first and second crop.

Physical properties of soil

Results of physical properties of soil are presented in Table 2. The results indicated that by the addition of organic manures, soil pH found to be increased. The increase in pH might be due to increase in bases of active degradation of organic matter and the suppression of activity of Fe and Al oxides and hydroxides which play vital role in protonation and deprotonation mechanisms controlling H^+ ion concentration in soil solution. This is in agreement with the observation by Datta (1996).

Table 2: Post harvest analysis for pH, ECand BD

Treatments	pH	EC(dS m^{-1})	Bulk density(Mg m^{-3})
Control	5.50	0.16	1.36
100% N as EM compost	5.80	0.49	1.29
75% N as EM compost	5.90	0.32	1.22
50% N as EM compost	5.90	0.30	1.37

The treatment 100% N as EM compostregistered the maximum value for Electrical Conductivity (EC) of soil. Generally by the addition of organic manures EC of the soil was found to be increased. This might be due to the faster release of bases and soluble organicfractions to the soil system by mineralization. This is in agreement with the findings of Thompson *et al.* (1989). They reported that total ionic concentration of system containing organic amendments is increased leading to higher ionic mobility expressing high EC values.

Generally by the addition of organic manures bulk density of the soil was found to be decreased. Application of FYM has favorable effects on soil aggregation compared to chemical fertilizers (*Rabi*ndra*et al.*, 1985). In another experiment a decrease in bulk density by the addition of organic matter residues over long time was reported by Rasmussen *et al.* (1991). Reduction in bulk density may be due to better soil aggregation and aeration brought about by organic amendments (Kadalli *et al.*, 2000). Slight decrease in bulk density after the harvest in soil amended with compost compared to inorganic fertilizer treatment alone was noticed by Srikanth et al. (2000).

Dehydrogenase activity

Soil enzymes are the indicators of soil fertility as their activity depends on numerous factors such as

climate, amendment, cultivation practices, crop type and edaphic properties.Naseby and Lynch (1997) considered enzymatic determinations were more useful than microbial measures. Since the dehydrogenase is involved in the respiratory chain of microorganisms and it has often been used as a parameter to evaluate the overall microbial activity of soil (Serra-wittling*et al.*, 1995).

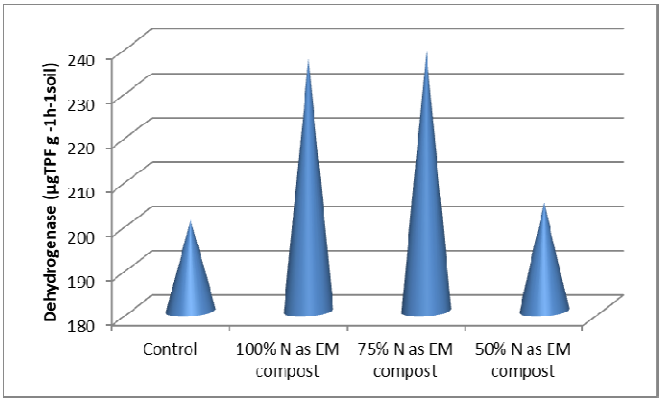

Fig. 3: Dehydrogenase activity of soil

Results of dehydrogenase activity of soil are presented in Figure 3. The result indicated that the treatment involving 75% N as EM compost registered the highest mean value for the maximum dehydrogenase activity in soil. Increase in dehydrogenase activity showed that organic fertilizer added to soil in the form of compost or growth promoter had enormous load of microorganisms as this assay is a measure of viable microbial activity. Improved dehydrogenase activity in organically amended soils was in accordance with the findings of Monreal*et al.* (1998), Debosz et al. (1999) and Lovieno et al., (2009).

Conclusions

Available NPK content, micronutrients, organic carbon and soil humus were improved by the use of Effective Micro-organism Compost. Among different treatments, application of 100% N as EM compost reported highest values for organic carbon, NPK and micronutrients. Microbial activity of soil was measured in terms of dehydrogenase activity. It was observed that presence of effective micro-organisms in soil helped to improve soil biological properties thereby increasing the availability of nutrients in soil.

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