Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(1): 926-929
Received: 10-11-2018
Accepted: 13-12-2018

Ramesh Naik Malavath
Dept. of Biotechnology,
Telangana University,
Nizamabad, Telangana, India

Satyam Raj Thurpu
Dept. of Biotechnology,
Telangana University,
Nizamabad, Telangana, India

Correspondence
Ramesh Naik Malavath
Dept. of Biotechnology,
Telangana University,
Nizamabad, Telangana, India

Soil fertility status of some turmeric growing soils of Nizamabad district of Telangana in relation to root-knot nematodes

Ramesh Naik Malavath and Satyam Raj Thurpu

Abstract

A study was undertaken to assess the nutrient status of turmeric (*Curcuma longa L.*) growing soils in relation to Root-knot Nematode of Nizamabad district, Telangana. Twenty eight representative villages were chosen and total twenty eight surface soil samples (0-15 cm) were collected and analysed for available N, P, K and micronutrient status. Results revealed that available nitrogen content ranged from 198 to 285 kg ha^{-1}, available phosphorus content ranged from 14.0 to 34.0 kg ha^{-1} and available potassium content ranged from and 232 to 393 kg ha^{-1}. Soils are deficient to sufficient in Zn and sufficient in available Cu, Mn and Fe. The available DTPA Zn status varied from 0.07 to 6.18 mg kg^{-1}, Cu status varied from 0.60 to 11.52 mg kg^{-1}, Mn status of these soils varied from 5.75 to 24.40 mg kg^{-1} and Fe content varied from 3.93 to 20.60 mg kg^{-1}.

Keywords: Nutrient status, turmeric growing soils in relation to root-knot nematode

1. Introduction

Turmeric *Curcuma longa L* belonging to the family Zingeberaceae is grown extensively in South East Asia. India is called the “Spice Bowl of the World” as it cultivates 63 spices out of total 107 spices identified and also a traditional item of export. Turmeric is an important annual commercial spice crop grown in India which is also known as “Indian Saffr on”. It is used in diversified forms as a condiment, flavouring and colouring agent and as a principal ingredient in Indian culinary as curry powder. It has anti cancer and anti viral activities and hence finds use in the drug industry and cosmetic industry. The increasing demand for natural products as food additives makes turmeric as ideal produce as a food colourant. The major varieties of turmeric cultivated in Nizamabad district are ACC-79, ACC-48, Armoor, Duggirala, Prathibha, Roma, and Nizamabad local. Agriculture is the backbone of the Nizamabad district's economy and about 81% of the working population depends on agri-culture. The important soils prevailing in the district are black and red chalka (Sandy loams) soils covering 55% and 45% respectively of the total area. The blocks of Armoor, Bheemgal are predominantly dominated with red chalka soils followed by black soils. To comprehend and understand the potential capability of turmeric growing soils, the systemic study of turmeric cultivated soils is important for better management and scientific utilization of its resources.

The soil fertility status exhibits the status of different soils with regard to amount and availability of nutrients essential for plant growth. The crop growth and yield largely depend upon potential of soil resources and their characteristic provides water, nutrients and anchorage for the growth and yield of crops. Keeping in view the above facts, the present study was carried out to find soil fertility status of some Turmeric Growing soils in relation to study the Root-Knot Nematode of Nizamabad District. This paper deals with analysis of turmeric growing soils of Nizamabad district major and micronutrient nutrient status.

Materials and Methods

Location and description of the study area

The Nizamabad district of Telangana, extending over an area of 7956 km^2 is bounded on the North by Adilabad District, East by Karimnagar District, South by Medak district and West by Bidar District of Karnataka and Nanded district of Maharashtra. It lies between 18-5' and 19' of the Northern latitudes, 77-40' and 78-37' of the Eastern longitudes. As the District is situated at a considerable distance from the Sea coast, the climatic condition is tropical and temperature fluctuations are high in the district. The Normal mean minimum temperature is 13.7 °C, and mean maximum is 39.9 °C. The climate is semi-arid which is comparatively equitable and although it is very hot in May with mercury rising up to 47 °C.

