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Research Article

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Characterization of soil samples for physical and chemical properties under *Alfisols* of finger millet growing area of Bangalore rural district (Doddaballapura), Karnataka

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Summary

An investigation was taken at the University of Agricultural Sciences, Bangalore during 2013 in order to characterize the soils coming under *Alfisols* of Bangalore rural district (Doddaballapura) of Karnataka with respect to physical and chemical properties. The predominant finger millet growing area Doddaballapura of Bangalore rural district was selected for the present study. Ten surface samples (0-15cm) were collected from area and analyzed for physical and chemical properties. This study leads us to the conclusion of the nutrient's quantity of soils of Doddaballapura taluk, Bangalore rural district, Karnataka State. Result show that overage all the soils of Doddaballapura taluk have various physical and chemical parameters. This information will help farmers to decide the problems related to soil nutrients and also amount of fertilizers to be added to soil to make production economic.

Key words : Characterization of soil samples, Physical parameter, Chemical parameter

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Introduction

Alfisols form a major order of soils of Karnataka and finger millet is a staple food crop grown on these soils (Malinda *et al.*, 2015). These soils are low in organic matter content and their ability to retain moisture is also low. The structural instability of these soils leads to reduction in surface roughness and enhance surface sealing. These properties induce excessive runoff under high intensity rain and affects the seedling emergence particularly the small seeded crops like finger millet, pearl millet and sorghum. Due to intensive cultivation involving adoption of high yielding varieties, continuous use of high analysis fertilizers and imbalanced use of fertilizers without organic manures or organic residues, soils are becoming deficient in available nutrients (Ramakrishna parama and Atheefa, 2012). Many workers have reported the deficiency of micronutrients particularly boron in soils of India (Maha Singh, 2008). Therefore, it has become very much essential to know the available nutrient status in soils in order to achieve sustainability in production. Soil plays a major role in macro and micronutrients management and also availability of these nutrients in soil is known to be influenced by soil factors such as

Table A : Details of soil samples collected from selected villages of Bangalore rural district

Sr. No.	Farmers name	Village	Taluk
1.	Chinnaswamy, S.N	Saslu	Doddaballapura
2.	Arasaraju	Kadathippuru	Doddaballapura
3.	Venkateshmurthy	Lakkasandra	Doddaballapura
4.	Manjunath, T.N	Tubagere	Doddaballapura
5.	Siddagangappathubuguntte	Kattivasanahalli	Doddaballapura
6.	Bhagyamma	Akkatammanahalli	Doddaballapura
7.	Ramegowda	Sonnenahalli	Doddaballapura
8.	Rajanna	Adakavala	Doddaballapura
9.	Ramaih	Kansavadi	Doddaballapura
10.	Swamy, S	Honnavara	Doddaballapura

nature of parent material from which soil has been derived, texture, pH, organic matter status. Hence, a study was under taken to know the available nutrient status in soils belonging to Bangalore rural district (Doddaballapura) of Karnataka. This study lead us to the conclusion of the nutrient's quantity of soils of Doddaballapura taluk, Bangalore rural district, Karnataka State. Result show that overage all the soils of Doddaballapura taluk have various physical, chemical and biological parameters. This information will help farmers to decide the problems related to soil nutrients and also amount of fertilizers to be added to soil to make production economic.

Resource and Research Methods

A total of 10 soil samples at 0-15cm depth were collected from the major finger millet growing area of Bangalore Rural district (Doddaballapura) of Karnataka and characterized for physical (% of sand, silt and clay) and chemical (pH, EC, orgamic matter, macro and micronutrients) of the soil. The location, farmer's details and other relevant information on where the samples were collected are given in Table A.

Statistical analysis :

The methods outlined by Panse and Sukhatme (1985) were made used for statistical analysis of the data for drawing conclusion on the effect of various treatments on different parameters studied.

Research Findings and Discussion

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

Status of physico-chemical properties of soils of Doddaballapura taluk,Bangalore rural district :

The results pertaining to physico-chemical properties of the soils collected from different villages of Doddaballapura taluk, Bangalore rural district are presented in Table 1.

Results indicated that sand, silt and clay varied from 48.57 to 82.20, 3.40 to23.60 and 9.45 to 41.53 per cent, respectively. These soils belong to sandy clay loam, sandy loam and sandy in texture. Out of ten samples, four samples recorded more than 6.5 pH and rest of the samples were acidic in nature (4.02 to 6.15). The electrical conductivity of these soils ranged from 0.03 to 0.17 dS m^{-1}.

