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Impact of various nutrient management practices on soil fertility status of farmers field of Nagpur Mandarin

Tejashri R Patekar, RM Ghodpage, Sindhu R Rathod, NN Ghube and SD Bodkhe

Abstract
The field investigation was carried out on farmer's field of Katol tehsil during the year 2016-17 with the objective to evaluate the soil fertility status under various nutrient management practices on farmers field of Nagpur mandarin. The five locations viz., Fetri, Katol, Katol (RFRS), Wandali wagh and Hatla were selected for recording various observations and considering the different nutrient management practices viz. Organic, inorganic and integrated nutrient management. Fifteen soil profile samples were taken from 0-30, 30-60 and 60-90 cm depth randomly selected over the field of Nagpur mandarin. The results revealed that data of soil reaction indicating moderately alkaline in nature with no much variations in electrical conductivity of soil with the practices of various organic, inorganic and integrated nutrient management. The values of organic carbon found decreased with depth and the maximum values of organic carbon in soil was observed (9.2 g kg^{-1}) with orchards treated with use of organic inputs. Organic carbon was observed 9.2 g kg^{-1} and 7.8 g $kg^{-1}$with orchards aged eight treated with use of 15 kg FYM + 332:140:83 g NPK $tree^{-1}$ and 20 kg FYM + 171:125:83 g NPK $tree^{1}$, respectively. Fertility status of soils was maintained with the application of various organic liquids alone or in combination of FYM, inorganic fertilizer and integrated manner. The use of FYM, manurial liquid and solid organic sources was found useful in maintaining the soil available micronutrient status of orchards of Nagpur mandarin of area of Katol tehsil.

Keywords: Nagpur mandarin, nutrient management practices, micronutrients

Introduction
Orange (*Citrus reticulata Blanco*) is one of the most important commercial fruit crops grown in different parts of the world. The United States of America ranks first and India ranks fifth in its cultivation. In India, Maharashtra state ranks first in area and production of oranges followed by Punjab, Karnataka, Andhra Pradesh, and Tamil Nadu. Orange is an evergreen subtropical fruit crop grown in different soil and climatic conditions, due to which there is a wide variation in performance of the crop. Orange is successfully grown in semi-arid to sub humid areas of Maharashtra. The performance of orange orchards in Nagpur district was directly related to the physical and the chemical characteristics of the soils influencing the plant growth. In India it is cultivated on 329900 ha i.e. 3.9% of the total area under fruit crops with annual production of 3431400 MT. In India, the average productivity of Mandarin is 10.4 t ha^{-1} (National Horticulture Database, 2015) [10].

Citrus is a nutrient loving and responsive plant and requires adequate nutrition for proper growth and development. The bearing tree removes a considerable amount of nutrients from the soil and these must be replenished to maintain soil fertility to get high yields of good quality fruits. The micronutrient has much importance to affect the vigour and fruit yield. The application of FYM has been reported to enhance the availability of native as well as applied P. The various implications of commercial fertilizer decreasing the soil productivity due to their huge and continuous use. In modern agriculture, ever increasing use of fertilizer without adequate organic recycling has not only aggravated multi nutrient deficiency in the soil plant system but also deteriorated soil productivity (Singh *et al*. 2017a; Singh *et al*. 2017b; Singh *et al*. 2017c; Singh *et al*. 2018; Tiwari *et al*. 2018; Tiwari *et al*. 2019a; Tiwari *et al*. 2019b

Kour *et al*. 2019; Singh *et al*. 2019) [15, 16, 17, 18, 19, 20, 21, 22, 23]. The concept of various nutrient management practices gaining importance, hence integrated use of chemical fertilizer along with biofertilizer, organic manure and agriculture waste is essential. Integrated nutrient management involves the judicious blend of organic, inorganic manure along with biofertilizer which maintain soil sustainability and ultimately cause a significant reduction in chemical fertilizer which is cost effective. The aim is ecological safety exploitation of local resources which can produce desired yield and maintain soil health on long term basis of various nutrient management practices. The knowledge of precise macro and micro nutrient requirements of different citrus cultivars is a prerequisite for improved fertilizer use efficiency avoiding unnecessary use of excess fertilizer.