The temperature dips to 5 ºC in winters during the months of December and January. The mean maximum and minimum temperature vary from 38° to 25 °C. Mean humidity varies from 64 percent in July to 75 percent in December. The mean annual rainfall is 900 mm of which 75 percent is received during the southwest monsoon (June to September), 15 percent during the northeast monsoon (October to December) and 10 percent during the premonsoon period (March to May). The rainfall is highest in the month of August. The natural vegetation existing in the study area are grasses, shrubs, thorny bushes such as *Cynodon dactylon, Cyprus rotundus, Butea frondosa, Dalbergia latifolia, Azadirachta indica, Tectona grandis, Terminalia tomertose and Acacia spp. Prosopis juliflora, Cacia sp,* broad leaf weeds such as *Selotia, Parthenium, Eucalyptus, Euforbia* sps., *etc.* The major crops grown are rice, sugarcane, maize, turmeric, cotton, groundnut, sunflower and pulses etc.

Collection Methods used for soil sample analysis

The major turmeric growing villages from different manadals were selected. Surface soil samples (0-15 cm depth) from 28 turmeric growing villages of seven mandals. The representative soil samples of the villages were characterized for their important physical, physico-chemical properties using standard procedures. The available nitrogen in the soil was estimated by modified alkaline potassium permanganate method (Sharawat and Buford, 1982) [15]. The available phosphorus was estimated by Olsen's method using 0.5 M $NaHCO_3$ as an extranctant and phosphorus concentration was determined colorimetrically using spectrophotometer at 660 nm. Available potassium was extracted by neutral normal ammonium acetate (NH_4OAc) (1:5) and subsequently potassium was estimated by flame photometer (Sparks, 1996) [16]. The available micronutrients were determined using the method given by Lindsay and Norvell, 1978 [4].

Results and Discussion

Available major nutrient status

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads.

Available Nitrogen

The available macronutrients status of soils is presented in (Table 1). The available nitrogen status was found to be low to medium (198.0 to 285.0 kg ha^{-1}) in all the villages of surface soils. However, available N content of all the above soils was found to be low to medium in surface soils. The reason for the maximum available nitrogen content observed in the surface could be attributed to the fact that cultivation of crops are mainly confined to the surface horizon (Rhizosphere) only and at regular interval the depleted nitrogen content is supplemented by the external addition of fertilizers during crop cultivation (Rajeshwar and Mani, 2014) [12]. The available nitrogen content in 90 percent of the soils were low. The low values of available nitrogen was due to low organic carbon content (Karthikeyan *et al*., 2014) [3]. The soils of medium available nitrogen status content may be related to variation in soil management, application of FYM and kind and quantity of fertilizers to the previous crop etc. Similar results were also reported by Ramya (2013) [14].

Available Phosphorus

The available phosphorus status was found to be medium to high in surface soils (14.0 to 34.0 kg ha^{-1}) in all the villages. The reason for higher P in surface soils might possibly be the confinement of crop cultivation to the rhizosphere and supplementing of the depleted phosphorus through external fertilizers. Similar results were reported by Rajeshwar and Mani (2014) [12]. High organic matter ensured adequate amount of available soil phosphorous in the soils of above average yield category. Majority of soils in the study area were medium to high in available phosphorus (Motsara, 2002) [5].

Available Potassium

The available potassium was medium to high (232.0 to 393.0kg ha^{-1}) in soils of all villages.. The available K status was more in surface soils which could be attributed to release of labile-K from organic residues, application of K fertilizers and upward translocation of K from lower depths along with capillary rise of ground water. Similar results were reported by Pal and Mukhopadyay (1992) [9]. The soils were medium to high in available potassium. The higher K values could be attributed to predominance of K rich micaceous and feldspar minerals as reported by Pal (1985) [8]. In addition to this, potassium contained in organic matter and fertilizer might have led to higher exchangeable potassium in soils as reported by Chahal *et al.* (1976) [1]. The percentage (low, medium and high) of nitrogen, phosphorus, and potassium is presented in Table 3.

