EFFECT OF APPLICATION OF FERTILIZERS AND DIFFERENT ORGANIC MANURES ON AVAILABLE PHOSPHOROUS AND THEIR FRACTIONS IN SOIL OF MANGO ORCHARDS

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Abstract: The field experiment was conducted on the farm of the Department of Agronomy, College of Agriculture, Dapoli during the year 2003-2004. The results regarding available P_2O_5 content of soil and **c**hanges in phosphorus fractions of soil at two different depths viz., 0-30 cm and 30-60 cm due to the application of fertilizers and different organic manures. Maximum available phosphorous content of soil was recorded in the treatment receiving poultry manures 13.65 kg ha^{-1} and 11.41 kg ha^{-1} in both the layer of soil i.e 0-30 cm and 30-60 cm respectively. In case P fractions, application of Poultry manure, Vermicompost and Recommended Dose of Fertilizers played significant role in availability of P fractions in both the layers of soil. In the treatment, application of Poultry manure maintained significantly higher level of Saloid P, Ca-P, Occluded P, Residual-P, Inorganic-P, Organic-P and Total-p at 0 – 30 cm of soil. But at the 30 – 60 cm depth of soil the maximum availability of P Fractions i. e. Ca-P, Residual-P, Inorganic-P and Total –P noted in the treatment application of FYM.

Keywords: Available P_2O_5, Fertilizers, Organic Manures and Phosphorous Fractions.

Introduction: The soil fertility started to decline due to intensive cropping with high yielding variety, use of inorganic fertilizers and pesticides ignoring the use of organic manures, thereby causing pollution by poisonous substances and nutritional imbalance in soil (Ramesh and Gondi, 2004).

Phosphorus is an essential input in agriculture and it appears to be a major constraint for successful crop production in India, since majority of soils are inadequate in available phosphorus content. Acid soils are generally low in phosphorus. In these soils, the fraction of total phosphorus present in the organic form is higher than that present in the inorganic form. Organic acids and other microbiological products of decomposition may solubilize the insoluble P by interacting with P binding cations and clay minerals (Talashilkar and Kadrekar, 1979).

A study on the distribution pattern of different fractions of soil phosphorous helps in tracing the contribution of organic phosphorous fractions to the mineralized phosphorous. Because of the dynamic nature of available forms of soil phosphorous and heavy consumption by plants, crops generally suffer from inadequate

phosphorous supply by soil alone and the need to supplement it mainly through manures and fertilizers has long been realized.

Materials and Methods: The field experiment on the effect of organic manures on yield and quality of Alphonso mango (*Mangifera indica* L.) is being conducted from 1996-97 at the Agronomy farm, College of Agriculture, Dapoli. The field experiment was laid in Randomized Block Design (R.B.D.) with seven treatments and three replications. The details of the treatment along with their symbols are given in Table 1. Organic manures were applied to mango trees in second fortnight of June in the form of poultry manure, FYM, vermicompost, glyricidia, and urban compost. Dose of manures were equivalent to 0.75 kg N/tree. Recommended Fertilizer dose of 0.75kg N, 0.5kg P_2O_5 and 0.5kg K_2O/tree and 50kg FYM were also applied to mango trees in second fortnight of June. The recommended dose of nitrogen was applied in two splits. Half of N was applied with full dose of P and K with FYM in second fortnight of June while the remaining half dose of N was applied in first week of September. The soil samples were collected in the month of April 2003, one month before harvest of mango fruits. Representative soil samples around the trees nearly three feet away from the trunk were drawn separately from two depths i.e. 0-30 cm and 30-60 cm and processed for chemical analysis by following usual methods in table 2. The statistical analysis of data of different characters studied during the course of investigation was carried out through the procedure appropriate to the design of the experiment as described by Panse and Sukhatme (1967).

Results:

Available Phosphorous: The data regarding available P of soil at two different depths viz., 0-30 cm and 30-60 cm due to the application of fertilizers and different organic manures are presented in Table 3. The available phosphorus content in the soil treated with different organic manures and fertilizers was observed to be varied significantly from 6.67 kg ha^{-1} to 13.65 kg ha^{-1} at the time of harvesting of mango fruits at 0-30 cm depth of soil. The treatments receiving poultry manure (13.65 kg ha^{-1}) and vermicompost (12.47 kg ha^{-1}) were significantly superior over the treatments receiving Recommended dose of Fertilizers, Urban compost, FYM, Glyricidia and control. The maximum available phosphorus content at 30-60 cm was in the treatment receiving Poultry manure (11.41 kg ha^{-1}) followed by the treatment receiving Vermicompost (9.62 kg ha^{-1}).

