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RESPONSE OF COMBINATION OF TWO COMPOSTS ALONG WITH TWO GROWTH PROMOTERS ON SOIL HEALTH AND PRODUCTIVITY OF CHILLI (*Capsicum annuum* L.)- A CASE STUDY

Lekshmi V.[1*], *Ex-M Sc. Student*
Dr. K. Ushakumari[2], *Professor*
[1 & 2] *Dept. of Soil Science and Agricultural Chemistry, College of Agriculture, Vellyani, Kerala*

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Abstract: *Present study evaluated the effect of two enriched composts viz. BM compost and EM compost at different rates alone as well as in combination with two growth promoters viz, Panchagavya and vermiwash on soil health and also their impact on productivity of chilli (Capsicum annuum L.). The treatment T_8 (75% N as BM compost + Panchagavya) recorded the highest values for all these characters but it was found to be on par with T_7 (75% N as EM compost + Panchagavya). This shows that BM compost can be substituted with EM compost when used along with Panchagavya.With respect to quality characters, the treatment T_8 (75% N as BM compost + Panchagavya) registered the highest values for capsaicin, ascorbic acid and shelf life of fruits. From the results it was clearly indicated that 75% N as BM compost and Panchagavya or 75% N as EM compost and Panchagavya was superior to all other organic sources in promoting soil health and yield and quality of chilli.*

Keywords: *Organic farming, BM compost, em compost, panchagavya, vermiwash, chilli.*

Introduction

Organic farming is today's answer not only for higher and sustained productivity but also for safe nutritious food. One of the major constraints in popularizing organic farming is the non-availability of good quality organic manures. This is achieved partially through reducing losses and adoption of new technologies for enrichment of nutrient content in manures. Panchagavya defined in Vrkshayurveda is a plant growth stimulant and is reported to enhance the biological efficiency of crop plants (Natarajan, 2002).Panchagavya applied @ 3 percent sprayalong with different organic manures at 0, 30, 50 days after sowing in rice recorded significantly higher grain yield (Ramanathan, 2006). Venkataramana *et al.* (2009) reported that application of Panchagavya along with organic manures influenced the growth and production of Mulberry.According to Sangeetha and Thevanathan (2010) application of panchagavya registered higher rate of growth of roots and shoots and also enhanced the yield and shelf life of fruits.

Degradation of organic wastes by organic additives and bio-inoculants are the recent developments in the composting technology to enrich the nutritional quality of composts. Lertola (1991) stated that compost and rock dust had a symbiotic combination. The compost provided an excellent medium for the "microorganism population explosion" and incorporation of rock dust increased the microbial activity of soil.The literature pertaining to enriched manure is scanty.Highest rhizome yield was recorded with the application of poultry manure enriched with microbial inoculant followed by *Trichodermaviride*-banana pseudostem compost (Thenmozhi and Paulraj, 2009).Amendment of paddy straw with fungi like *Aspergillus, Trichoderma* and *Phanerochaete* recorded highest yield in rice (Gaind and Nain, 2010). Pandhare *et al.* (2009) found that enriched compost made using *Azotobacterchroococcum* and PSB increased the number of leaves, height of plant and number of days required for the emergence of spike in tuberose.According to Dheware and Waghmare (2009) compost prepared using *Azospirillum, Bacillus polymyxa, B. subtilis* and *Pseudomonas striata* increased number of fruits per tree and average weight of fruit in sweet orange.

In the light of the above background, the present study was conducted to assess soil health and productivity under organic nutrient management and its effect on growth, yield and quality parameters of the test crop, chilli. Use of organic additive like rock dust and bio-inoculants such as *Trichoderma* and Effective Micro-organism (EM) were carried out in the study. Effect of two growth promoters *viz.,* Panchagavya and Vermiwash were also studied.

Materials and Methods

Chilli variety "VellayaniAthulya" was used for the experiment.