Available micro nutrient status:

The DTPA Zn status varied from 0.07 to 6.18 mg kg^{-1} in soils (Table 2). Considering 0.6 mg kg^{-1} as critical level (Lindsay and Norvel, 1978) [4], it was found that 43% of the surface soils are deficient in availability. The available Zn content were low due to low organic carbon content (Karthikeyan *et al*., 2014) [3]. The availability was sufficient in surface soils which might be due to accumulation of comparatively more amount of organic matter and supplementing $ZnSO_4$ through external sources. Similar results were reported by Jalali *et al.*, (1989) [2], Nayak *et al*., (2000) [7] and Rajeshwar *et al*., (2009) [9]. Considering 0.6 ppm as critical limit, 36.4 percent of soils were found deficit in available zinc.

The DTPA Cu status varied from 0.60 to 11.52 mg kg^{-1}. Considering 0.2 mg kg^{-1} as critical level (Lindsay and Norvel, 1978) [4], it was found that all the soils are sufficient which might be due to its association with organic carbon affecting its availability in surface layers (Rajeshwar and Ariff khan, 2007) [11].

The available Mn status of these soils varied from 5.75 to 24.40 mg kg^{-1}. Considering 2.0 mg kg^{-1} as critical level (Lindsay and Norvel, 1978) [4], it was found that all the soils are high in availability which might be due to its presence in the reduced forms, higher biological activity and organic carbon in the surface soils. These observations were in agreement with the findings of Murthy *et al*., (1997) [6] and Nayak *et al.*, (2000) [7].

The DTPA Fe content varied from 3.93 to 20.60 mg kg^{-1}. Based on the critical limit of 3.7 mg kg^{-1} for non-calcareous soils ((Lindsay and Norvel, 1978) [4], the soils were sufficient in available Fe. It was relatively high might be due to accumulation of humic material in the surface soils besides prevalence of reduced conditions in subsurface soils. The findings were in agreement with the findings of Prasad and Sakal (1991) [10]. The sufficiency status of Fe may be attributed to the non calcareous nature of soils of the study area. The percentage of micronutrient deficiency and sufficiency is presented in Table 4.

Nematode pests

In the study area of turmeric growing soils of Nizamabad district in some patches all the villages found that the parasitic root-knot nematodes (*Meloidogyne spp*.) are damaging to turmeric majorly by feed on tender rhizomes, roots and base of pseudostem causing stunting, chlorosis, poor tillering and necrosis of leaves are the common aerial symptoms. Characteristic root galls and lesions that lead to rotting are generally seen in roots. The infested rhizomes have brown, water soaked areas in the outer tissues. Nematode infestation aggravates rhizome rot disease. Nematodes survive in soil and infected rhizomes as primary inoculum. Therefore, tissues from infected crops remaining in the field serve as a reservoir of the fungus. It spreads from infected plants or through soil.

Table 1: Available major nutrient status of turmeric growing soils of Nizamabad district