Material and Methods

The field investigation in relation to various nutrient management practices on soil fertility status of farmers field of Nagpur Mandarin was undertaken during the year 2016-2017 to assess the soil properties of farmers field of Nagpur mandarin considering the different nutrient management practices. The fifteen Nagpur mandarin orchards were selected from Katol tehsil of Nagpur and profile soil sampling were done. The soil profiles were selected by surveying the mandarin orchards of Katol District of Nagpur and therefore a total of fifteen profiles were selected for the present study. Representing Fetri, Katol- RFRS, Wandali wagh, and Hatla area of Nagpur district during 2016-2017 the one sample was collected from each orchard, sampling was done from 0-30, 30-60 and 60-90 cm depth.

Soils samples were analysed for soil pH and Electrical conductivity (Jackson, 1973) [6], organic carbon by Wet Oxidation Method (Walkley and Black, 1934) [24], calcium carbonate by Rapid Titration method (Piper, 1966) [11], Cation Exchange Capacity (Jackson, 1973) [6], available nitrogen using alkaline potassium permanganate method (Subbiah and Asija, 1956) [13], available potassium using flame photometer (Jackson,1973) [6]. Determination of Zn, Fe, Cu and Mn (Lindsay and Norvell, 1978) [4].

Results and Discussion

A) Chemical properties of soil influenced by various nutrient management practices

The pH of saturated soil (1:2.5 soil: water suspension) ranged from 6.5 to 7.9, 7.2 to 7.8 and 7.1 to 8.5 in different location under the practices of nutrient management of organic, inorganic and integrated manner in Nagpur mandarin orchards in vertisol since 7 to 12 years. Present data of soil reaction indicating their moderately alkaline in nature. Dhawan *et al*. (1957) [2] report similar in their finding that the safe limit of soil pH was 7.0 to 8.5 for citrus. Generally EC increases with depth. The EC of Nagpur mandarin soils ranged from 0.30 to 0.42, 0.23 to 0.47 and 0.29 to 0.51dS m^{-1} found in different locations with management practices of organic, inorganic and integrated manner, respectively. However the soils of all locations indicated non-saline. Patil (1979) [12] suggested that EC should not exceed 3 dS m^{-1} for orange fruit crop. In all locations, there is not much variation in EC of soils. Low EC was observed in all locations which could be ascribed to increase permeability and thus leaching of salts.

The organic carbon values generally decreased with depth and it ranged from 4.3 to 9.2, 3.9 to 8.2 and 3.1 to 9.2 g kg^{-1} observed in different locations of Katol area in Nagpur mandarin orchards under the nutrient management practices of organic, inorganic and integrated manner, respectively. The maximum values of organic carbon in soil were observed in location of Fetri-II (9.2 g kg^{-1}) with orchards treated with use of organic inputs comprising of Jivamrut- 60 lit diluted in 100 lit water + Dashparni ark – 10 lit diluted in 100 lit water + Nimboli ark - 10 lit diluted in 100 lit water and applied 500 lit ha^{-1} every month through foliar spray orchards of Nagpur mandarin for monthly from June to January. The surface soil is comparatively rich in organic carbon content than the subsurface layer. The observed values of organic carbon of soil in different depths of locations of Nagpur mandarin orchards comes under the categories of medium to very high, medium to high and low to high range with management practices of organic, inorganic and integrated nutrient management, respectively. Jagdish Prasad *et al.* (2001) [5] reported that organic carbon in orange growing soil ranged from 2.1 to 9.9 g kg^{-1}through depth being higher in the surface layer of pedon than the subsurface horizons.

The $CaCO_3$ is one of the important properties of soil which is associated with the nutrient availability, effect of organic carbon, soil reaction, availability of micronutrients and exchangeable cations. The $CaCO_3$ content (table-1) in soil shows that it generally increased with depth and ranged from 2.8 to 5.8, 3.2 to 5.6 and 3.8 to 8.4 per cent under nutrient management practices of organic, inorganic and integrated nutrient management, respectively. Reddy *et al.* (2013) [14] studied the influence of soil $CaCO_3$ on yield and quality of Nagpur mandarin. They reported orange growing soils are moderate to high calcareous (3.13 to 15.48%) in nature and it adversely affects the availability of macronutrients on yield of Nagpur mandarin.