Further the organic carbonstatus of soils varied from 0.28 to 0.94 per cent with a mean value of 0.69 per cent and two out of 10 samples recorded (0.34 and 0.28 %) low status of organic carbon and remaining samples were medium to high.

The overall available nitrogen status in the surface soils ranged from 275.96 to 401.40 kg ha^{-1} with a mean value of 319.84 kg ha^{-1}. Out of 10 samples, two samples were low in nitrogen content and remaining samples were medium (282.24 to 401.40 kg ha^{-1}) in nitrogen status. The available phosphorus status in surface soils ranged from 26.37 to 84.81 kg ha^{-1} with an overall mean of 46.15 kg ha^{-1} and soils of Doddaballapura taluk had medium to high available phosphorus status. The available potassium content varied from 185.47 to 799.68 kg ha^{-1} with an overall mean of 384.65 kg ha^{-1} and out of 10 samples six were medium (185.47 to 333.31 kg ha^{-1}) in potassium content and remaining samples were high in potassium.

Status of secondary and micro nutrients in soils of Doddaballapura taluk, Bangalore rural district :

The results pertaining to status of secondary and micronutrients of the soils collected from different villages of Doddaballapura taluk, Bangalore rural district are presented in Table 2.

The results indicated that available calcium content ranged from 2.00 to 7.00 cmol (P+) kg^{-1} with a mean value of 3.93 c mol (P+) kg^{-1} in soils coming under Doddaballapura taluk. All the soils had sufficient amount of calcium (more than 1 c mol (P+) kg^{-1}). Available magnesium varied from 1.05 to 3.75 c mol (P+) $kg^{-1}$with a mean value of 2.05 c mol (P+) kg^{-1}. Three out of 10 samples are under below the critical level [less than 1.5 c mol (P+) kg^{-1}] and remaining soils had sufficient amount of magnesium. The available sulphur content ranged from 7.43 to 15.84 mg kg^{-1} with a mean value of 9.95 mg kg^{-1} and out of 10 samples, three were medium and remaining soils were low in sulphur content.

According to the results, the hot water extractable

Table 1 : Status of physico-chemical properties of soils of Doddaballapurataluk, Bangalore rural district

Sr. No.	Farmer's name	Village name	Sand	Silt	Clay	Textural class	pH (1:2.5)	EC (dS m^{-1})	OC (%)	Avail. N	Avail. P_2O_5	Avail. K_2O
				(%)							(kg ha^{-1})	
1.	Chinnaswamy	Saslu	82.20	3.40	12.90	sl	7.38	0.07	0.90	319.87	65.59	333.31
2.	Arasaraju	Kadathippuru	68.70	6.80	23.68	scl	4.35	0.08	0.62	326.14	84.81	201.60
3.	Venkateshmurthy	Lakkasandra	54.70	3.60	41.53	s	6.97	0.10	0.87	332.41	29.88	581.95
4.	Manjunath, T. N	Tubagere	50.90	8.90	39.86	s	6.15	0.09	0.94	275.96	67.45	353.47
5.	Siddagangappathubuguntte	Kattivasanahalli	74.60	15.95	9.45	sl	4.02	0.09	0.55	401.40	32.74	223.10
6.	Bhagyamma	Akkatammanahalli	68.70	6.20	24.21	sl	5.50	0.04	0.69	282.24	26.37	275.52
7.	Ramegowda	Sonnenahalli	65.40	9.40	24.60	scl	4.79	0.03	0.34	326.14	69.10	799.68
8.	Rajanna	Adakavala	50.00	10.60	38.92	scl	6.67	0.09	0.28	332.14	26.37	185.47
9.	Ramaih	Kansavadi	48.57	11.40	39.43	s	5.78	0.06	0.67	326.14	30.32	278.21
10.	Swamy. S	Honnavara	49.33	23.60	26.80	scl	6.90	0.17	0.87	275.96	28.90	614.21
Range			48.57-82.20	3.40-23.60	9.45-41.53	-	4.02-7.38	0.03-0.17	0.28-0.94	275.96-401.40	26.37-84.81	185.47-799.68
Mean			61.31	9.98	28.13	-	5.85	0.08	0.69	319.84	46.15	384.65
SD			12.13	6.08	11.50	-	1.17	0.04	0.23	37.04	22.68	208.17

scl = Sandy clay loam sl= Sandy loam s = Sandy

Table 2 : Status of secondary and micronutrients in soils of Doddaballapurataluk, Bangalore rural district

