# ASSESSMENT AND MAPPING OF SOME IMPORTANT SOIL PARAMETERS INCLUDING SOIL ACIDITY FOR THE STATE OF JHARKHAND (1:50,000 SCALE) TOWARDS RATIONAL LAND USE PLAN

## SARAIKELA DISTRICT


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# 1. INTRODUCTION

Reliable information on the location, extent and quality of soil and land resources is the first requirement in planning for the sustainable management of land resources. The components of land i.e., soils, climate, water, nutrient and biota are organised into eco-system which provide a variety of services that are essential to the maintenance of the life support system and the productive capacity of the environment. Our land mass is fixed, but the competition among different kinds of uses for this land is increasing because of rapidly rising global population. Therefore, integrated land resource planning and management are required to resolve these conflicts and soil resource survey seems to be a viable means in this process and knowledge of soil fertility status and problems of soils like soil acidity/alkalinity become essential for sustainable land use plan.

Soil fertility is an aspect of the soil-plant relationship. Fertility status of the soils is primarily and importantly dependent upon both the macro and micronutrient reserve of that soil. Continued removal of nutrients by crops, with little or no replacement will increase the nutrient stress in plants and ultimately lowers the productivity. The fertility status of the soils mainly depends on the nature of vegetation, climate, topography, texture of soil and decomposition rate of organic matter. Optimum productivity of any cropping systems depends on adequate supply of plant nutrients. GIS is a versatile tool used for integration of soil database and production of a variety of users specific and user-friendly interpretative maps. This further leads to accurately and scientifically interpret and plan some of the aspects like conservation of organic matter, soil reaction (pH) control and fertilization.

Keeping in view NBSS & LUP, Regional Centre, Kolkata in collaboration with Department of Soil Science and Agricultural Chemistry, BAU, Ranchi, Jharkhand undertook a project entitled "Assessment and mapping of some important soil parameters including soil acidity for the state of Jharkhand (1:50,000 scale) towards rational land use plan” from Department of Agriculture, Govt. of Jharkhand. The major objectives of the project were

- Preparation of districtwise soil acidity maps
- Preparation of districtwise soil fertility maps (Organic carbon, available N, P, K, S and available Fe, Mn, Zn, Cu and B)

The above maps will provide information regarding soil nutrients and soil acidity status for the districts, which will be very useful in identification of site specific problems for planning purposes. The present report deals with the above mentioned objectives of the Saraikela district, Jharkhand.

# 2. GENERAL DESCRIPTION OF THE AREA

## 2.1 Location and Extent

Saraikela district is located in southeastern part of the state. It is bounded by the Purulia district of west Bengal state in the north, Ranchi district in the west, West Singhbhum district in south and East Singhbhum district in south east and East. Total geographical area of the district is 2725 sq. km and population of 8,48,307 persons (Census of India, 2001). The district comprises two subdivision (Saraikela and Chandil) and eight development blocks viz. Govindpur, Adityapur, Saraikela, Kharsawan, Kuchai, Idhagarh, Chandil and Nimdih.

## 2.2 Physiography, Geology and Drainage

This area is dominated by hilly ranges, valleys and plateaus. Hilly and steeply sloping area are under dense forest cover. Dalma hills ranges are stretched from Chandil towards Ghatsila. Geologically the area is comprised of Archean lava, laterite and pre-cambrian fold mountains. Major river flowing in the district is Kharkai.

## 2.3 Climate

The district receives an annual rainfall of 1500 mm. and most of the rainfall occurs during the rainy season. The mean annual temperature remains at about $26^0$C. The temperature ranges from $16^0$C in winter months to $44^0$C in summer months.

## 2.4 Agriculture and Land Use

More than 40 per cent area of the district is under forest. The forest is full of kendu leaves, bamboo, sal, teak and other timber species. The hilly areas are mostly under forest with patches of cultivation on scarp areas. The valley land in the district provides suitable site for agricultural use. Major crops grown in the district are rice, oilseed and pulses.

