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Soil fertility mapping of macro nutrients and micro nutrients in Kumachahalli Micro watershed of Chamarajanagar District of Karnataka

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Abstract
The investigation was conducted at UAS, Bengaluru to know the soil physicochemical, macro and micronutrients status in Kumachahalli-2 micro watershed of Chamarajanagar district. Surface (64) soil samples were collected grid wise by using cadastral map of study area and were analyzed for their fertility status. pH, electrical conductivity and organic carbon value ranged from 6.45-8.60, 0.05 to 0.16 dSm^{-1}, 4.4 to 10.5 g kg^{-1}of soil respectively. The available N, P2O5, K_2O ranged from 101.69 to 303.56 kg ha^{-1}, 7.09 to 46.67 kg ha^{-1} and 170.40 to 484.80 kg ha^{-1}, respectively. The entire micro-watershed was low, low to medium and medium to high in available nitrogen, phosphorus and potassium content respectively. The exchangeable calcium, magnesium were sufficient with values of 2.0 to 13.0 meq./100g and 0.40 to 8.40 meq./100g, respectively. Sulphur was high with value of 9.97 to 67.08 ppm. Available micronutrients iron, manganese, zinc and copper ranged from 2.45 to 11.27 ppm, 0.85 to 15.91 ppm, 0.39 to 1.68 ppm and 0.48 to 1.91 ppm, respectively. Micronutrients *viz*., Cu, Mn, Zn, Fe were sufficient whereas B was medium in major portion of the micro-watershed area.

Keywords: Cadastral map, KSRSAC, grid, GIS, fertility map

Introduction
Soil is the most valuable natural resource, but is finite and non-renewable. It has been meeting basic requirements of human and animal population through production of food, fodder, fibre and fuel. The inherent ability of soils to supply nutrients for crop growth and maintenance of soil physical conditions to optimize crop yields are the most important components of soil fertility that virtually determine the productivity of agricultural system. There is an overwhelming need to manage and conserve the natural resource base with adoption of appropriate technologies that are economically viable, socially acceptable and environmentally non-degrading in all aspects.

A thorough and proper understanding of the morphological, physical, physico-chemical and chemical characteristics of the soils will give greater insight of the dynamics of the soil. Similarly different cropping systems are suitable for different soil groups as regards to production and productivity, for understanding the reasons of deficiency of available nutrients in soils with available macro and micronutrients was needed. Hence present investigation was undertaken for mapping Soil fertility status of major nutrients, micronutrients in Kumachahalli-2 micro watershed of Chamarajanagar district, Karnataka.

Materials and Methods
Kumachahalli-2 micro-watershed (Harve sub-watershed, Chamarajanagar taluk, Chamarajanagar district) is located between 11^0 51' 27.00" and 11^0 52' 35.02" North latitude and 76^0 46' 31.95"and $76^0$48' 41.84" East longitude covering an area of about 407 ha. The merged data of Cartosat-1 (PAN) and Resourcesat-2 (LISS IV) MX in the form of digital and geo-coded false colour composites (FCC) which were analysed in GIS environment long with cadastral maps. The required topographic map (C43E13) at 1:50,000 scale covering the study area was collected from the Survey of India and utilised for the study. The digital cadastral map of micro-watershed procured from the Karnataka State Remote Sensing Application Centre (KSRSAC), Bangalore was used for the study.

The Geographic Information System (GIS) with Arc GIS software was used for database creation and for creating the union of various thematic maps. A surface soil sample from 0 to 20 cm was collected at 250 m x 250 m grid samples in the study area. A total of 103 samples were collected from the fixed grid points. The processed samples were analyzed for physicochemical properties and available nutrients using standard procedure. The thematic maps were prepared using the detailed information obtained during field survey and laboratory data. Map was reclassified based on ratings of respective nutrients.

Results and Discussion

The soil reaction in the study area was neutral to moderately alkaline (6.45 to 8.50).The high pH of the soils might be due to the presence of high degree of base saturation as reported by Meena *et al.* (2006) [5]. Out of 407 ha, 224 ha was under slightly alkaline condition (54.99%), 165 ha under moderately alkaline condition (40.54%) and rest was in neutral range (Table 1). The extent of different classes of soil reaction is presented in Fig. 1. The EC values in watershed area ranged from 0.05 to 0.16 dS m^{-1}. About 97.89 per cent area covered under normal range. These soils did not show any specific relationship with depth. This may be due to free drainage conditions, which removed the released bases by percolation or by drainage water. These results were in confirmation with the findings of Kumar (2011) [4]. Organic carbon content of these surface soil samples was found low to medium and ranged from 4.4 to 10.1 g kg^{-1}. About 393 ha area of the micro watershed was under medium category (96.40%).