Fig. 1: General view of field experiment

The experiment was conducted by adopting the following treatments.

T_1: Absolute control
T_2: POP (FYM @ 20-25 t ha^{-1}, NPK @ 75:40:25 kg ha^{-1})
T_3: 100% N as EM compost
T_4: 100% N as BM compost
T_5: 75% N as EM compost
T_6: 75% N as BM compost
T_7: 75% N as EM compost + Panchagavya
T_8: 75% N as BM compost + Panchagavya
T_9: 75% N as EM compost + Vermiwash
T_{10}: 75% N as BM compost + Vermiwash
T_{11}: 50% N as EM compost
T_{12}: 50% N as BM compost
T_{13}: 50% N as EM compost + Panchagavya
T_{14}: 50% N as BM compost + Panchagavya
T_{15}: 50% N as EM compost + Vermiwash
T_{16}: 50% N as BM compost + Vermiwash

Preparation of Biomineral Compost (BM compost)

The banana pseudostem and dried leaves of banana were collected, chopped and mixed with cowdung in the ratio of 10:1 on volume basisin pits of size 2.5×1×0.5 m. Rock dust @ 5% was added initially to the biowaste-cowdung mixture and microbial inoculant *Trichoderma* sp. @ 0.2% was added after two weeks. Optimum moisture level *i.e.,* 60-70% was maintained and compost was ready for application at 80th day.

Preparation of EM Compost

The raw materials used and the methods adopted were the same as that in the preparation of BM compost. Activated EM solution was sprayed @ 2ml L^{-1} on the biowaste-cowdung mixture to moisten the mixture after two weeks and mixed thoroughly. The moisture content was maintained at 60-70% level and the compost was ready for fieldapplicationat 70th day.

Preparation of Vermiwash

A layer of gravels was placed at the bottom of the tank of size 80 cm^3.Above it a layer of coconut fibre of 3-4 cm thickness was placed. A definite quantity of biowaste was added to the system along with 2 kg of earthworms. After 2 weeks the entire mass of the biowaste turned into brownish black compost. Then 2L of water was added to the tank containing freshly formed compost and earthworms. Vermiwash was collected through the side tap after 24 hours. Again the biowaste was added to the system and the process was repeated till the entire quantity of Vermiwash required for the experiment was collected (KAU, 2009).

Preparation of Panchagavya

7 kg of cowdung and 1 kg of cowghee were mixed in a clean plastic container thoroughly both in morning and evening hours. After 3 days, cow's urine and water 10 L each were added. The mixture was mixed regularly both in morning and evening hours for 15 days. 3L of cow milk, 2L of cow curd, 3L of tender coconut water,3 kg of jaggery and 12 numbers of well ripened poovanbanana were added to the mixture after 15 days. The solution was stored for 30 days and after that Panchagavya stock solution was ready for application (KAU, 2009).

Results and Discussion

Biometric observations

The critical evaluation of the data (Fig. 2) revealed that T_8 received 75% N as BM compost along with Panchagavya was significantly superior to all other treatments with respect to plant height at all stages. The increased plant height might be due to increased uptake of nutrients supplied through soil application by BM compost and foliar spray in the form of Panchagavya. Combined effect of *Trichoderma*, rockdust and Panchagavya helped in improving the growth characters of the plant. According to Kishor and Ghosh (2010) *Trichoderma* strains solubilise phosphates andmicronutrients and increases the root growth and development, crop productivity and uptake and use of nutrients. Similar results were also reported by several researchers (Inbar*et al.*, 1994; Requena*et al.*, 1996and Kumar *et al.*, 2007).