Sr. No.	Farmers'name	Village name	Ca	Mg	S	Micronutrient (mg kg^{-1})				
			[c mol (P^+)	kg^{-1}]	(mg kg^{-1})	B	Zn	Fe	Cu	Mn
1.	Chinnaswamy S. N	Saslu	7.00	3.75	15.84	0.24	0.84	15.43	2.59	9.80
2.	Arasaraju	Kadathippuru	2.75	1.50	10.56	0.11	0.61	21.14	2.03	22.44
3.	Venkateshmurthy	Lakkasandra	4.00	1.90	12.32	0.16	0.79	13.43	1.60	9.14
4.	Manjunath, T. N	Tubagere	2.75	1.50	9.19	0.33	1.76	9.81	2.67	23.96
5.	Siddagangappathubuguntte	Kattivasanahalli	4.75	2.50	8.02	0.13	0.79	13.27	1.73	15.06
6.	Bhagyamma	Akkatammanahalli	2.75	1.25	8.41	0.22	0.73	15.06	1.80	24.60
7.	Ramegowda	Sonnenahalli	4.75	2.25	9.19	0.13	0.82	19.46	1.93	28.88
8.	Rajanna	Adakavala	2.00	1.05	9.38	0.15	0.47	19.80	1.75	16.71
9.	Ramaih	Kansavadi	4.25	2.00	7.43	0.37	0.48	8.11	2.16	23.94
10.	Swamy. S	Honnavara	4.25	2.75	9.19	0.40	0.85	10.09	2.49	19.50
Range			2.00-7.00	1.05 – 3.75	7.43-15.84	0.11-0.40	0.47-1.76	8.11-21.14	1.60-2.67	9.14-28.88
Mean			3.93	2.05	9.95	0.22	0.81	14.56	2.08	19.40
SD			1.45	0.81	2.48	0.11	0.36	4.51	0.39	6.59

boron varied from 0.11 to0.40 mg kg^{-1} with 0.22 mg kg^{-1} as mean value. All the soils of Doddaballapura were below the critical value of boron (0.50 mg kg^{-1}). The available zinc status in these soils ranged from 0.47 to 1.76 mg kg^{-1} with a mean of 0.81 mg kg^{-1}. Further it was noticed that two out of 10 samples analyzed were deficient in zinc (less than 0.60 mg kg^{-1}) and remaining eight samples recorded sufficient (0.61 to 1.76) zinc. Available iron ranged from 8.11 to 21.14 mg kg^{-1} and all the soils were found to contain high amount of iron. The available copper status in these soils varied from 1.60 to 2.67 mg kg^{-1} and 50 per cent of samples are deficient (less than 2 mg kg^{-1}) in copper content and remaining 50 per cent samples were found sufficient in copper content. The available manganese status in soils ranged from 9.14 to 28.88 mg kg^{-1} with a mean of 19.40 mg kg^{-1}. All the soils were found to contain high amount of manganese.

It was noticed from the results, the soils belong to sandy clay loam, sandy loam and sandy in texture. This suggests that more number of the soils are coarse texture. High per cent of sand fraction in the soils under study is probably due to the granite type of parent material from which these soils have been derived. This is in conformity with the results of soils of Karnataka for optimizing land use (Bhavitha, 2013 and Sathyanarayana and Biswas, 1970) who reported that soils developed from granite type of parent material had a coarse texture.

The pH of these soils varied from acidic to alkaline in nature. Hence, variation in the pH of these soils from 4.02 to 7.32 may be attributed to the nature of parent material and also the amount of clay and organic matter content in soils. The soluble salts concentration were found to be low and also within the normal range in soils of Bangalore rural district.

