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Soil Properties as Affected by Various Sources Of Nutrient Under High Density Mango Orchard (*Mangifera Indica* L.) Cv. Amrapali

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ABSTRACT
A field investigation was conducted to study the effect of organic and inorganic sources of nutrients on physico-chemical properties of soil under high density mango orchard (Mangifera indica L.) cv. Amrapali at Horticulture Complex, Maharajpur, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during 2012-13 and 2013-14. A total of twenty four treatment combinations of inorganic and organic sources of nutrient were tested in factorial randomized block design with three replications. The results of study revealed that higher level of nutrient either in the form of chemical fertilizer or organic sources improves the physical and chemical properties of soils. Application of 520: 160: 450 NPK g plant^{-1} (i.e. 125 % of RDF) and Vermicompost (25 kg) + Oil cake (2.5 kg) + Azotobacter + VAM + TV + PSB (100g each plant^{-1}) registered higher concentration of organic carbon (0.58 and 0.59 %) during both the years of study, respectively, available nitrogen (248.3 kg ha-1), phosphorus (17.1 kg ha^{-1}) and potassium (354 kg ha^{-1}) in post harvest soil from the base value. Further, it was noted that these sources significantly decreased the bulk density 1.36 and 1.33 Mg m^{-3}) during first and second year, respectively. The soil pH and electric conductivity of soil did not differed significantly when plant received nutrient either in the form of chemical fertilizer or organic sources.
Key words: Mycorrhiza (VAM), Trichoderma viridi, Azotobacter, Vermicompost

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INTRODUCTION

An inadequate nutrition and indiscriminate use of chemical fertilizers and least attention towards the use of organic and bio agents paved the way for deterioration of soil health. In order to harvest quality produce as well as sustain the soil healthy integrated approach is viable mean. This can be achieved by inclusion of manure like FYM, vermicompost, bio agents, oil cake etc., in addition to inorganic fertilizers in nutrient supply system. However, the bulky manures (Vermicompost, FYM, oilcake) are low grade source of nutrient though have longer effect on soil physical and biological properties as compared to fertilizer with high grade [3]. Inoculation of soil with Azotobacter proved to be an effective for increasing the productivity under well manured soil with high organic matter content. Apart from fixation of atmospheric nitrogen, is also known to synthesize biological active substances such as B-vitamins, Indole Acetic Acid and Gibberellins [1]. VAM fungi from the most intimated relationship with rhizosphere of the plant and soil microflora.

MATERIAL AND METHODS

A field experiment was conducted at Horticulture Complex, Maharajpur, JNKVV during 2012-13 and 2013-14. The soil of experimental site was clay in texture (58.4% clay, 21.5 silt and 20.1% sand) natural in reaction (pH 7.4) having 0.25 dS m-1 electric conductivity, medium available N(230.7 kg ha-1), low in P (12.6 kg ha-1) and medium in K (340.2kg ha-1) and low in organic carbon (0.47%). The experiment consisted of four level of NPK fertilizer (F1:Without fertilizer, F2: 75% of RDF (310: 100: 270 NPK g plant-

1), F3: (100% of RDF (415: 130: 360 NPK g plant-1) and F4: 125% of RDF (520: 160: 450 NPK g plant-1) and six organic sources (O1: Oil cake 2.5 kg plant-1, O2:Azotobacter+VAM + Trichoderma viridi + PSB (100g of each plant-1), O3: Vermicompost (25 kg plant-1), O4: Vermicompost (25 kg plant-1) + Oil cake (2.5 kg plant-1), O5: Vermicompost (25 kg plant-1) + Azotobacter + VAM + Trichoderma viridi + PSB (100g of each plant-1), O6: Vermicompost (25 kg plant-1) + Oil cake (2.5 kg plant-1) + Azotobacter + VAM + Trichoderma viridi + PSB (100g of each plant-1). Bulk density was determined as per the method described by Piper [7]. The pH was determined in soil water suspension (1:2) using a glass electrode pH meter of soil and electrical conductivity of the 1:2 soil water filtered extract was measured on a solubridge [8]. Available nitrogen was determined by alkaline potassium per management method [9]. The soil P was extracted with 0.5M sodium bicarbonate (pH 8.5) by following the procedure given by Olsen *et al*. [6] and phosphorus was estimated calorimetrically [2] available K was determined on flame photometer .

RESULTS AND DISCUSSION

Physico- chemical composition of soil

The hydrogen ion concentrations and electrical conductivity (dSm-1) in post harvest soil samples were determined during both the year of study and presented in table 1. Data indicated that the value of pH and EC did not change significantly neither due to application of inorganic fertilizers nor organic source of nutrients during both the years of experimentation. However, the sources of nutrients had brought significant about the change in organic carbon and soil bulk density. The decrease in bulk density from 1.36 and 1.33 Mg m-3 was recorded under 125% of RDF (520: 160: 450 NPK g plant-1) during first and second year, respectively. Further it was also noted that the increasing fertilizer doses decreased the bulk density. Though, the differences between two closer doses were non significant. Similarly, organic carbon increased with increasing dose of fertilizers and higher content of OC (0.58 and 0.59 %) was recorded under 125% RDF during both the years of study, respectively. Moreover, the slight increase in values of OC was noted over previous and variation in two closer doses of fertilizer was not significant. On the other hand, organics also showed the increasing trend over preceding year. The Vermicompost (25kg plant-1) + Oil cake (2.5 kg plant-1) alongwith bio-agent (Azotobacter ,VAM , Trichoderma viridi and PSB) @100g plant-1 of agent recorded significantly higher OC (0.567 and 0.580 %) over other but found statistically at par to O5 and O4 during the both the years of study. Mishra and Sharma (1997) also observed that the FYM played important role in formation of aggregation over unmanured plot and decreased the bulk density.

