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ASSESSMENT OF SOIL MICRONUTRIENT STATUS OF KARNATAKA LIGHT SOILS UNDER FLUE CURED VIRGINIA TOBACCO IN *MYSORE* DISTRICT OF KARNATAKA.

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Two hundred and fifty-two soil samples were collected from different farmers of seven villages in Karnataka light soil area of FCV tobacco in Mysore district of Karnataka. The representative surface soil samples at 6" depth were collected and analysed for micronutrients. The results of the study area indicated that the values of available zinc varied from 0.04 -9.97 µg/g, available iron ranged from 0.30 to 58.64 µg/g, available copper and available manganese varied from 0.18 to 3.76 µg/g and 0.82 to 28.76 µg/g, respectively. Among the DTPA extractable micronutrients, manganese was found to be high to very high whereas the soils were very low in available zinc and medium to high in available iron and available copper. The nutrient index values were low for available Zn (1.17), medium to high for Fe (2.62) and high for available Cu (2.56) and Mn (2.92) in FCV tobacco grown light textured soils of *Mysore* district.

Key words: DTPA extractable micronutrients, FCV Tobacco, Light soils and Nutrient Index.

INTRODUCTION

Exploring soil fertility variation including micronutrients in areas under commercial crops is important to have comprehensive information for managing natural resources, crop diversification and improving production. Especially, the importance of micronutrients has been realized during past three decades when wide spread micronutrient deficiencies were observed throughout the country (Deb, D.L. and Sakal, R. 2002).

Soil plays a major role in determining the sustainable productivity of an agro ecosystem. The sustainable productivity of a soil mainly depends upon its ability to supply essential nutrients to the crop. The deficiency of micronutrients has become a major constraint in optimizing crop productivity and soil sustainability (Alloway, B.J. 2008; Bell, R.W. and Dell, B. 2008). The availability of micronutrients in soil is dependent on the parent material, pedogenic process and soil management which may promote, in some cases a reduction of cationic micronutrients content (Moraghan, J.T. and Mascagni, H. J. 1991). Reduction in native levels of micronutrients in soils due to continuous removal without replenishment has been a cause of concern for all the stakeholders. It is well known that optimum plant growth and crop yields depend upon the plant available micronutrients to the crop but not on their total concentration (Shorrocks, V.M. 1984).

Micronutrients play a vital role in plant nutrition and are essential for various enzymatic reactions and metabolic processes. Micronutrients availability varies with changes occurring in the soils. Majority of our soils are generally light to medium textured, high in pH, low in organic matter, deficient in nitrogen and phosphorus, calcareous to varying degrees, where micronutrients may form insoluble compounds and become unavailable to the plants. Moreover, high application of nitrogen and phosphorus fertilizers, introduction of high yielding varieties and intensive crop production system may also induce the deficiencies of micronutrients. Due to these facts, the micronutrients have become of widespread concern during recent years. Application of micronutrient is very important for getting high yields and quality of tobacco. Maximum percentage of top quality leaves was obtained at a higher dose of Cu fertilization (Hoppe, B.R. 1988). Baber *et al.* (1987) mentioned that Zn and B application increased the yield of Flue cured Virginia (FCV) tobacco, while Cu fertilization increased the potash and sugar contents of tobacco.

In this context the study is undertaken to explore the status of soil micronutrients in light textured Karnataka soils wherein FCV and other important crops are being cultivated.

MATERIALS AND METHODS

Natural resources, landforms and land use pattern of the study area

The study area is under the Southern Transition Zone consisting of *H. D. Kote, Hunsur, and Periyapatna* taluks. Soil type varied with different land forms. Land forms are mostly plateau lands. The area is a conglomerate of red and red sandy soils. Depth of the soil is shallow to moderate. The annual rainfall ranges from 612 mm to 1054 mm in the transition zone. The average annual rainfall of the district is 782 mm. The temperature ranges from 11 to 38 C. Thus, the climate of *Mysuru* district is temperate with moderate variations in temperature in different seasons. The area is blessed with good irrigation facilities from major and medium dams, and many small, medium and big tanks. The climatic conditions of the study area are favourable to crops like paddy, jowar, ragi, pulses, sugarcane and tobacco.