Phosphorous Fractions At 0-30 and 30-60 CM Depth: The data regarding changes in the content of different fractions of P in the surface layer of soil presented in table 4 revealed that the treatment receiving Poultry manure was noted the maximum value of Saloid P (2.5), Ca-P (11.4), Occluded P (52), Residual P (212), Inorganic P (508), Organic P (260) and Total P (768). Whereas, the treatment receiving Vermicompost were noted the maximum values of Al-P (41.1) and Fe-P (97.1).

In case of subsurface layer of soil presented in table 5 revealed that the treatment receiving Poultry manure was noted the maximum value of Fe-P and Occluded P. While the treatment FYM was record the maximum values of Ca-P (10.8), Residual P (154), Reductant soluble P (96.4) and Inorganic P (444. The treatment vermicompost was found best in the accumulation of Saloid P (2.2), Al- P (39.5), Organic P (256) and Total P (643).

The differences in Saloid bound P among the treatments receiving Vermicompost, Poultry manure and Recommended dose of Fertilizers were found to be statistically non-significant in both the layers. Maximum Al-P content was noted in Vermicompost in both the layers which was statistically at par with Recommended dose of Fertilizers and Poultry manure treatments. The differences in Fe-P among the treatments receiving Vermicompost, FYM, Recommended dose of Fertilizers and Poultry manure were found to be statistically non-significant in both the layers. Poultry manure, Vermicompost and Recommended dose of Fertilizers maintained equal status of Ca-P in both the layers.

Maximum occluded P was maintained in the treatment receiving Poultry manure while maximum Reductant soluble P was maintained in the treatment receiving Vermicompost followed by poultry manure in both the layers. The treatments receiving Poultry manure, Recommended dose of Fertilizers, Vermicompost, Glyricidia and FYM were statistically at par with each other in respect of Residual P content of soil, which is not readily available form of phosphorus. The significant differences in Inorganic P content were not noticed among the treatments receiving Recommended dose of Fertilizers, Poultry manure and Vermicompost in both the layers of soil. The treatments receiving Poultry manure, Vermicompost, Recommended dose of Fertilizers, FYM and Glyricidia were statistically at par with each other in respect of Organic P content of soil. Maximum Total P

content of soil was noted in the treatment receiving Poultry manure followed by Vermicompost and Recommended dose of Fertilizers in 0-30 cm, while application of Recommended dose of Fertilizers resulted in maintenance of maximum Total P content of soil followed by Vermicompost and Poultry manure in the lower layer.

Madhavi and Reddy (1994) also reported that the availability of phosphorus in soil significantly increased with increase in rate of fertilizer or Poultry manure or combination of both. They observed the higher availability of phosphorus (40.9 per cent) due to application of Poultry manure @ 4.5 t/ha over control at harvest stage.

Sood *et al.* (1991) reported the variation in organic and Total P content in the range of 11 to 217 ppm and 238 to 685 ppm, respectively. Organic P fractions constituted 3.9 to 35.2 per cent of the Total P with their amount higher in upper layer and gradually decreased with depth. Tripathi and Minhas (1991) observed that the addition of FYM increased transformation of P in Typic Hapludalf soils. Application of pig and cattle manure increased all organic fractions in soils as reported by Zhang *et al.* (1993).

Bhardwaj *et al.* (2000) observed that the different forms of Inorganic P in soil were influenced by application of fertilizers with or without FYM. Dhopavkar (2001) noted significant buildup of all fractions of phosphorus except Saloid bound P and Ca-P in comparison to control. Among all organic manures, Poultry manure has maintained maximum concentration of Saloid bound P, Al-P and Fe-P.

Chakraborty *et al.* (2002) reported that the P fractionation of profile soils revealed the dominance of Fe-P and Al-P over Ca-P. The relative sequence of P fractions indicated that the lateritic soils under different agro-ecosystems are in advanced stage of weathering.