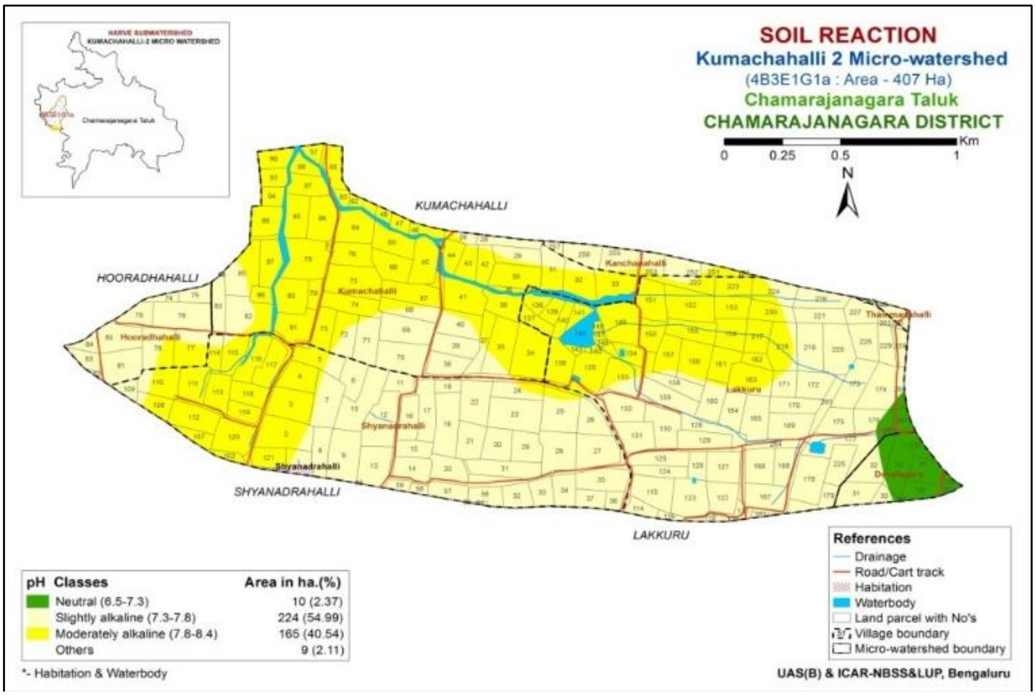

Fig 1: Fertility map of soil reaction

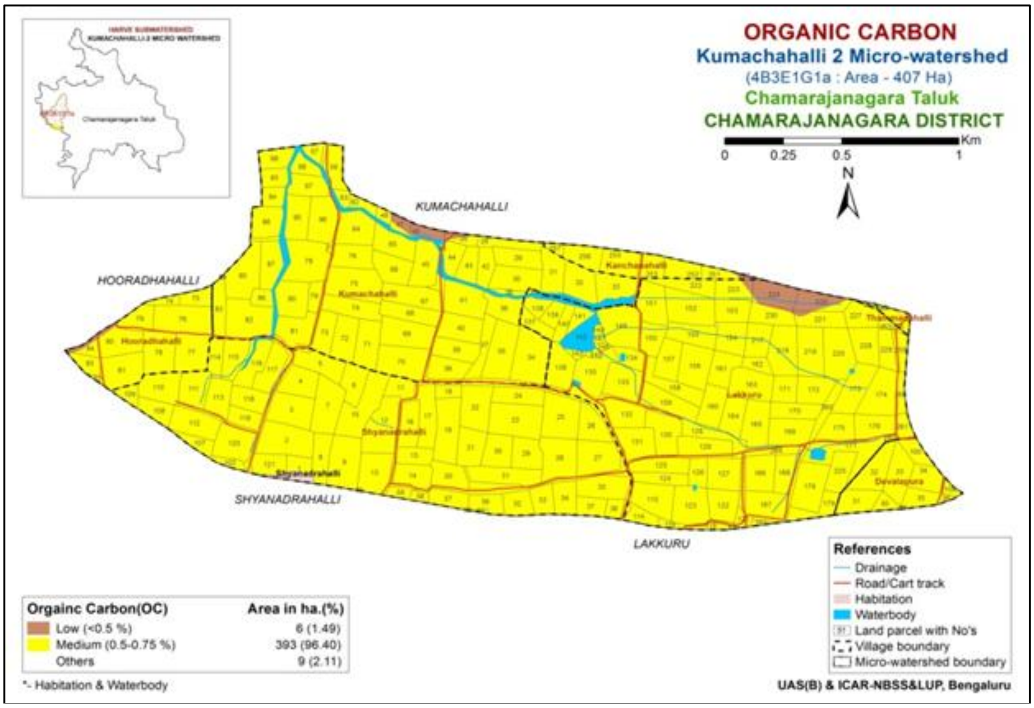

Fig 2: Fertility map of organic carbon content

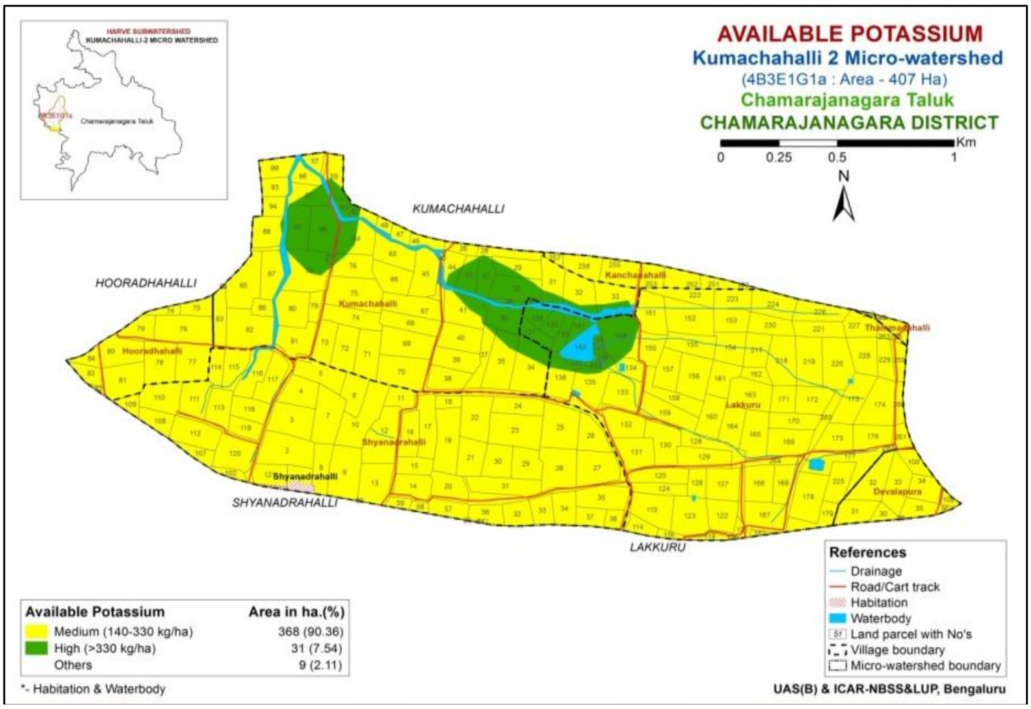

Fig 3: Fertility map of Available potassium

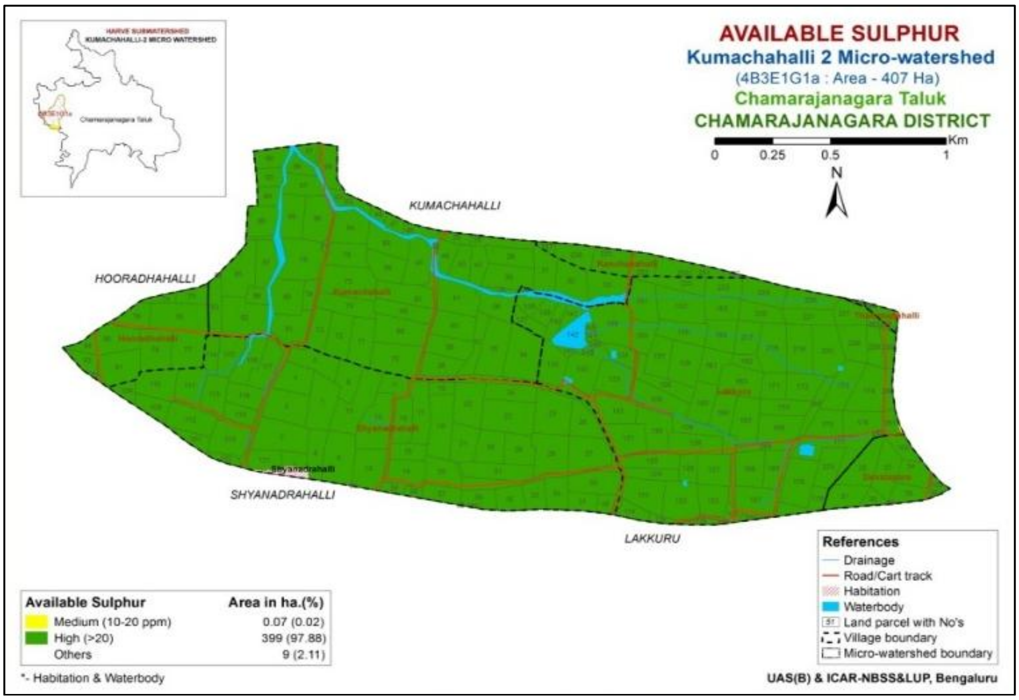

Fig 4: Fertility map of Available Sulphur

Soils coming under low in organic carbon content was 6 ha (1.49%).The low organic carbon content of the soils may be attributed to the prevalence of high temperature. The organic matter degradation and removal has taken place at faster rate coupled with low vegetation cover, thereby leaving less chances of accumulation of organic matter in the soil. These observations are in accordance with Basavaraju *et al.* (2005) [1]. The extent of different classes of organic carbon is presented in Fig. 2. The available nitrogen status in study area ranged from 101.69 to 303.56 kg ha^{-1}. The area falling under low category was 399 ha (Table 2). Lower organic matter content in this area might be due to low rainfall and low vegetation cover which facilitated faster degradation and removal of organic matter leading to nitrogen deficiency. The available phosphorus content was low