Sample collection and analysis

The samples were collected from different farmers comprising of seven villages in Karnataka light soil area of FCV tobacco. The representative soil samples from 6" depth from the surface were taken with the help of famers. The samples were air-dried, ground and passed through a 2 mm sieve for analysis of micronutrients (Zn, Fe, Mn, and Cu). Analysis of Zn, Fe, Mn and Cu was performed using Diethylene Tri-amine Penta Acetic Acid (0.005 DTPA + 0.1 M Tri-ethanol amine and 0.01M $CaCl_2$ solution buffer, at pH 7.3) extractant and with the help of AAS as outlined by Lindsay and Norwell (1978). Critical limits used to categorize level of deficiency were 0.60 mg/kg soil for DTPA extractable Zn, 5.0 mg/kg soil for DTPA - extractable Fe, 0.20 mg/kg soil for DTPA - extractable Cu and 2.0 mg/kg soil for DTPA extractable Mn. Based on soil critical limits soil samples were categorized in to five classes.

The nutrient index (NI) values for available micronutrients present in the soils were calculated utilizing the formula as suggested by Parker et al. (1951) and classified this index as low (< 1.5), medium (1.5 to 2.5) and high (> 2.5) giving under weightage to medium category. Ramamoorthy and Bajaj (1969) modified the index classification as low (< 1.70), medium (1.71 to 2.33) and high (> 2.33).

Nutrient index = (Nl x 1) (Nm x 2) (Nh x 3) / Nt
Where, Nl, Nm and Nh are the number of soil samples falling in low, medium and high categories for nutrient status and are given weightage of 1, 2 and 3, respectively. Nt is the total number of samples. Micronutrient Nutrient indexes were grouped according to index ratings.

RESULTS AND DISCUSSION

The data on available micronutrients status and their distribution and index values are presented in tables 1, 2, 3 and 4, respectively. In the study area the available zinc varied from 0.04 to 9.97 µg/g. Lowest mean value for zinc was recorded in *Kalahalli* village (0.19 µg/g while the highest value of zinc was also observed in the village *M D Koppal* (1.23 µg/g). The available iron ranged from 0.30 to 58.64 µg/g. Lowest mean value of iron was recorded in *Kothagale* village (9.78 µg/g) and highest mean value of iron was observed in the village *K G Koppal* (15.20 µg/g).

The available copper varied from 0.18 to 3.76 µg/g. Lowest mean value of copper was observed in the village *UG Halli* (0.44 µg/g) while the highest mean value of copper was recorded in soils of *JD Koppal* village (0.18 µg/g). Available manganese varied from 0.82 to 38.12 µg/g. Lowest mean value (9.61 µg/g) of Manganese was recorded in *Kalahalli* village and the highest mean value of Manganese was observed in *JD Koppal* village (16.70 µg/g). The details are given in Table 1.

Distribution of different categories was studied for four micronutrients and classified according to critical limits (Table 2 and 3). Among the four micronutrients, available zinc was low to very low in 83.3 % samples followed by available iron (9.1%) and available copper (4 %).

Table 1: Soil available micronutrient status in sampled villages of KLS area of FCV tobacco.

S.No	VillageName	Available Zinc	Available Iron	Available Copper	Available Manganese
		——— Range & Mean in µg/g ———			
1	*UG Halli*	0.15-1.89(0.63)	3.92-38.88(12.61)	0.18-0.74(0.44)	6.20-24.52(12.37)
2	*Harinalli*	0.04-9.97(1.07)	0.30-34.52(11.11)	0.48-3.76(1.52)	4.00-27.56(9.74)
3	*JD Koppal*	0.22-6.51(0.99)	4.78 - 25.00(11.97)	1.30-2.60(1.60)	3.66-38.12(16.70)
4	*Kalahalli*	0.37-5.52(0.19)	2.24-20.88(10.12)	0.70-2.18(1.24)	3.94-15.54(9.61)
5	*K G Koppal*	0.19-2.04(0.55)	2.64-58.64(15.20)	0.20-3.30(0.98)	0.82-28.76(10.68)
6	*Kothagale*	0.07-4.20(0.69)	0.90-44.78(9.78)	0.42-2.94(1.40)	4.58-22.88(10.96)
7	*M D Koppal*	0.41-3.61(1.23)	4.92-19.66(10.80)	0.80-1.90(1.32)	8.12-23.48(14.94)

Table 2: Distribution of soil available micronutrient status in FCV tobacco growing area of KLS

S.No	Class	Available Zinc	Available Iron	Available Copper	Available Manganese
1	*Very Low*	118 (46.8)	6 (2.4)	0 (0.0)	0 (0.0)
2	*Low*	92 (36.5)	17 (6.7)	10 (4.0)	1 (0.4)
3	*Medium*	34 (13.5)	33 (13.1)	76 (30.2)	0 (0.0)
4	*High*	5 (2.0)	75 (29.8)	164 (65.1)	24 (9.5)
5	*Very High*	3 (1.2)	121 (48.0)	2 (0.8)	227(90.1)