Shivaprasad *et al*. (1998) while characterizing the soils of Karnataka observed that soils derived from granite-gneiss material were found to be slightly acidic to neutral in reaction. According to Mahapatra *et al*. (2000), soils of sub humid ecosystem of Kashmir region were generally slightly acidic to neutral in reaction, which was associated with high level of organic matter and leaching of bases due to slopy landscape and fluvial actions whereas high pH reported in some areas was due to $CaCO_3$ accumulation. Acharya *et al.* (1988) and Roopa *et al.* (2014) observed that significant decrease in pH of an *Alfisol* as a result of continuous manuring over the initial value. Bhavitha (2013) reported that the lower amounts of soluble salts in soils of Krishna raj pet (T), Mandya district may be attributed due to the leaching loss of salts.

Organic matter plays a very important role in soil when nutrients availability is considered because as it acts as source of nutrient elements and also keeps them in available form in soils. The results indicated that organic carbon status in soils varied from medium to high status. The low organic carbon status may be due to low biomass incorporation by the crop like finger millet grown on these soils and high organic carbon status may be due to addition of organics by majority of the farmers. Similar results were obtained by Bhavitha (2013). On the contrary, Chidanadappa (2003) also opined that regular addition of organics such as FYM and composts increased the organic carbon status in soils. Sharma (1999) reported that application of FYM and crop residue alone or in combination with reduced level of fertilizer was effective in building up of soil fertility with respect to organic carbon content of the soil in long run.

Major nutrients (N, P and K) :

Available nitrogen content in these soils varied from low to medium and these soils had medium to high status of both available phosphorus and available potassium. considerable variation in the available nitrogen status of soils is not only due to their diverse physical and chemical characteristics of the soils, but also due to the management practices involving high yielding varieties and use of high analysis fertilizers with increasing annual cropping intensity. Irrespective of cropping and N fertilization, the amount of available N significantly decreased with the depth and organic fractions also contributed to the available N in the soil (Pal *et al.*, 1987).

High phosphorus content may be due application of organic matter along with P fertilization. Sharma (1999) reported that application of FYM and crop residue alone or in combination with reduced level of fertilizer was effective in building up of soil fertility with respect to phosphorus and potassium content of the soil in long run.

Secondary nutrients (Ca, Mg and S) :

It's observed that the available calcium content from the results of thirty samples, all samples were in the sufficient range. Nine out of thirty samples were low in magnesium content and remaining soils had high magnesium status. It was noticed from the results of 30 samples, 14 samples were low in sulphur status where as 10 samples had medium in sulphur content and remaining 6 samples were high in the sulphur status. Low and medium level of available sulphur in soils of the area may be due to lack of sulphur addition, use of di-ammonium phosphate fertilizer (DAP) and continuous removal of S by crops (Balanagoudar, 1989).

Micronutrients (B, Fe, Zn, Cu and Mn) :

In the present investigation, except one soil all other soils that were taken for analysis recorded the available boron status below the critical level (0.50 mg kg^{-1}). This may be attributed to the coarse textured soils which are more prone to leaching and low to medium organic carbon status. Generally many workers reported that the deficiency of boron in acidic coarse textured soils found in high rainfall areas. Bhavitha (2013) reported that available boron increased with increase in fineness of soils.

Five out of 30 samples analyzed were deficient in available zinc status (less than 0.60 mg kg^{-1})and remaining samples had sufficient zinc content. This may be attributed to the reason that organic matter acts as a source of zinc in soils and also during its decomposition, the released chelating substances complex the zinc and keeps it in soluble and mobile form in soil by preventing its fixation by soil constituents. Mathur *et al*. (2006); Chidanadappa (2003) and Yadav (2008) who got a positive and significant correlation between available zinc and organic carbon status of soils and also increase in the availability of zinc due to organic manures application.

Available iron in soils was found to be medium to high status in the soils analyzed. Rajkumar *et al*. (1990) reported that soils derived from granite gneiss parent rocks exhibited medium values for available iron and results of the present investigation is in conformity with the findings of Katyal and Sharma (1991) and Patiram *et al*. (2000).

Seventeen samples out of 30 samples were found sufficient (more than 2.00 mg kg^{-1}) in copper content. Organic matter acts as a source of copper and also during its decomposition, the released organic compounds act as chelating agents for copper and prevents it from fixation by other soil constituents. Similar findings have been reported by Chidanadappa (2003) and Bhavitha (2013).

All the samples analyzed had sufficient manganese content. Similar results were reported by Yadav (2008); Ibrahim *et al*. (2011) and Roopa *et al*. (2014) also.