**Land Use in Saraikela District (1997-98)**

| | | Saraikela | Jharkhand |
|---|---|---|---|
| 1. | Forest | 40.44 % | 29.2 % |
| 2. | Net sown area | 25.09 % | 22.7 % |
| 3. | Barren and unculturable waste | 8.89 % | 7.2 % |
| 4. | Non agricultural use | 6.34 % | 9.9 % |
| 5. | Orchards | 1.03 % | 2.5 % |
| 6. | Pasture | 0.56 % | |
| 7. | Culturable wasteland | 4.17 % | 3.5 % |
| 8. | Current and other fallow | 13.48 % | 25.0 % |

Source: Fertilizer and Agriculture Statistics, Eastern Region (2003-2004)

## 2.5 Soils

The soils occurring in different landforms have been characterised during soil resource mapping of the state on 1:250,000 scale (Haldar et al. 1996) and three soil orders namely Entisols, Inceptisols and Alfisols were observed in Saraikela district (Fig.1 and table 1). Alfisols were the dominant soils covering 53.8 percent of TGA followed by Inceptisols (26.5 %) and Entisols (17.4 %).

**Table 1. Soils of the district and their extent**

| Map unit | Taxonomy | Area ('00ha) | % of TGA |
|---|---|---|---|
| 15 | Loamy-skeletal, mixed, hyperthermic Lithic Ustorthents<br>Fine loamy, mixed, hyperthermic Ultic Haplustalfs | 137 | 5.0 |
| 18 | Loamy, mixed, hyperthermic Lithic Ustorthents<br>Fine loamy, mixed, hyperthermic Typic Haplustalfs | 51 | 1.9 |
| 19 | Loamy-skeletal, mixed, hyperthermic,Lithic Ustorthents<br>Fine loamy, mixed, hyperthermic, Typic Haplustepts | 46 | 1.7 |
| 27 | Fine-loamy, mixed, hyperthermic Typic Paleustalfs<br>Fine-loamy, mixed, hyperthermic Typic Haplustalfs | 35 | 1.3 |
| 33 | Fine, mixed, hyperthermic Typic Paleustalfs<br>Fine, mixed, hyperthermic Typic Rhodustalfs | 60 | 2.2 |
| 34 | Fine loamy, mixed, hyperthermic Typic Paleustalfs<br>Fine-loamy, mixed, hyperthermic Typic Rhodustalfs | 306 | 11.2 |
| 36 | Fine, mixed, hyperthermic, Typic Paleustalfs<br>Fine loamy, mixed, hyperthermic, Typic Rhodustalfs | 63 | 2.3 |
| 48 | Loamy-skeletal, mixed, hyperthermic Lithic Ustorthents<br>Fine, mixed, hyperthermic Typic Rhodustalfs | 88 | 3.2 |
| 52 | Loamy-skeletal, mixed, hyperthermic Lithic Haplustepts<br>Loamy, mixed, hyperthermic Lithic Ustorthents | 19 | 0.7 |
| 54 | Loamy, mixed, hyperthermic Lithic Ustorthents<br>Fine, mixed, hyperthermic Typic Haplustalfs | 198 | 7.2 |
| 55 | Loamy, mixed, hyperthermic Lithic Ustorthents<br>Fine, mixed, hyperthermic Typic Haplustalfs | 111 | 4.1 |
| 56 | Fine, mixed, hyperthermic Typic Haplustalfs<br>Fine, mixed, hyperthermic Typic Endoaqualfs | 219 | 8.1 |
| 58 | Fine, mixed, hyperthermic Typic Haplustepts<br>Fine, mixed, hyperthermic Fluventic Haplustepts | 49 | 1.8 |
| 64 | Loamy, mixed, hyperthermic Lithic Ustorthents<br>Fine, mixed, hyperthermic Typic Paleustalfs | 78 | 2.9 |
| 67 | Coarse loamy, mixed, hyperthermic Typic Ustorthents<br>Fine, mixed, hyperthermic Typic Haplustalfs | 67 | 2.5 |
| 68 | Fine loamy, mixed, hyperthermic Typic Plinthustalfs<br>Fine, mixed, hyperthermic Typic Endoaqualfs | 397 | 14.6 |
| 70 | Fine loamy, mixed, hyperthermic Typic Haplustepts<br>Fine, mixed, hyperthermic Aeric Endoaqualfs | 6 | 0.2 |
| 71 | Fine, mixed, hyperthermic Aeric Endoaquepts<br>Fine, mixed, hyperthermic Typic Haplustepts | 574 | 21.1 |
| 72 | Fine loamy, mixed, hyperthermic Typic Plinthustalfs<br>Fine loamy, mixed, hyperthermic Typic Plinthaqualfs | 14 | 0.5 |
| 73 | Fine, mixed, hyperthermic Aeric Endoaquepts<br>Very fine, mixed, hyperthermic Vertic Endoaquepts | 66 | 2.4 |
| 74 | Fine loamy, mixed, hyperthermic Typic Plinthaqualfs<br>Fine, mixed, hyperthermic Aeric Endoaqualfs | 77 | 2.8 |
| Miscellaneous | | 64 | 2.3 |
| Total | | 2725 | 100.0 |