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Table 1: Details of Treatments

Sr. No.	Treatments	Quantity (kg/tree)	Treatment Symbol
1.	Control	-	T_1
2.	Recommended dose of fertilizers		T_2
	i. Urea	3.250	
	ii. Single super phosphate	3.230	
	iii. Muriate of potash	0.835	
3.	Poultry manure	35.00	T_3
4.	FYM	343.00	T_4
5.	Vermicompost	45.00	T_5
6.	Glyricidia	308.00	T_6
7.	Urban compost	56.00	T_7

Table 2: Analytical methods for

Sr. No	Property	Method		Reference
	Phosphorus Fractions			
a)	Total Phosphorus	Digestion with HNO_3 and $HClO_3$ and determination by using ammonium molybdate and ammonium vanadate		Hesse (1971)
b)	Available Phosphorus	Use of Bray's-II extractant and determination with spectrophotometer at 660nm.		Bray and Kurtz (1945)
c)	Inorganic Phosphorus	**Extractant used**	**Shaking time**	Peterson and Corey(1966)
	i) Saloid-P	1M NH_4Cl	30 min	
	ii) Aluminium-P	0.5M NH_4F	1 hr	
	iii)Iron-P	0.1M NaOH	17 hrs	
	iv)Occluded-P	0.1M NaOH	1 hr	
	v) Calcium-P	0.25M H_2SO_4	1 hr	
	Reductant soluble-P	0.3M Na-citrate	10 min	
d)	Organic Phosphorus	Ignition method		Hesse (1971)

Table 3: Effect of Different Organic Manures on Available Phosphorous Content (Kg Ha^{-1}) At Two Different Depths Of Soil

Tr. No.	Treatments	P_2O_5 (kg ha^{-1})	
		0-30 cm	**30-60 cm**
T_1.	**Control**	6.67	5.37
T_2.	**Recommended Dose of fertilizers**	10.35	7.59
T_3.	**Poultry manure**	13.65	11.41
T_4.	**FYM**	10.07	7.48
T_5.	**Vermicompost**	12.47	9.62
T_6.	**Glyricidia**	9.94	7.62
T_7.	**Urban compost**	10.18	7.40
	S.E. ±	**0.29**	**0.57**
	C.D. (P = 0.05)	**0.91**	**1.75**

Table 4: Effect of Different Organic Manures on Contents of Phosphorus Fractions (ppm) at 0-30cm Depth of Soil

Tr No	Treatments	Saloid bound-P	Al-P	Fe-P	Ca-P	Occluded-P	Red. soluble-P	Residual-P	Inorg.-P	Org.-P	Total-P
T_1.	**Control**	1.5	27.7	83.7	8.07	36.2	82.2	78	318	134	451
T_2.	**Recommended Dose of fertilizers**	1.9	33.7	89.6	9.6	43.2	88.4	110	377	195	572
T_3.	**Poultry manure**	2.5	41.0	93.2	11.4	52.0	96.7	212	508	260	768
T_4.	**FYM**	2.2	39.3	95.2	10.9	48.9	95.0	165	457	235	692
T_5.	**Vermicompost**	2.5	41.1	97.1	11.2	49.7	98.9	185	486	205	734
T_6.	**Glyricidia**	2.0	36.7	92.8	10.7	44.6	88.3	153	428	219	647
T_7.	**Urban compost**	2.1	36.9	95.8	10.3	46.5	91.6	151	434	222	656
	S.E. ±	**0.10**	**1.29**	**1.32**	**0.23**	**1.24**	**1.65**	**15.87**	**18.82**	**20.40**	**25.34**
	C.D. (P = 0.05)	**0.31**	**3.98**	**4.06**	**0.72**	**3.82**	**5.07**	**48.89**	**57.99**	**62.86**	**78.09**

Table 5: Effect of Different Organic Manures on Contents of Phosphorus Fractions (ppm) at 30-60cm Depth of Soil

Tr No	Treatments	Saloid bound-P	Al-P	Fe-P	Ca-P	Occluded-P	Red. soluble-P	Residual-P	Inorg.-P	Org.-P	Total-P
T_1.	**Control**	1.2	26.4	82.5	7.8	33.3	80.8	31	263	104	366
T_2.	**Recommended Dose of fertilizers**	1.7	32.5	88.2	9.3	40.8	86.8	83	343	167	509
T_3.	**Poultry manure**	2.1	38.5	94.4	10.7	47.6	94.6	103	403	204	607
T_4.	**FYM**	2.0	39.1	94.3	10.8	47.5	96.4	154	444	230	607
T_5.	**Vermicompost**	2.2	39.5	94.0	10.6	45.3	95.7	133	420	256	643
T_6.	**Glyricidia**	1.7	33.3	90.4	10.1	40.7	86.7	92	355	181	536
T_7.	**Urban compost**	1.9	34.3	91.8	9.9	42.6	88.1	67	380	134	571
	S.E. $^+$	**0.10**	**1.29**	**1.06**	**0.19**	**1.46**	**1.61**	**17.90**	**20.55**	**19.02**	**23.94**
	C.D. (P = 0.05)	**0.30**	**3.98**	**3.26**	**0.58**	**4.51**	**4.95**	**55.14**	**63.31**	**58.62**	**73.77**

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