Note: ( ) % distribution of samples under each class

Table 3: Critical limits for DTPA extractable micronutrients in ppm

S.No	Class	Available Zinc	Available Iron	Available Copper	Available Manganese
1	*Very Low*	0.0-0.5	0.0-2.0	0.0-0.1	0.0-0.5
2	*Low*	0.5-1.0	2.0-4.0	0.1-0.3	0.5-1.2
3	*Medium*	1.0-3.0	4.0-6.0	0.3-0.8	1.2-3.5
4	*High*	3.0-5.0	6.0-10.0	0.8-3.0	3.5-6.0
5	*Very High*	>5.0	>10	>3.0	>6.0

Table 4: Nutrient Index and Rating of Micronutrients in KLS area of FCV Tobacco

NI/Rating	Available Zinc	Available Iron	Available Copper	Available Manganese
Nutrient Index	1.17	2.62	2.56	2.92
Parker et., al (1951)	Low	High	High	High
Ramamoorthy and Bajaj (1969)	Low	High	High	High

Micronutrient deficiencies were found in light soils of *Andhra Pradesh and Telangana states*, especially the available forms of zinc and iron (Prasad., *et al.,* 2016, Shukla, *et al.,*2015 and Venkata Subbaiah, Vet al.,1995). However, available manganese was very high to high in almost all the samples. The results showed that a large scale area under the study was deficient in zinc followed by iron and copper (Table 2). The low zinc content is ascribed to low amount of zinc bearing minerals in the light textured red and red sandy soils which are categorized mostly in to *Alfisols* where usage of zinc-based fertilizers in the FCV tobacco cultivation was meager. The low content of organic matter in soils influences the Fe solubility in soils. The available Fe content is low in some soils due to conversion of total Fe into less available ferric form especially under arid and semiarid conditions. Poor addition of fertilizer iron and copper to tobacco cultivated soils has lead to the reduction in the available status of these micronutrients. High available manganese content in most of the soil samples is due to high contents of manganese bearing minerals in the parent material of these red and sandy soils under the study which were originated from recent *Alluviums and Gneisses and Charnockites* (Report on Ground water Information, Ministry of Water Resources, GOI, 2007). The soils under the deficient zone would require fertilization of these micronutrients for better crop production.

Nutrient Index and rating of micronutrients in Karnataka light soil area of FCV Tobacco were calculated utilizing the formula as suggested by Parker *et al.,* (1951) and Ramamoorthy and Bajaj (1969) and classified according to the suggested classes (Table 5). Nutrient index values varied from 1.17 to 2.92 among the four micronutrients. NI value for available zinc is 1.17 which is falling under the low class. While the available iron (2.62), available copper (2.56) and available manganese (2.92) values were under high index class according to NI classification of Parker et al. (1951) (Table 4). Similar index classes were obtained according to Ramamoorthy and Bajaj (1969) classification except in case of available iron. The light textured soils were found deficient in Zn and medium in available iron with low to medium classes of index values in *Gir* district of Gujarat as reported by Polar, J.V and Chauhan, R.B (2015). The Karnataka light soils area under the FCV tobacco cultivation had significantly low available zinc content of 88 % with a lowest mean value of 0.19 µg/g (Kalahalli) and a nutrient index value of 1.17 (Low). The available iron content in the area was very low to medium (21.4 %) with a mean value of 9.78 µg/g. However, the nutrient index value for available iron was high (2.62) as the around 80 % samples recorded high to very high content. The contents of available copper and manganese in soils were found high to very high. The balanced fertilization along with addition of fertilizer micro nutrients especially zinc and use of organic matter in the form of farm yard manure and in-situ green manuring to the soils as per requirement of FCV tobacco grown in Karnataka light textured soils is recommended not only to improve the status of required micronutrients but also for sustaining the soil health, productivity and quality of FCV tobacco.

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Table 5: Nutrient Index classes *(Parker et., al. 1951 & Ramamoorthy and Bajaj, 1969)*

Nutrient index rating	**Low**	**Medium**	**High**
Parker et., al (1951)	< 1.50	1.50 – 2.50	> 2.50
Ramamoorthy and Bajaj (1969)	< 1.70	1.71 – 2.33	> 2.33

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