to medium in major part of the micro watershed ranged from 7.09 to 46.67 kg ha^{-1}. Around 93.06% of study area (399 ha) coming under low to medium category. The red soils shown low values of available phosphorus which may be due to low CEC, clay content and soil reaction of <6.5 (Bopathi and Sharma, 2006) [5]. The soils (surface samples) were medium to high in available potassium and ranged from 170.40 to 484.80 kg ha^{-1}. This could be attributed to more intense weathering, release of labile K from organic residues, application of K fertilizers and upward translocation of potassium from lower depth along with capillary rise of ground water. The higher content of potassium might be due to the predominance of potash rich micaceous and feldspar minerals in parent rocks (Dasog and

Patil, 2011 and Pulakeshi *et al.*, 2014) [3, 7]. The extent of different classes of available potassium is presented in Fig. 3. The available sulphur content was medium to high in major part of the micro watershed ranging from 9.97 to 36.26 ppm. it may be due to the amount of clay having negative charge which shows repulsion (Anionic repulsion) to sulphate anion resulted as higher in availability. About 97.89 per cent of the area was under high range (399 ha) and 0.02 per cent was under medium range (0.07 ha). The extent of different classes of available sulphur is presented in Fig. 4. Entire study area was sufficient in exchangeable calcium, except small portion. Magnesium was found sufficient in major portion of area. The exchangeable Ca and Mg content in micro-watershed ranged from 2.0 to 13.0 meq./100g and 0.60 to 15.50meq./100g respectively. The available zinc was sufficient in the surface samples of micro-watershed as the soils were not subjected to intensive cultivation. Majority of surface samples of the micro-watershed fall under sufficient category of available iron. This type of variation may be due to soil management practices and cropping pattern adopted by different farmers (Nayak *et al.*, 2002) [6]. Iron was sufficient in maximum area of 233ha (57.20%) and was deficient in 166 ha (40.69%) of study area (Table 3). The extent of different classes of available Iron is presented in Fig. 5. The available manganese was found to be sufficient in entire study area, which may be due to neutral to low pH and nature of the parent material as reported by Vijayshekar *et al.* (2000) [8]. Zinc was sufficient in maximum