B) Fertility status of soil influenced by various nutrient management practices

Available nitrogen locations of mandarin orchards were observed between 200.1 to 333.0, 210.3 to 328.4 and 203.8 to 330.2 kg ha^{-1} with the management practices of organic, inorganic and integrated nutrient management for Nagpur mandarin since 7-12 years. Increase the availability of nitrogen content in soil under management practice of organic and integrated nutrients applied as compared to practice of inorganic nutrient management. The highest available N (333.0 kg ha^{-1}) was noticed in nutrient management practice under use of liquid organic inputs alone since 7 years consisting jivamrut 60 lit in 100 lit water + Dashparni ark 10 lit in 100 lit water and Nimboli ark- 10 lit in 100 lit water and applied as foliar spray 500 lit ha^{-1} every month from June to January whereas the maximum available N content were observed 328.4 and 330.2 kg ha^{-1} at Katol- III and Hatla-I with orchards treated highest dose of inorganic fertilizers N:P:K- 322:270:300 g $tree^{-1}$ through Urea + SSP + MOP and FYM- 15 kg + N:P:K:Mg:S- 449.5:67.5:25:150:50 g $tree^{-1}$ through SSP + 18:18:10 + Urea + magnesium sulphate + sulphur, respectively. Medhi *et al.* (2007) [9] showed that surface soils contained higher levels of available N, P, K and organic carbon reflecting their maximum accumulation than the subsurface layers. Performed better possibly because supplying nutrients contributes a good amount and activities of microorganism. The fertility status of soil might have helped in the mineralization of soil N leading to its higher build up with use of adequate (balanced organic and inorganic inputs).

In the present study, available phosphorus content recorded in the soil ranging from 7.30 to 18.0, 11.2 to 19.5 and 8.6 to 18.6 kg ha^{-1} with the mean (14.16, 15.78 and 13.72) management practices of organic, inorganic and integrated nutrient management for Nagpur mandarin since 7-12 years. Increase the availability of phosphorus content in soil under management practice of inorganic as compared to practice of organic nutrient management. The highest available P (19.5 kg ha^{-1}) was noticed in inorganic nutrient management practice at Katol- III with the application of balanced inorganic fertilizer N:P:K- 322:270:300 g $tree^{-1}$ through Urea + SSP + MOP.Whereas the available P content was observed 17.9 at fetri-II with orchards treated highest dose of organic liquid fertilizer alone comprising Jivamrut- 60 lit diluted in 100 lit water + Dashparni ark – 10 lit diluted in 100 lit water + Nimboli Ark - 10 lit diluted in 100 lit water and applied 500 lit ha^{-1} through foliar spray from June to January, performed better possibly because of build up of level of phosphorus and activity of microorganism. Dhale and Prasad (2009) [1] studied sweet orange growing soils of Jalna district of Maharashtra and reported that, the available N, P and K ranged from 68 to 313, 0.9 to 27 and 195 to 1287 kg ha^{-1}, respectively in different horizons and in general their content exhibited a decrease the nutrient with depth.

Potassium serves metabolic function in the growth and cell division of young tissue. It improves fruit quality and regulates water requirements and greatly increases fruit yield. In the present study available potassium content was recorded in the soil between 290.2 to 390.5, 325.5 to 419.5 and 298.7 to 423.1 kg ha^{-1} under different orchards management practices of organic, inorganic and integrated nutrient management for Nagpur mandarin since 7-12 years. The observed value of available K content of soil comes under moderately high to very high in range in all the locations when the orchard is treated with the continuous use of organic liquid as spraying and also uses FYM and inorganic fertilizers since 7-12 years. Increase the availability of potassium content in soil under management practice of inorganic as compared to practice of organic and integrated nutrient management. The highest available K (423.1 kg ha^{-1}) was noticed in inorganic nutrient management practice at Hatla-I under use of inorganic dose fertilizer FYM- 15 kg + N:P:K:Mg:S- 449.5:67.5:25:150:50 g $tree^{-1}$ through SSP + 18:18:10 + Urea + magnesium sulphates + sulphur since 10-12 years.