## 3. METHODOLOGY

The base map of the district was prepared on 1:50,000 scale using Survey of India toposheets (73E/16,73F/9,10,13,14,15,73I/4,8 and 73J/1,2) and all the maps were demarcated with grid points at 2.5 km interval.

Surface soil samples from demarcated grid points and other related informations were collected through field survey. Soil samples were air dried, processed and analysed for pH, organic carbon, available phosphorous and potassium (Page *et al.*, 1982), available nitrogen (Subbaiah and Asija, 1956), available sulphur by using 0.15 percent $CaCl_2$ as the extractant (William and Steinbergs, 1959), available (DTPA extractable) Fe, Mn, Zn and Cu (Lindsay and Norvell, 1978) and available B (hot water soluble) by Carmine method (Hatcher and Wilcox, 1950).

The soils are grouped under different soil reaction classess viz extreamely acidic (pH<4.5), very strongly acidic (pH 4.5 – 5.0 ), strongly acidic (pH 5.1 – 5.5), moderately acidic (pH 5.6-6.0), slightly acidic (pH 6.1-6.5), neutral (pH 6.6-7.3), slightly alkaline (pH 7.4-7.8), moderately alkaline (pH 7.9-8.4), strongly alkaline (pH 8.5-9.0) according to Soil Survey Manual (IARI, 1970).The soils are rated as low (below 0.50 %), medium (0.50-0.75 %) and high (above 0.75 %) in case of organic carbon, low (<280 kg $ha^{-1}$), medium (280 to 560 kg $ha^{-1}$) and high (>560 kg $ha^{-1}$) in case of available nitrogen, low (< 10 kg $ha^{-1}$), medium (10 to 25 kg $ha^{-1}$) and high (> 25 kg $ha^{-1}$) for available phosphorus, low (< 108 kg $ha^{-1}$), medium (108 to 280 kg $ha^{-1}$) and high (> 280 kg $ha^{-1}$) for available potassium and low (<10 mg $kg^{-1}$), medium (10-20 mg $kg^{-1}$) and high (> 20 mg $kg^{-1}$) for available sulphur (Singh *et. al.* 2004, Mehta *et. al.*1988). Critical limits of Fe, Mn, Zn, Cu and B, which separate deficient from non-deficient soils followed in India are 4.5, 2.0, 0.5, 0.2 and 0.5 mg $kg^{-1}$ respectively. (Follet and Lindsay, 1970 and Berger and Truog, 1940).