Table 1: pH, Salinity and Organic carbon classes of study area

pH classes	Area	
	Hectare	**Percentage**
Neutral (6.5-7.3)	10	2.37
Slightly Alkaline (7.3-7.8)	224	54.99
Moderately Alkaline (7.8-8.4)	165	40.54
Others	9	2.11
Salinity classes		
Normal (0.8 dSm^{-1})	399	97.89
Others	9	2.11
Organic carbon classes		
Low (<0.5%)	6	1.49
Medium (0.5-0.75%)	393	96.40
Others	9	2.11

Table 2: primary and secondary nutrients classes of study area

Available nitrogen classes	Area	
	Hectare	**Percentage**
Low(<280 $kgha^{-1}$)	399	97.91
Others	9	2.11
Available phosphorus classes		
Medium (23-56 $kgha^{-1}$)	399	97.89
Others	9	2.11
Available potassium classes		
Medium (140-330 $kgha^{-1}$)	369	90.36
High (>330 $kgha^{-1}$)	31	7.54
Others	9	2.11
Available calcium classes		
Sufficient (>1.5 meq/100g)	399	97.89
Others	9	2.11
Available magnesium classes		
Sufficient (>1.0 meq/100g)	399	97.89
Others	9	2.11
Available Sulphur class		
Medium (10-20 ppm)	0.07	0.02
High (>20 ppm)	399	97.89
Others	9	2.11

Table 3: Micro-nutrients classes of study area

Available copper classes	Area	
	Hectare	**Percentage**
Sufficient (>0.2 ppm)	399	97.89
Others	9	2.11
Available boron classes		
Medium (0.5- 1.0 ppm)	295	72.32
High (>1.0ppm)	104	25.59
Others	9	2.11
Available Zinc classes		
Deficient (<0.6 ppm)	0.45	0.11
Sufficient (>0.6 ppm)	398	97.78
Others	9	2.11

Available Iron classes		
Deficient (<4.5ppm)	166	40.69
Sufficient (>4.5 ppm)	233	57.20
Others	9	2.11
Available Manganese classes		
Sufficient (>1.0 ppm)	399	97.89
Others	9	2.11