C) Micro-nutrients of soil influenced by various nutrient management practices

Micronutrients play an important physiological role in plant growth and development and it participates in the enzyme system. Zinc plays a role in protein synthesis and of some growth hormones like auxins and in the reproductive process of certain plants. The growing of available micronutrients into deficient, marginal and adequate or low, medium and high categories facilitates in understanding the status of soil fertility. The main source of micronutrients are parent material, FYM, organic matter residues. The availability of native micronutrients in soil is governed by several soil properties viz- pH, organic matter (Dahiya *et al*. 2005) [3]

Results obtained in this investigation showed that the available Zn content (table 2) in under soil was ranged from 0.30 to 1.03 mg kg^{-1} with mean value of 0.57 mg kg^{-1} organic nutrient management practices. While, the average available Zn status in the soil under the application of inorganic fertilizer in different orchards of Nagpur mandarin was found 0.31 to 0.91 mg kg^{-1} with mean value of 0.55 mg kg^{-1} and it ranged from 0.32 to 1.01 mg kg^{-1} with mean value of 0.55 under integrated manner, which was comparatively somewhat lower in different depth in inorganic than organic and integrated nutrient management. Zn status in soil of different locations of Nagpur mandarin of Katol area comes under deficient to medium level (0.6 to 1.8) with different nutrient management practices. Marathe and Bharambe (2007) [8] reported that zinc status ranged from 0.66 to 0.74 mg kg^{-1} under sweet orange orchards aged 8 years at Regional Fruit Research Station, Katol during 2002-2004.

Results obtained in this investigation that the available Fe content in the soil was ranged from 7.91 to 10.6 mg kg^{-1} comes in medium ranged but not deficit with mean value of 8.70 mg kg^{-1} with the organic nutrient management practices. The average available Fe status in the soil under the application of inorganic fertilizer in different orchards of Nagpur mandarin was found 2.35 to 9.84 mg kg^{-1}which comes from low to medium (low- 4.5 and medium- 4.5 to 18.00 mg kg^{-1}) with mean value of 6.93 mg kg^{-1} and it values from 7.52 to 10.9 mg kg^{-1} with mean value of 8.75 under integrated manner, which was comparatively somewhat lower in inorganic (low to medium) than organic and integrated nutrient management (medium ranged).

Manganese seems to be essential for photosynthesis, respiration and nitrogen metabolism. The data clearly indicated that the available Mn content in this soil was ranged from 4.23 to 5.34 mg kg^{-1} with mean value of 4.68 mg kg^{-1}, 3.42 to 5.74 mg kg^{-1} with mean value of 4.46 mg kg^{-1} and 3.32 to 5.72 mg kg^{-1} with mean value of 4.60 mg kg^{-1} under different organic nutrient management practices, the application of inorganic fertilizers and integrated nutrient management, respectively. Copper is involved in both photosynthesis and respiration.

Copper and iron are capable of acting as electron carriers in enzyme systems that bring about oxidation reduction reactions in plants. The available Cu content in soil ranging from 0.70 to 1.31 mg $kg^{-1}$with mean value of 0.88 mg kg^{-1} with the organic nutrient management practices. While the average available Cu status in the soil under the application of inorganic fertilizer in different orchards of Nagpur mandarin was found 0.62 to 2.55 mg kg^{-1} with mean value of 1.23 mg kg^{-1} and it ranged from 0.61 to 2.53 mg kg^{-1} with mean value of 2.09 under integrated manner, which was comparatively somewhat lower in inorganic than organic and integrated nutrient management.

Table 1: Status of chemical properties of soil as influenced by different nutrient management practices in Nagpur mandarin

Depth (cm)	Nutrient management practices											
	Organic *				Inorganic **				Integrated ***			
	pH	EC dS m^{-1}	O.C g kg^{-1}	$CaCO_3$ (%)	pH	EC dS m^{-1}	O.C g kg^{-1}	$CaCO_3$ (%)	pH	EC dS m^{-1}	O.C g kg^{-1}	$CaCO_3$ (%)
	Fetri- I				Kato l- RFRS- I				Wandali wagh- I			
0-30	6.5	0.33	8.8	3.0	7.4	0.27	7.5	3.5	7.5	0.35	9.2	4.0
30-60	6.5	0.34	6.9	3.5	7.4	0.33	6.0	3.9	7.6	0.32	8.3	4.5
60-90	6.6	0.39	4.3	3.9	7.2	0.23	4.7	5.5	7.3	0.31	5.5	5.1
	Fetri- II				Katol – RFRS- II				Wandali wagh- II			
0-30	7.0	0.30	9.2	2.8	7.4	0.33	7	3.2	7.5	0.31	7.8	3.8
30-60	7.1	0.39	6.2	3.6	7.5	0.31	6.5	4.0	7.3	0.37	6.2	4.1
60-90	7.3	0.40	4.3	4.5	7.2	0.33	4.2	4.5	7.1	0.32	3.1	4.8
	Fetri- III				Katol - RFRS –III				Wandali wagh- III			
0-30	7.4	0.32	9.2	3.1	7.5	0.31	7.9	3.9	7.4	0.32	8.5	4.0
30-60	7.4	0.30	7.2	3.8	7.8	0.32	6.3	4.0	7.3	0.42	6.5	4.5
60-90	7.6	0.39	4.6	4.2	7.6	0.33	5.1	5.5	7.3	0.31	4.8	5.5
	Katol-I				Katol- III				Wandali wagh- IV			
0-30	7.3	0.30	9.1	3.1	7.5	0.33	8.5	3.4	8.4	0.32	6.5	3.9
30-60	7.2	0.32	5.6	3.9	7.3	0.32	7.5	4.1	8.4	0.43	5.2	4.2
60-90	7.5	0.42	4.5	4.2	7.6	0.33	3.9	5.6	8.3	0.29	4.1	4.8
	Katol-II				Katol- IV				Hatla- I			
0-30	7.6	0.30	7.9	3.5	7.6	0.32	8.2	3.5	8.1	0.42	6.7	6.7
30-60	7.7	0.32	6.6	3.9	7.6	0.34	7.2	3.9	8.3	0.43	6.5	8.3
60-90	7.9	0.32	4.5	5.8	7.3	0.47	4.2	4.5	8.5	0.51	4.3	8.4