The maps for the above mentioned parameters have been prepared using Geographic Information System (GIS) from data generated by analysis of grid soil samples.

# 4. SOIL ACIDITY AND FERTILITY STATUS

## 4.1 Soil Reaction

Soil pH is an important soil property, which affects the availability of several plant nutrients. It is a measure of acidity and alkalinity and reflects the status of base saturation. The soils of the district have been grouped under seven soil reaction classes according to Soil Survey Manual (IARI, 1970).

The soil pH ranges from 4.5 to 6.6. The soil reaction classes with area are given in table 2 and figure 2. The data reveals that soils of majority area are acidic (96.1 % of TGA), in which 42.9 percent area is strongly acidic, 24.2 percent very strongly acidic, 23.1 percent moderately acidic and 5.9 percent slightly acidic in reaction. Soils of 1.6 percent area of the district are neutral in reaction.

**Table 2. Soils under different reaction classes**

| Soil reaction | Area ('00ha) | % of the TGA |
|---|---|---|
| Very strongly acidic (pH 4.5 to 5.0) | 659 | 24.2 |
| Strongly acidic (pH 5.1 to 5.5) | 1169 | 42.9 |
| Moderately acidic (pH 5.6 to 6.0) | 628 | 23.1 |
| Slightly acidic (pH 6.1 to 6.5) | 162 | 5.9 |
| Neutral (pH 6.6 to 7.3) | 43 | 1.6 |
| Miscellaneous | 64 | 2.3 |
| Total | 2725 | 100.0 |

## 4.2 Organic Carbon

The effect of soil organic matter on soil properties is well recognized. Soil organic matter plays a vital role in supplying plant nutrients, cation exchange capacity, improving soil aggregation and hence water retention and soil biological activity.

The organic carbon content in the district ranges from 0.26 to 1.55 %. They are mapped into three classes i.e., low (below 0.5 %), medium (0.5-0.75

%) and high (above 0.75 %) (Table 3 and Figure 3). From table 3 it is seen that 60.4 percent area of the district shows high organic carbon content. Medium and low organic carbon content constitute 22.2 and 15.1 percent area respectively.

**Table 3. Organic carbon status**

| Organic carbon (%) | Area ('00ha) | % of the TGA |
|---|---|---|
| Low (below 0.50 %) | 411 | 15.1 |
| Medium (0.50-0.75 %) | 605 | 22.2 |
| High (above 0.75 %) | 1645 | 60.4 |
| Miscellaneous | 64 | 2.3 |
| Total | 2725 | 100.0 |

**4.3 Macronutrients**

Nutrients like nitrogen (N), phosphorus (P) and potassium (K) are considered as primary nutrients and sulphur (S) as secondary nutrient. These nutrients help in proper growth, development and yield differentiation of plants and are generally required by plants in large quantity.

**4.3.1 Available Nitrogen**

Nitrogen is an integral component of many compounds including chlorophyll and enzyme essential for plant growth. It is an essential constituent for amino acids which is building blocks for plant tissue, cell nuclei and protoplasm. It encourage aboveground vegetative growth and deep green colour to leaves. Deficiency of nitrogen decreases rate and extent of protein synthesis and result into stunted growth and develop chlorosis.

Available nitrogen content in the surface soils of the district ranges between 183 and 611 kg/ha and details are given in table 4 and figure 4. Majority soils (80.2 % of TGA) of the district have medium availability of nitrogen (280-560 kg $ha^{-1}$) and soils of 12.4 percent area have low available nitrogen content (<280 kg $ha^{-1}$).