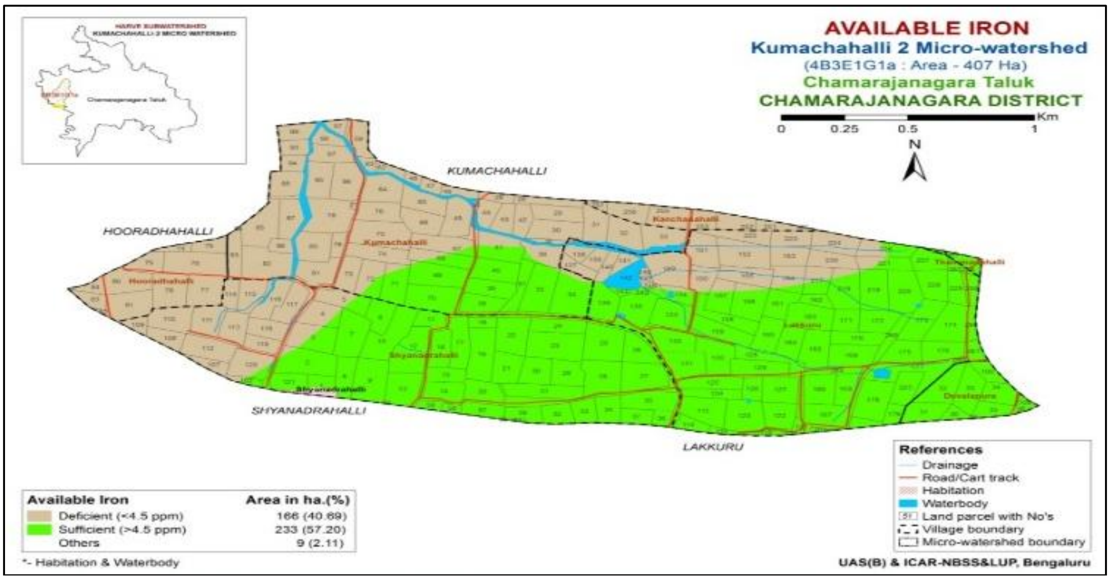

Fig 5: Fertility map of Available Iron

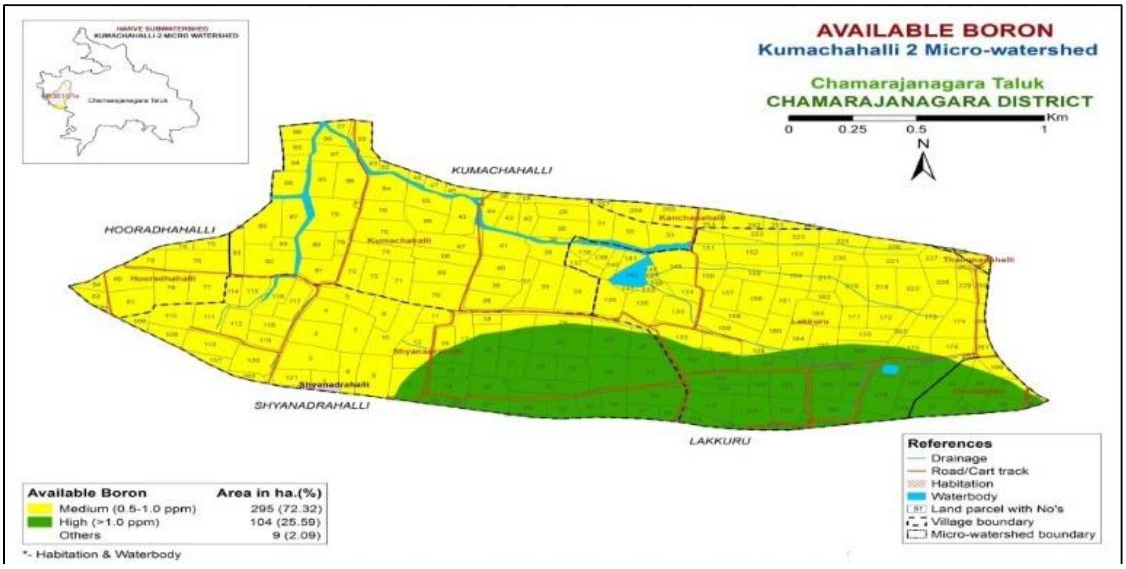

Fig 6: Fertility map of Available Boron

area of 398 ha (97.78%) and deficient soils occupied a minimum area of 0.45 ha (0.11%). Major samples of the micro-watershed area fall under medium category for available Boron (Fig. 6). 295ha of study area falls under medium category and 104 ha coming under high category of Boron class.

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References

1. Basavaraju, Naidu D, Ramavatharam MVS, Venkaih N, Rama Rao KG, Reddy KS. Characterization, classification and evaluation of soils in Chandragiri mandal of Chittoor district, Andhra Pradesh. Agropedolgy. 2005; 15:55-62.
2. Bopathi HK, Sharma KN. Phosphorus adsorption and desorption characteristics of some soils as affected by clay and available phosphorus content. Journal of Indian Society of Soil Science. 2006; 54(1):111-114.
3. Dasog GS, Patil PL. Genesis and classification of black, red and lateritic soils of Karnataka. Soil Science Research in North Karnataka, Dharwad chapter of ISSS (Ed.), 76 th annual convention of ISSS.2011, 110.
4. Kumar MD. Characterization and classification of soils of a micro-watershed on basalt parent rock in Northern transition zone of Karnataka. M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka, 2011.

5. Meena HB, Sharma RS, Rawat RS. Status of Macro and Micronutrients in some soils of Tonk district of Rajasthan. Journal of Indian Society of Soil Science. 2006; 54(4):508-512.
6. Nayak RK, Sahu GC, Nanda SSK. Characterization and classification of the soils of Central Research Station, Bhubaneswar. Agropedolgy. 2002; 12:1-8.
7. Pulakeshi HBP, Patil PL, Dasog GS. Characterization and classification of soil resources of soil resources derived from chlorite schist in northern transition zone of Karnataka. Karnataka Journal of Agricultural Science. 2014; 27(1):14-21.
8. Vijayasekhar R, Vittal Kuligod B, Basavaraj PK, Dasog GS, Salimath SB. Studies on micronutrient status in important black soil series of UKP command. Karnataka. Andhra Agricultural Journal. 2000; 47(1, 2):141-143.