*Fetri- I, II and III- Jivamrut- 60 lit diluted in 100 lit water + Dashparni ark – 10 lit diluted in 100 lit water + Nimboli ark - 10 lit diluted in 100 lit water and applied 500 lit ha^{-1} every month through spraying from June to January. (Total 8 months)

Katol- I and II- FYM- 20 kg^{-1} + Jivamrut- 60 lit diluted in 100 lit water and applied 500 lit ha^{-1} every month through spraying from June to January.

**Katol RFRS- I, II and III- N:P:K 502:460:160 g $tree^{-1}$ through DAP + MOP + urea.

Katol- III and IV- N:P:K- 322:270:300 g $tree^{-1}$ through Urea + SSP + MOP.

***Wandali wagh- I- FYM- 15 kg + N:P:K- 332:140:82 g $tree^{-1}$ through SSP + Urea + MOP.

Wandali wagh- II- FYM- 20 kg + N:P:K:-171:125:83 g $tree^{-1}$ through 20:20:0 + urea + MOP.

Wandali wagh- III- FYM- 15 kg + N:P:K:- 502:460:83 g $tree^{-1}$ through DAP + Urea + MOP.

Wandali wagh- IV- FYM-15 kg+N:P:K:-171:158:83 g $tree^{-1}$ through 20:20:0 + SSP + urea + MOP $tree^{-1}$

Hatla- I FYM- 15 kg + N:P:K:Mg:S- 449.5:67.5:25:150:50 g $tree^{-1}$ through SSP + 18:18:10 + urea + magnesium sulphate + sulphur

Table 2: Fertility status of soil as influenced by different nutrient management practices in Nagpur mandarin

Depth (cm)	Nutrient management practices								
	Organic			Inorganic			Integrated		
	Available N kg ha^{-1}	Available P kg ha^{-1}	Available K kg ha^{-1}	Available N kg ha^{-1}	Available P kg ha^{-1}	Available K kg ha^{-1}	Available N kg ha^{-1}	Available P kg ha^{-1}	Available K kg ha^{-1}
	Fetri I			Katol – RFRS- I			Wandali wagh- I		
0-30	321.2	16.8	360.2	288.1	17.6	375.6	311.5	15.6	326.2
30-60	288.1	15.6	350.4	275.4	16.5	360.0	290.5	14.5	322.3
60-90	200.1	13.1	315.4	268.0	13.3	345.0	268.8	11.2	298.7
	Fetri- II			Katol - RFRS-II			Wandali wagh- II		
0-30	333.0	17.9	385.2	280.3	18.1	364.2	302.0	18.5	325.6
30-60	278.1	15.9	340.4	268.2	14.9	355.0	259.0	12.3	320.5
60-90	232.3	15.0	300.2	255.7	14.2	340.0	243.8	11.2	299.3
	Fetri- III			Katol - RFRS- III			Wandali wagh- III		
0-30	305.7	10.8	380.5	304.0	17.9	360.6	305.0	18.6	379.4
30-60	293.2	8.67	352.6	253.0	16.5	365.0	266.3	14.5	325.2
60-90	260.7	7.30	337.4	242.1	11.2	355.2	240.0	10.4	322.2
	Katol- I			Katol- III			Wandali wagh- IV		
0-30	330.4	17.8	390.5	328.4	19.5	419.5	325.5	17.9	401.5
30-60	288.4	16.5	340.4	278.0	17.5	368.7	225.3	13.5	345.2
60-90	235.2	13.3	320.2	210.3	12.2	355.3	203.8	9.3	312.2
	Katol- II			Katol- IV			Hatla- I		
0-30	305.7	18.0	380.4	320.0	18.4	413.0	330.2	18.3	423.1
30-60	288.2	13.4	325.4	295.2	17.1	375.6	272.3	11.2	368.2
60-90	208.3	12.3	290.2	241.3	11.8	325.5	215.1	8.6	345.3
Range	200.1-333.0	7.30-18.0	290.2-390.5	210.3-328.4	11.2- 19.5	325.5-419.5	203.8- 330.2	8.6-18.6	298.7- 423.1
Mean	277.3	14.16	370.3	273.8	15.78	365.2	270.6	13.72	305.1