S. No	Mandals	Villages	Depth (cm)	Available macronutrients (kg ha^{-1})		
				N	P	K
1	Sirikonda	Nyavanandi	0-15	240.0	22.0	315.0
		Gadkole	0-15	278.7	30.5	357.0
		Valgote	0-15	264.0	34.0	368.0
		Kondur	0-15	231.0	26.0	290.0
2	Armoor	Ankapoor	0-15	275.1	27.6	336.7
		Govindpet	0-15	277.0	15.0	282.0
		Pipri	0-15	201.9	19.9	341.3
		Mamidipally	0-15	263.0	26.0	262.0
3	Kammarpally	Konapur	0-15	259.7	20.8	393.0
		Choutapally	0-15	212.7	18.9	364.4
		Kammarpally	0-15	240.0	18.0	271.0
		Narsapur	0-15	271.4	26.1	381.9
4	Velpur	Velpur	0-15	184.0	14.0	296.0
		Kothapally	0-15	256.6	17.5	307.2
		Kuknoor	0-15	277.3	22.0	388.9
		Padgal	0-15	244.0	14.0	391.0
5	Balkonda	Balkonda	0-15	264.0	18.0	268.0
		Mendora	0-15	278.7	25.0	370.7
		Bodepally	0-15	269.7	17.8	293.0
		Kothapalley	0-15	208.1	18.1	372.7
6	Jakranpally	Jakranpally	0-15	285.0	28.1	355.3
		Lakshamapur	0-15	258.0	15.0	294.0
		Brahmnapally	0-15	263.2	19.6	326.4
		Chintalur	0-15	261.0	24.0	271.0
7	Dharpally	Dharpally	0-15	2450	18.0	232.0
		Dubbaka	0-15	266.5	15.6	295.0
		Dammanapet	0-15	198.0	20.0	275.0
		Honnajipet	0-15	278.0	26.7	355.7

Table 2: Available micro nutrient status of turmeric growing soils of Nizamabad district

S. No	Mandals	Villages	Depth (cm)	Micro Nutrient status (mg/kg)			
				Zn	Cu	Mn	Fe
1	Sirikonda	Nyavanandi	0-15	0.32	1.66	14.44	10.60
		Gadkole	0-15	1.08	3.01	14.25	11.60
		Valgote	0-15	0.57	3.90	16.20	16.66
		Kondur	0-15	0.52	5.00	20.00	12.46
2	Armoor	Ankapoor	0-15	0.09	0.99	5.75	9.24
		Govindpet	0-15	0.55	0.98	22.00	16.74
		Pipri	0-15	0.57	1.61	24.60	13.96
		Mamidipally	0-15	0.82	2.36	20.00	13.80
3	Kammarpally	Konapur	0-15	0.40	1.51	20.60	17.86
		Choutapally	0-15	0.09	1.26	10.80	9.92
		Kammarpally	0-15	0.47	2.47	18.60	15.70
		Narsapur	0-15	0.26	0.99	14.20	15.30
4	Velpur	Velpur	0-15	0.07	0.60	16.40	3.93
		Kothapally	0-15	1.41	9.03	18.00	9.20
		Kuknoor	0-15	6.18	11.52	20.40	10.40
		Padgal	0-15	1.47	5.48	19.98	6.80
5	Balkonda	Balkonda	0-15	1.97	6.90	20.24	15.92
		Mendora	0-15	1.37	6.66	20.46	8.20
		Bodepally	0-15	0.15	7.80	24.40	6.22
		Kothapalley	0-15	1.69	8.67	22.60	11.60
6	Jakranpally	Jakrampally	0-15	2.48	8.90	24.60	13.00
		Lakshamapur	0-15	1.22	5.89	18.40	24.60
		Brahmnapally	0-15	1.29	6.01	17.40	19.78
		Chintalur	0-15	2.62	4.14	15.60	18.00
7	Dharpally	Dharpally	0-15	1.38	3.15	13.80	15.32
		Dubbaka	0-15	1.21	4.49	14.40	18.16
		Dammanapet	0-15	0. 40	4.00	17.60	11.56
		Honnajipet	0-15	0.87	4.59	21.60	19.46

Table 3: Number of samples under low, medium and high for N, P, K of surface soil samples from turmeric growing areas of Nizamabad district

Properties	Total No. of samples	Rating		
		Low	Medium	High
Available N	28	25 (89%)	3 (11%)	-
Available P_2O_5	28	-	16 (57%)	12 (43%)
Available K_2O	28	-	6 (21.4)	22 (78.6%)

Table 4: Number of samples under deficiency and sufficiency for Available micronutrients of surface soil samples from turmeric growing areas of Nizamabad district

Properties	Total No. of samples	Rating	
		Deficient	Sufficient
Available DTPA Zn	28	12 (43%)	16 (57.0%)
Available DTPA Cu	28	-	28 (100%)
Available DTPA Fe	28	-	28 (100%)
Available DTPA Mn	28	-	28 (100%)

Conclusions
Results revealed that the soils were shown available nitrogen and available phosphorus status was low to medium in these soils. Available potassium status was medium to high. Soils are deficient to sufficient in Zn and sufficient in available Cu, Mn and Fe.