**Table 4. Available nitrogen status in the surface soils**

| Available nitrogen (kg $ha^{-1}$) | Area ('00ha) | % of the TGA |
|---|---|---|
| Low (below 280) | 337 | 12.4 |
| Medium (280-560) | 2185 | 80.2 |
| High (above 560) | 139 | 5.1 |
| Miscellaneous | 64 | 2.3 |
| Total | 2725 | 100.0 |

**4.3.2 Available Phosphorus**

Phosphorus is important component of adenosine di-phosphate (ADP) and adenosine tri-phosphate (ATP), which involves in energy transformation in plant. It is essential component of deoxyribonucleic acid (DNA), the seat of genetic inheritance in plant and animal. Phosphorous take part in important functions like photosynthesis, nitrogen fixation, crop maturation, root development, strengthening straw in cereal crops etc. The availability of phosphorous is restricted under acidic and alkaline soil reaction mainly due to P-fixation. In acidic condition it get fixed with aluminum and iron and in alkaline condition with calcium.

Available phosphorus content in these soils ranges between 0.8 and 25.1 kg/ha and their distribution is given in table 5 and figure 5. Data reveals that majority of the soils are low (94.9 % of TGA) followed by medium (2.7 % of TGA) and high (0.1 % of TGA) content of available phosphorous.

**Table 5. Available phosphorous status in the surface soils**

| Available phosphorous (kg $ha^{-1}$) | Area ('00ha) | % of the TGA |
|---|---|---|
| Low (below 10) | 2585 | 94.9 |
| Medium (10-25) | 74 | 2.7 |
| High (above 25) | 2 | 0.1 |
| Miscellaneous | 64 | 2.3 |
| Total | 2725 | 100.0 |

### 4.3.3 Available Potassium

Potassium is an activator of various enzymes responsible for plant processes like energy metabolism, starch synthesis, nitrate reduction and sugar degradation. It is extremely mobile in plant and help to regulate opening and closing of stomata in the leaves and uptake of water by root cells. It is important in grain formation and tuber development and encourages crop resistance for certain fungal and bacterial diseases.

Available potassium content in these soils ranges between 43 and 420 kg/ha and details about area and distribution is given in table 6 and figure 6. The data reveals that most of the soils (64.8 % of TGA) have medium available potassium content (108-280 kg $ha^{-1}$). Soils of 27.4 percent area are low (below 108) and 5.5 percent area are high (above 280 kg $ha^{-1}$) in available potassium content.

**Table 6. Available potassium status in the surface soils**

| Available potassium (kg $ha^{-1}$) | Area ('00ha) | % of the TGA |
|---|---|---|
| Low (below 108) | 746 | 27.4 |
| Medium (108-280) | 1765 | 64.8 |
| High (above 280) | 150 | 5.5 |
| Miscellaneous | 64 | 2.3 |
| Total | 2725 | 100.0 |

### 4.3.4 Available Sulphur

Sulphur is essential in synthesis of sulphur containing amino acids (cystine, cysteine and methionine), chlorophyll and metabolites including co-enzyme A, biotin, thiamine, or vitamin B1 and glutathione. It activates many proteolytic enzymes, increase root growth and nodule formation and stimulate seed formation.

The available sulphur content in the soils ranges from 0.36 to 81.67 mg $kg^{-1}$ and details about area and distribution is given in table 7 and figure 7. Soils of 40.9 percent of the area are low (<10 mg $kg^{-1}$) whereas soils of 26.2 and 30.6 percent area are medium (10-20 mg $kg^{-1}$) and high (>20 mg $kg^{-1}$) in available sulphur content respectively.

**Table 7. Available sulphur status in the surface soils**

| Available sulphur (mg $kg^{-1}$) | Area ('00ha) | % of the TGA |
|---|---|---|
| Low (<10) | 1113 | 40.9 |
| Medium (10-20) | 714 | 26.2 |
| High (>20) | 834 | 30.6 |
| Miscellaneous | 64 | 2.3 |
| Total | 2725 | 100.0 |

## 4.4 Micronutrients

Proper understanding of micronutrients availability in soils and extent of their deficiencies is the pre-requisite for efficient management of micronutrient fertilizer to sustain crop productivity. Therefore, it is essential to know the micronutrients status of soil before introducing any type of land use.