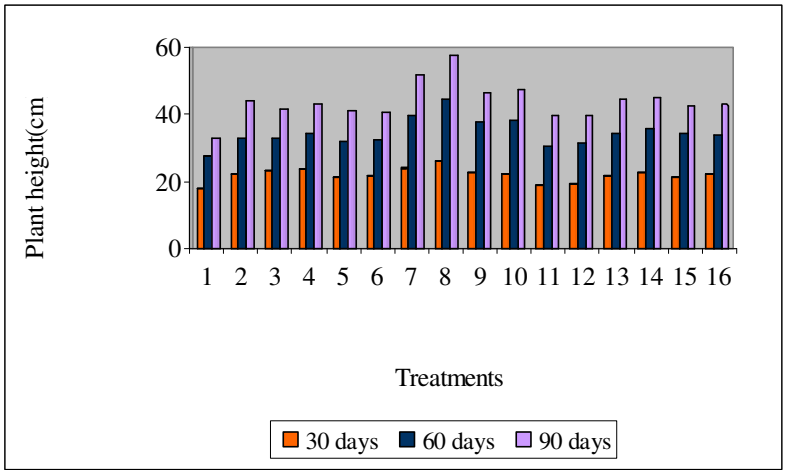

Fig. 2: Effect of different types of organics on plant height (cm)

Yield and yield attributes

Yield and yield characters showed significant variation due to the treatments. Results are presented in Fig. 3. The result showed that BM compost can be substituted for EM compost for combined application with Panchagavya for getting lengthier fruits. This indicates that application of organics along with Panchagavya is essential to get higher crop yield. Among the composts, BM compost is found to be superior and the superiority is due to the complementary effect of *Trichoderma* and rock dust. The organic manures increases the availability of native nutrients to the crops and also improves the soil environment, which encouraged proliferous root system resulting in better absorption of water and nutrients from lower layers resulting in higher uptake

and yield (Thenmozhi and Paulraj, 2009). The fruit yield is the manifestation of various growth and yield attributing characters and the higher yield could be traced back to significant differences in dry matter production and its accumulation.Combined effect of *Trichoderma*, rock dust and Panchagavya helped in improving the growth characters of the plant. This was supported by findings of Somasundaram and Sankaran (2004) and Rose (2008).

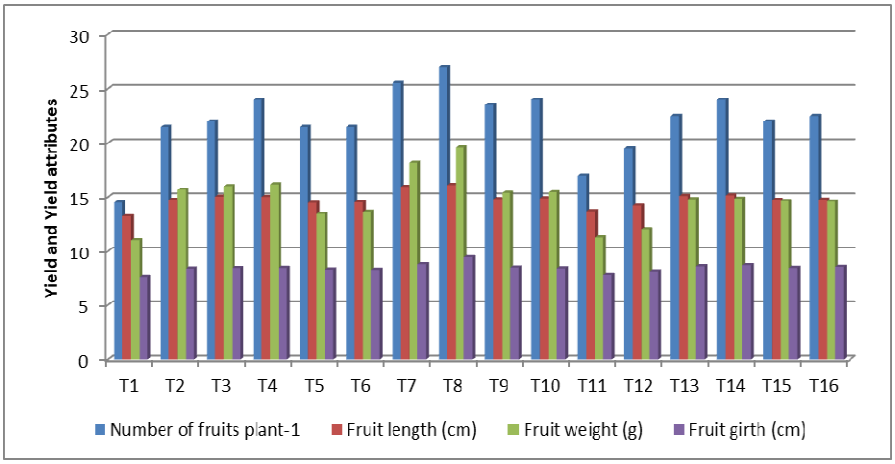

Fig. 3: Effect of different manures on yield and yield attributes

Quality Parameters of Fruit

Different treatments significantly influenced capsaicin content and shelf life of the fruit as shown in Table 1. Singh *et al.* (2003) and Garg (2009) reported that variation in capsaicin content was due to cultivars, environmental factors, size of fruits, thickness of pericarp height of plant, weight of fruit plant^{-1}, ratio of seed to pericarp and yield. Since the combination of 75% N as BM compost and Panchagavya reported the highest value for the growth and yield characters, capsaicin content also observed to be the highest for the above mentioned treatment. The result showed that BM compost can be substituted for EM compost and vermiwash can be substituted for Panchagavya when the BM compost and Panchagavya are not available.