Table 3: Status of micronutrients of soil as influenced by different nutrient management practices in Nagpur mandarin

Depth (cm)	Nutrient management practices											
	Organic				Inorganic				Integrated			
	Zn (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Cu (mg kg^{-1})	Zn (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Cu (mg kg^{-1})	Zn (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Cu (mg kg^{-1})
	Fetri- I				Katol-RFRS- I				Wandali wagh- I			
0-30	0.68	8.68	4.91	1.31	0.61	7.83	4.64	1.24	0.63	10.9	4.54	1.87
30-60	0.43	8.21	4.42	0.92	0.51	5.12	3.63	0.73	0.48	9.81	3.32	0.73
60-90	0.32	7.91	4.23	0.83	0.43	3.31	3.42	0.62	0.41	9.21	3.43	0.61
	Fetri- II				Katol-RFRS- II				Wandali wagh- II			
0-30	0.62	9.62	4.82	1.02	0.75	6.87	4.64	1.24	1.01	9.23	5.34	0.94
30-60	0.48	8.24	4.34	0.84	0.53	5.26	3.63	0.84	0.92	8.92	5.33	0.83
60-90	0.30	7.93	4.23	0.80	0.31	2.35	3.42	0.71	0.61	8.31	4.42	0.72
	Fetri- III				Katol-RFRS- III				Wandali wagh- III			
0-30	0.57	10.6	5.01	1.30	0.54	9.84	5.54	1.14	0.56	9.86	5.57	1.17
30-60	0.49	8.21	4.52	0.82	0.43	7.33	4.33	0.83	0.48	7.35	4.38	0.88
60-90	0.31	8.22	4.03	0.73	0.32	5.62	4.22	0.72	0.34	5.64	4.29	0.79
	Katol- I				Katol- III				Wandali wagh- IV			
0-30	1.03	9.38	5.34	0.91	0.83	8.34	5.74	2.55	0.44	10.7	4.92	1.21
30-60	0.82	8.93	5.30	0.81	0.62	7.93	4.53	1.96	0.32	8.91	4.42	0.91
60-90	0.57	8.31	4.41	0.70	0.41	7.52	4.51	0.87	0.34	8.81	4.31	0.82
	Katol- II				Katol- IV				Hatla- I			
0-30	0.83	9.23	5.26	0.94	0.91	9.31	5.72	2.52	0.81	8.31	5.72	2.53
30-60	0.72	8.90	5.03	0.74	0.61	8.91	4.53	1.83	0.61	7.91	4.53	1.92
60-90	0.51	8.21	4.40	0.62	0.43	8.51	4.51	0.71	0.42	7.52	4.51	0.82
Range	0.30-1.03	7.91-10.6	4.23-5.34	0.70-1.31	0.31-0.91	2.35-9.84	3.42-5.74	0.62-2.55	0.32-1.01	7.52-10.9	3.32-5.72	0.61-2.53
Mean	0.57	8.70	4.68	0.88	0.55	6.93	4.46	1.23	0.55	8.75	4.60	2.09

Conclusion
On the basis of results, it can be concluded that the soils of Nagpur mandarin orchards inoculated with balanced different organic inputs alone and application of inorganic and integrated nutrient management enhanced the fertility status of soil.

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