### 4.4.1 Available Iron

Iron is constituent of cytochromes, haems and nonhaem enzymes. It is capable of acting as electron carrier in many enzyme systems that bring about oxidation-reduction reactions in plants. It promotes starch formation and seed maturation.

The available iron content in the surface soils ranges between 14.9 and 96.8 mg $kg^{-1}$. As per the critical limit of available iron (> 4.5 mg $kg^{-1}$), all the soils are sufficient in available iron. They are grouped and mapped into four classes. Majority of the soils (60.5 % of TGA) have available iron content between the range of 50 to 100 mg $kg^{-1}$. The details of area and distribution is presented in table 8 and figure 8.

**Table 8. Available iron status in the surface soils**

| Available iron (mg $kg^{-1}$) | Area ('00ha) | % of the TGA | Rating |
|---|---|---|---|
| <15 | 101 | 3.7 | Sufficient |
| 15-25 | 177 | 6.5 | |
| 25-50 | 735 | 27.0 | |
| 50-100 | 1648 | 60.5 | |
| Miscellaneous | 64 | 2.3 | |
| Total | 2725 | 100.0 | |

### 4.4.2 Available Manganese

Manganese is essential in photosynthesis and nitrogen transformations in plants. It activates decarboxylase, dehydrogenase, and oxidase enzymes.

The available manganese content in surface soils ranges between 9.6 and 48.8 mg $kg^{-1}$. As per the critical limit of available manganese (> 2 mg $kg^{-1}$), all the soils are sufficient in available manganese. They are grouped and mapped into three classes. Soils of 83.8 % area of district have available Mn content between 25 and 50 mg $kg^{-1}$. The details of area and distribution are presented in table 9 and figure 9.

**Table 9. Available manganese status in the surface soils**

| Available manganese (mg $kg^{-1}$) | Area ('00ha) | % of the TGA | Rating |
|---|---|---|---|
| <10 | 19 | 0.7 | Sufficient |
| 10-25 | 359 | 13.2 | |
| 25-50 | 2283 | 83.8 | |
| Miscellaneous | 64 | 2.3 | |
| Total | 2725 | 100.0 | |

### 4.4.3 Available Zinc

Zinc plays role in protein synthesis, reproductive process of certain plants and in the formation starch and some growth hormones. It promotes seed maturation and production.

The available zinc in surface soils ranges between 0.44 and 5.70 mg $kg^{-1}$. They are grouped and mapped into five classes. Soils of Majority of soils (94.1 % of TGA) are sufficient (>0.5 mg $kg^{-1}$) whereas soils of 3.6 percent area are deficient (<0.5 mg $kg^{-1}$) in available zinc. The details of area and distribution are presented in table 10 and figure 10.

**Table 10. Available zinc status in the surface soils**

| Available zinc (mg $kg^{-1}$) | Area ('00ha) | % of the TGA | Rating |
|---|---|---|---|
| <0.5 | 98 | 3.6 | Deficient |
| 0.5-1.0 | 439 | 16.1 | Sufficient |
| 1.0-2.0 | 1188 | 43.6 | |
| 2.0-3.0 | 632 | 23.2 | |
| 3.0-6.0 | 304 | 11.2 | |
| Miscellaneous | 64 | 2.3 | |
| Total | 2725 | 100.0 | |

### 4.4.4 Available Copper

Copper involves in photosynthesis, respiration, protein and carbohydrate metabolism and in the use of iron. It stimulates lignifications of all the plant cell wall and is capable of acting as electron carrier in many enzyme systems that bring about oxidation-reduction reactions in plants.

The available copper status in surface soils ranges between 0.16 and 8.62 mg $kg^{-1}$. They are grouped and mapped into six classes. Majority of soils (92.3 % of TGA) have sufficient amount of available copper (>0.2 mg $kg^{-1}$) and soils of 5.4 % area are deficient in available copper (<0.2 mg $kg^{-1}$). The details of area and distribution are presented in table 11 and figure 11.