Table 1: Quality parameters of fruit affected by different organic manures on chilli

Treatments	Capsaicin (%)	Shelf life (days)
T_1	0.65	8.00
T_2	0.72	9.50
T_3	0.72	10.00
T_4	0.74	10.00
T_5	0.70	10.00
T_6	0.71	9.50
T_7	0.78	11.00
T_8	0.79	11.50
T_9	0.76	9.50
T_{10}	0.77	10.00
T_{11}	0.70	8.00
T_{12}	0.71	8.50
T_{13}	0.74	11.00
T_{14}	0.72	11.00
T_{15}	0.72	10.50
T_{16}	0.75	10.00

The results indicated that the application of Panchagavya along with reduced doses (75 % and 50%) of either BM compost or EM compost can increase the shelf life. This is in conformity with the findings of Sangeetha and Thevanathan (2010) who

reported that application of Panchagavya amended with seaweed extract increased the shelf life of fruits.

Resistance to diseases

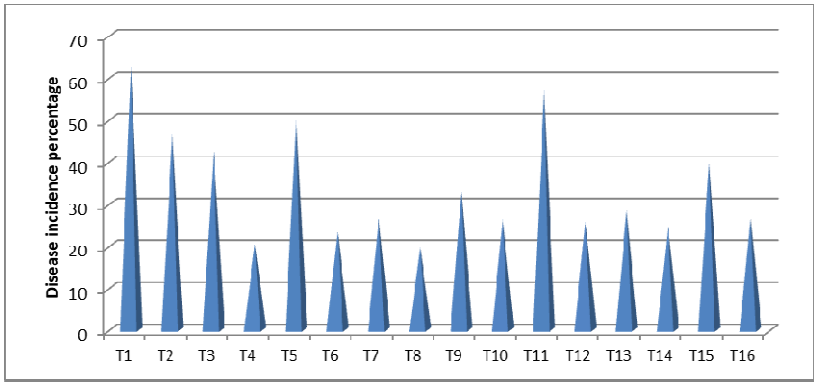

Fig. 4: Disease incidence percentageaffected by different organic manures on chilli

Average of the percentage disease incidence *(Colletotrichum*fruit rot) was calculated at various stages throughout the crop period and results are presented in Table 3. Highest value for disease incidence percentage was recorded by the treatment T_1. Treatment T_8 registered the lowest mean value and it was found to be on par with T_4.From the result it was inferred that 75% N as BM compost + Panchagavya can be substituted with 100 % BM compost. BM compost containing *Trichoderma* spp. can help the plant to develop resistance against diseases. This was supported by Viswanathan and Samiyooran (1999) who reported that *Pseudomonas* sp. and *Trichoderma* sp. has antagonistic activity against soil pathogens make them complement to enhance the crop growth and systematic resistance. Similar observations were reported by Inbar *et al.* (1994); Kumar *et al.*(2007) and Kishor and Ghosh (2010).

Plant nutrient uptake

Results of plant nutrient uptake affected by different organic manures are presented in Fig. 5. From the result it can be inferred that application of Panchagavya along with BM compost enhanced the uptake of NPK by the crop. The increase in N uptake may be due to the fact that vast portion of non-oxidisable N present in organic matter could be made available to plants through microbial activity. Also it can be attributed to small increase in N input from biological N fixation. The increased mineralization of soil P and added P as a result of production of organic acid during decomposition is one reason for high P uptake. Chattopadhyay et al. (1993) and Rasal et al. (1996) found that plant P uptake was significantly enhanced by the application of compost amended with T. Viride compared with non-amended compost.Similar result was reported by Requena *et al.* (1996). As uptake of K is mostly through root interception, better the root system the more is K uptake (Niranjana, 1998).