The available of nitrogen, phosphorus and potassium in soil was determined after harvest of fruits during both the years (Table 1). The data in relation to chemically fertilized plots showed increasing trend in available nitrogen, phosphorus and potassium after each year over their initial values. Higher available nitrogen (247.5 kg ha-1), phosphorus (16.8 kg ha-1) and potassium (352.8 kg ha-1) was recorded when plant received 520: 160: 450 NPK g plant-1 (i.e. 125 % of RDF), though; it was statistically non- significant with recommended dose of fertilizer. Further, the each incremental dose of NPK increased the residual nutrient content in soil over control. The overall performance showed that fertilizers application maintain their original status of soil under high density orchard of mango. Furthermore, the addition of vermicompost alone or in combination with oil cake or microbes showed its positive response with respect to availability of nitrogen phosphorus and potassium in soil. The higher available nitrogen (243.11 and 243.43 kg ha-1), phosphorus (15.80 and 15.95 kg ha-1) and potassium (349.91 and 352.84 kg ha-1) was recorded with application of Vermicompost (25 kg) + Oil cake (2.5 kg) + Azotobacter + VAM + Trichoderma viridi + PSB (100g each plant-1). The addition of organic source of nutrients not only helped to maintain origin status of soil but also improve the nutrient content over preceding season. It also improves the physical properties of soil which create creating the favourable conditions for microbial activity resulting into increase in the nutrient availability. These findings are in agreement with the results of Mishra *et al.* [5] the increase in nutrient availability might be due to the process of mineralization made available the nutrients [4].

Table 1 Residual effect of inorganic and organic sources of nutrients on physico-chemical properties of post harvest soil under high density orchard of mango

Treatments	Soil pH	EC (dSm^{-1})	OC (%)	BD ($Mg\ m^{-3}$)	N ($kg\ ha^{-1}$)	P ($kg\ ha^{-1}$)	K ($kg\ ha^{-1}$)
Without fertilizer+ O C (2.5kg)	7.45	0.24	0.500	1.472	232.0	12.9	340.0
Without fertilizer + Azt + VAM + *TV*	7.40	0.25	0.494	1.481	231.9	13.2	338.8
Without fertilizer+ VC (25 kg)	7.50	0.25	0.507	1.433	232.8	13.1	343.8
Without fertilizer+ VC (25 kg) + OC(2.5 kg)	7.50	0.25	0.524	1.419	236.4	14.1	342.4
Without fertilizer+ VC (25 kg) + Azt + VAM + *TV*	7.50	0.25	0.534	1.410	236.1	14.5	347.3
Without fertilizer+ VC (25 kg) + OC(2.5 kg)+ Azt + VAM + *TV* (100g each)	7.55	0.26	0.535	1.404	236.0	14.5	348.0
75% RDF+ OC(2.5kg)	7.45	0.26	0.523	1.460	242.3	14.4	348.9
75% RDF+ Azt + VAM + *TV*, (100g each)	7.45	0.26	0.518	1.466	241.6	13.7	341.7
75% RDF+ VC (25 kg)	7.50	0.24	0.538	1.442	242.7	15.0	347.1
75%RDF + VC (25 kg) + OC (2.5 kg)	7.50	0.26	0.538	1.416	242.9	15.2	344.3
75% RDF+ VC (25 kg) + Azt + VAM + *TV*	7.50	0.27	0.541	1.407	242.7	15.2	349.5
75% RDF+ VC (25 kg) + OC (2.5 kg)+ Azt + VAM + *TV*	7.60	0.24	0.572	1.388	242.9	15.5	350.3
100% RDF+ OC (2.5kg)	7.45	0.26	0.557	1.407	246.0	14.4	350.7
100% RDF+ Azt + VAM + *TV*	7.45	0.26	0.559	1.416	245.5	13.9	343.3
100% RDF+ VC (25 kg)	7.50	0.24	0.575	1.380	246.5	15.1	350.4
100% RDF + VC(25 kg)+OC (2.5 kg)	7.55	0.24	0.572	1.360	247.6	15.5	347.3
100% RDF+ VC (25 kg) + Azt + VAM + *TV*	7.55	0.25	0.575	1.355	246.9	15.7	351.7
100% RDF+ VC (25 kg) + OC (2.5 kg)+ Azt + VAM + *TV*	7.60	0.26	0.582	1.321	246.9	16.5	353.3
125% RDF+ OC(2.5kg)	7.55	0.25	0.579	1.360	247.6	16.1	351.8
125% RDF+ Azt + VAM + *TV*	7.50	0.24	0.537	1.369	243.8	15.6	345.0
125% RDF+ VC (25 kg)	7.55	0.25	0.583	1.356	247.9	16.2	352.1
125%RDF + VC(25 kg) + Oil cake (2.5 kg)	7.60	0.24	0.599	1.346	245.3	16.1	349.0
125% RDF+ VC (25 kg) + Azt + VAM + *TV*	7.60	0.25	0.602	1.354	247.5	16.8	352.8
125% RDF+ VC (25 kg) + OC (2.5 kg)+ Azt + VAM + *TV*	7.60	0.24	0.605	1.316	248.3	17.1	354.0
CD at 5%							
Fertilizer	NS	NS	0.015	0.029	1.05	0.55	2.34
Organic Sources	NS	NS	0.018	0.036	1.29	0.67	2.87
Interaction (F x O)	NS	NS	NS	NS	NS	NS	NS

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