Acknowledgement
The authors are thankful to authorities of Telangana University, Nizamabad, Soil testing laboratory, Department of Agriculture and PJTSAU for their technical as well as financial support during the course of investigation.

References
1. Chahal RS, Rathee OP. Available nutrients status of some groundnut growing soils of Ambala and Gurgaon districts of Haryana. Haryana Agric. Univ., J Res. 1976; 6(2):111-116.
2. Jalali VK, Talib AR, Takkar PN. Distribution of micronutrients in some bench mark soils of Kashmir at different altitudes. Journal of the Indian Society of Soil Science. 1989; 7:465-469.
3. Karthikeyan K, Pushpanjali, Prasad J. Soil fertility status of soybean (*Glycine max* L.) growing soils of Malwa Plateau, Madhya Pradesh. J Indian Soc. Soil Sci. 2014; 62(2):174-178.
4. Lindsay WL, Norvell WA. Development of DTPA soil test for zinc, iron, manganese and copper. Soil Science Society of America. 1978; 42(3):421-428.
5. Motsara MR. Available nitrogen, phosphorus and potassium status of Indian soils as depicted by soil fertility maps. Ferti. News. 2002; 47:15-21.
6. Murthy IYL, Sastry N, Datta TG, Narayanaswamy SCG, Rattan RK. Distribution of micronutrient cations in vertisols derived fro different parent materials. J Indian Soc. Soil Sci. 1997; 45:577-580.
7. Nayak DC, Mukhopandhyay S, Sarkar D. Distribution of some available micronutrients in alluvial soils of Arunachal Pradesh in relation to soil characteristics. Journal of the Indian Society of Soil Science. 2000; 8:612-613.
8. Pal DK. Potassium release from muscovite and biotite under alkaline conditions. Pedologie. 1985; 35:133-136.
9. Pal SK, Mukhopadyay AK. Distribution of different forms of potassium in profiles of some Entisols. Journal of the Indian Society of Soil Science. 1992; 40:371-373.
10. Prasad R, Sakal R. Availability of Fe in calcareous soils in relation to soil properties. Journal of the Indian Society of Soil Science. 1991; 39:658-661.
11. Rajeswar M, Aariff Khan MA. Physico - chemical properties and available macro and micro nutrients in the soils of Garikapadu research station of Krishna district of Andhra Pradesh, India. An Asian J Soil Sci. 2007; 2(2):19-22.
12. Rajeshwar M, Mani S. Nutrients status in the surface and subsurface soils of dryland Agricultural Research Station at Chettinad in Sivaganga district of Tamil Nadu. Asian Journal of Soil Sciences. 2014; 9(2):169-175
13. Rajeshwar M, Aariff Khan MA, Ramulu V. Characterization and classification of soils of Ganapavaram pilot area of Nagarjuna Sagar Left Canal Command Area of Andhra Pradesh. International Journal of Tropical Agriculture. 2009; 27:1-7
14. Ramya SH. Studies on phosphorus status of Vertisols and response of Bt cotton to phosphatic fertilizers in northern transitional zone of Karnataka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka India, 2013.
15. Sharawat KL, Burford JR. Modification of alkaline permanganate method for assessing the availability of soil nitrogen in upland soils. Soil Sci. 1982; 133:53-57.
16. Sparks. Methods of Soil Analysis Part-3: Chemical Methods. Soil Sci. Soc. America, USA, 1996.