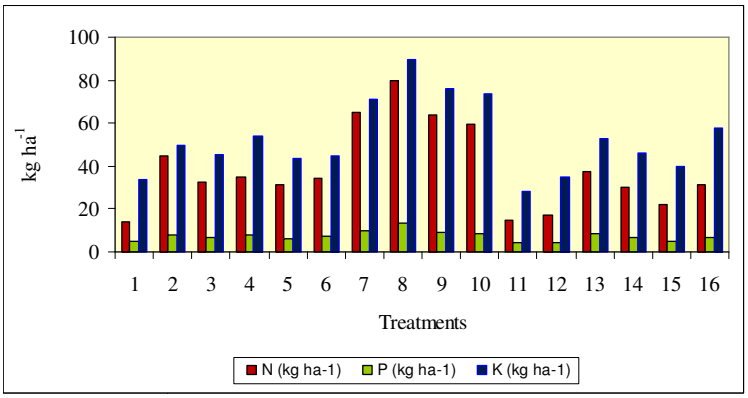

Fig. 5: Effect of different organic sources on plant uptake of major nutrients(kg ha^{-1})

Biological properties of soil

Table 2: Post harvest analysis of soil for microbial population (count g $^{-1}$of soil)and dehydrogenase (µgTPF g^{-1} h^{-1}soil) activity

Treatments	Fungi (Dilution 10^4)	Bacteria (Dilution 10^6)	Actinomycetes (Dilution 10^8)	Dehydrogenase (µgTPF g $^{-1}$h^{-1}soil)
T_1	10.00	10.00	1.00	200.63
T_2	12.85	10.00	2.50	201.88
T_3	14.85	22.00	4.00	236.88
T_4	17.30	22.00	5.00	235.00
T_5	13.20	12.00	2.00	238.75
T_6	13.65	13.00	2.00	238.75
T_7	18.85	28.00	2.50	311.88
T_8	22.35	14.00	3.00	301.88
T_9	15.15	25.00	6.00	241.25
T_{10}	17.15	25.50	6.50	243.75
T_{11}	12.50	12.00	1.50	204.38
T_{12}	13.65	13.00	2.00	223.75
T_{13}	17.65	22.50	2.50	226.25
T_{14}	18.50	24.00	3.50	229.38
T_{15}	14.20	24.00	5.00	234.38
T_{16}	15.65	24.50	6.00	231.88
CD(0.05)	1.37	8.99	2.13	1.93

Table 2 shows the microbial population of the soil after the harvest of crop. Dehydrogenase activity of soil was affected by the application of different types of organic manures. The result indicated that the treatment T_7 registered the highest mean value for the maximum dehydrogenase activity in soil. Among microbes fungal population was significantly influenced by different treatments. In case of population of fungus, bacteria and actinomycetes, highest mean values were recorded for treatments, T_8, T_7 and T_{10}, respectively.

The growth promoters *viz*. Panchagavya and Vermiwash play a vital role in enhancing the microbial population of the soil. This was in conformity with the findings of Somasundaram and Sankaran (2004). Presence of Effective Micro-organism in EM compost and *Trichoderma* in BM compost favoured the microbial activity of soil. Microbial biomass and enzyme activities are closely related to soil organic matter content. Organic amendments stimulated the biological activity preferably due to synergism of soil organic material and microorganisms (Gaind and Nain, 2010).

Conclusions

A significant increase in yield and quality of chilli was recorded with the combined application of enriched manures and growth promoters *viz*. 75% N as BM compost with Panchagavya and 75% N as EM compost with Panchagavya.In the case of N and P uptake T_8 (75% N as BM compost + Panchagavya) recorded the highest value followed by T_7 (75% N as EM compost + Panchagavya). For K, T_8 (75% N as BM compost + Panchagavya) recorded the highest mean value and was found to be on par with T_9 (75% N as EM compost + Vermiwash). There was significant improvement in the soil biological properties with the combined application of organic manures and liquid manures (growth promoters).

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