Literature Cited

Acharya, C.L., Bishnoi, S.K. and Yaduvanshi, H.S.(1988). Effect of long term application of fertilizers and organic and inorganic amendments under continuous cropping on soil physical and chemical properties in all Alfisols. *Indian. J. Agric. Sci.*,**58**: 509-516.

Balanagoudar, A.B. (1989). Investigation on status and forms of sulphur in soils of North Karnataka. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Bhavitha, N.C. (2013). Micronutrients status in soils of Krishnarajpet taluk, Mandya district, Karnataka. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Bangalore, KARNATAKA (INDIA).

Chidanadappa, H.M. (2003). Dynamics of zinc and copper in organic materials amended soils. Ph.D. Thesis, University of Agricultural Sciences, Bangalore, KARNATAKA (INDIA).

Ibrahim, A.K., Usman, A., Abubakar, B. and Aminu, U.H. (2011). Extractable micronutrients status in relation to other soil properties in Billiri local Government area. *J. Soil Sci. & Environ. Mgmt.*, **3**(10): 282-285.

Katyal, J.C. and Sharma, B.D.(1991). DTPA- extractable and total Zn, Cu, Mn and Fe in Indian soils and their association with some soil properties. *Geoderma.*, **49**: 165-179.

Mahapatra, S.K., Walia, C.S., Sidhu, G.S., Rana, K.P.C. and Tassemlal (2000). Characterisation and classification of the soils of different tophographic units in the sub humid eco-systems of Kashmir region. *J. Indian Soc. Soil Sci.*,**48**(3): 572-577.

Maha Singh,V. (2008). *Micronutrient deficiencies in crops and soils in India*, Text book of micronutrient deficiencies in global crop production, pp 93-125.

Malinda, S., Thilakarathna and Manish, N. Raizada (2015). A review of nutrient management studies involving finger millet in the semi-arid tropics of Asia and Africa, *Agronomy*,**5** : 262-290.

Mathur, G.M., Deo, Ram and Yadav, B.S. (2006). Status of zinc in irrigated north-west plain soils of Rajasthan. *J. Indian Soc. Soil. Sci.*, **54** (3): 359-361.

Pal, Sasanthakumar, Saha, Dipankar and Mukhopadhyay, Asit K. (1987). Influence of cropping and nitrogen fertilization on changes in different forms of nitrogen in alluvial soils. *Pl. Soil*, **101**: 137-139.

Panse, V.G. and Sukhatme, P.V. (1985). *Statistical methods for agricultural worker*. Publication and Information Division, ICAR, NEW DELHI, INDIA.

Patiram, Upadhyaya, R.C., Singh, C.S. and Munnaram (2000).

Micronutrient cation status of Mandarin (*Citrus reticulate*) orchards of Sikkim. *J. Indian Soc. Soil Sci*., **48**(2): 246-249.

Rajkumar, Nayyar, V.K., Sidhu, G.S. and Deshmukh, S.N. (1990). Distribution and available micronutrient cations in some dominant soil series in different physiographic units of Bhundelkhand region of Madhya Pradesh. *J. Indian Soc. Soil Sci*., **38** : 410-415.

Ramakrishna Parama, V.R. and Atheefa, Munawery (2012). Sustainable soil nutrient management, *J. Indian Institute Sci.*,**92**(1) : 16.

Roopa, V.M., Naveen, D.V. and Mamtha, B. (2014). Soil fertility maps of villages as assessment of soil fertility status in different cropping systems of Doddabela vangala raitha samparka Kendra (RSK), Doddaballapur taluk of Karnataka. *Inter. J. Sci. Res*., **3**(4): 1-2.

Sathyanarayana, T. and Biswas, T.D. (1970). Chemical and mineralogical studies of associated black and red soils. *Mysore. J. Agric. Sci*., **4**: 253-262.

Sharma, R.A. (1999). Management of crop residues and FYM for sustainable system of rainfed soybean and safflower and soil health under rainfed condition. *Crop Res*., **18**(3): 370-372.

Shivaprasad, C.R., Reddy, R.S., Sehgal, J. and Velayutham, M. (1998). Soils of Karnataka for optimizing land use.*NBSS Publ*., **47** : 15.

Yadav, K.K. (2008). Micronutrient status in soils of Udaipur district of Rajasthan. *Hydrology J*., **31**(3&4): 99-105.

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