**Table 11. Available copper status in the surface soils**

| Available copper (mg kg$^{-1}$) | Area ('00ha) | % of the TGA | Rating |
|---|---|---|---|
| <0.2 | 147 | 5.4 | Deficient |
| 0.2-0.5 | 38 | 1.4 | Sufficient |
| 0.5-1.0 | 112 | 4.1 | |
| 1.0-2.0 | 400 | 14.7 | |
| 2.0-4.0 | 847 | 31.1 | |
| 4.0-9.0 | 1117 | 41.0 | |
| Miscellaneous | 64 | 2.3 | |
| Total | 2725 | 100.0 | |

### 4.4.5 Available Boron

Boron increases solubility and mobility of calcium in the plant and it act as regulator of K/Ca ratio in the plant. It is required for development of new meristematic tissue and also necessary for proper pollination, fruit and seed setting and translocation of sugar, starch and phosphorous etc. It has role in synthesis of amino acid and protein and regulates carbohydrate metabolism.

The available boron content in the soils ranges from 0.02 to 3.03 mgkg$^{-1}$ and details about area and distribution is given in table 12 and figure 12. The critical limit for deficiency of the available boron is <0.5. Soils of 54.9 percent area of district are deficient (<0.50 mgkg$^{-1}$) whereas 42.8 percent area are sufficient (>0.50 mgkg$^{-1}$) in available boron content.

**Table 12. Available boron status in the surface soils**

| Available boron (mg kg$^{-1}$) | Area ('00ha) | % of the TGA | Rating |
|---|---|---|---|
| <0.25 | 694 | 25.5 | Deficient |
| 0.25-0.50 | 802 | 29.4 | |
| 0.50-0.75 | 555 | 20.4 | Sufficient |
| >0.75 | 610 | 22.4 | |
| Miscellaneous | 64 | 2.3 | |
| Total | 2725 | 100.0 | |

## 5. SUMMARY

The soil pH ranges from 4.5 to 6.6. Soils of majority area are acidic (96.1 % of TGA), in which 42.9 percent area is strongly acidic, 24.2 percent very strongly acidic, 23.1 percent moderately acidic and 5.9 percent slightly acidic in reaction. Soils of 1.6 percent area of the district are neutral in reaction. Organic carbon content in the district ranges from 0.26 to 1.55 %. Soils of 60.4 percent area of the district shows high organic carbon content. Medium and low organic carbon content constitute 22.2 and 15.1 percent area respectively.

Available nitrogen content in the surface soils of the district ranges between 183 and 611 kg/ha. Majority soils (80.2 % of TGA) of the district have medium availability of nitrogen and soils of 12.4 percent area have low available nitrogen content. Available phosphorus content in these soils ranges between 0.8 and 25.1 kg/ha. Majority of the soils are low (94.9 % of TGA) followed by medium (2.7 % of TGA) and high (0.1 % of TGA) in available phosphorous content. Available potassium content in these soils ranges between 43 and 420 kg/ha. Soils of majority area (64.8 % of TGA) have medium available potassium content. Soils of 27.4 percent area are low and 5.5 percent area are high in available potassium content. The available sulphur content in the soils ranges from 0.4 to 81.7 mg $kg^{-1}$. Soils of 40.9 percent of the area are low whereas soils of 26.2 and 30.6 percent area are medium and high in available sulphur content respectively.

Soils are analyses for available (DTPA extractable) micronutrients and seen that all the soils are sufficient in available iron and manganese whereas soils of 3.6 and 5.4 percent area are deficient in available zinc and copper respectively. The available boron content in the soils ranges from 0.02 to 3.03 $mgkg^{-1}$. Soils of 54.9 percent area of district are deficient (<0.50 $mgkg^{-1}$) whereas 42.8 percent area are sufficient (>0.50 $mgkg^{-1}$) in available boron content.

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