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# Evaluation of soil fertility status in Chikkmaskal village of Ramanagara district in eastern dry zone of Karnataka

**Chandrakant, Kamalabai S and Nagaraj KH**

**Abstract**

Soil fertility reaction were acidic to neutral in soil reaction (4.41 to 8.33), low in electrical conductivity (0.10 to 1.21dS $m^{-1}$), low to medium in organic carbon content (0.12 to 0.82 per cent), low to medium in available nitrogen (77.77to 421.47 kg $ha^{-1}$), low in available phosphorus (5.04 to 22.67 kg $ha^{-1}$) and low to medium in available potassium (39.60 to 302.40 kg $ha^{-1}$) in almost samples. Whereas, among the micronutrients manganese (2.92 to 25.24 ppm), iron (1.34 to 17.26 ppm) and copper content (0.10 to 0.88 ppm) were higher compared to zinc (0.16 to 0.88 ppm) and boron (0.20 to 1.54 ppm) which were low in soil.

**Keywords:** Fertility, secondary nutrients, micro nutrients.

## Introduction

Soil is the "soul" of infinite life and generally refers to the loose material composed of weathered rock and other materials including partly decayed organic matter. It is a reservoir of nutrients and plays a vital role in supporting the growth of crops and other vegetation maintaining the earth's environment clean. It also acts as a source and sink for atmospheric gases (Ratan Chand Sharma and Shivani Dogra. 2011) [10].

The physical and chemical attributes of soil regulates soil biological activity and exchange of ions between the solid, liquid and gaseous phases which influence nutrient cycling, plant growth and decomposition of organic materials. Organic carbon content in soils has an index of available nitrogen. Organic matter is one of the important factors to determine quality of soil and serves as sources of nutrients for improving physical and biological properties of soils in addition to productivity. The soil chemical environment is dynamic and reactions that maintain dilute solution of nutrient elements are indispensable for continual plant growth.

A soil fertility status for a particular area can prove highly beneficial in guiding the farmers and planners in ascertaining the requirement of various fertilizers in a season/year and making projections for increased requirement based on cropping pattern and intensity (Larsen and Robert. 1991) [4].

There is an increasing pressure to reduce the application of fertilizers in intensive agriculture and to minimize non-point sources of pollution of both surface and ground waters. Therefore, application of variable nutrient fertilizer rather than uniform rates of fertilizer has been proposed to avoid the application of fertilizers where it will not be properly utilized by the crops (Miller *et al.*, 1988 and Trivedy and Goel. 1986) [6, 14] If agricultural productivity has to be increased, precision farming is desirable which is widely adopted in developed countries but yet to take firm ground in India. Tailoring the management practices carefully for the soil and crop that suits to different conditions found in each field is called precision farming (Miller *et al.*, 1988) [6]. Therefore fertilizer recommendations based on soil fertility status will be the first step towards precision farming which will also help to reduce non-point sources of pollution of water bodies.

Keeping these points in view, investigation was carried out to study the evaluation of soil fertility status of Kudur hobli in Ramanagara district.

## Material and methods

107 surface soil samples were collected from farmer's field in and around the vicinity of different crops *viz.*, coconut, arecanut, paddy, ragi, maize, field bean etc. representing major production system in Chikkmaskal village of Kudur hobli in Magadi Taluk of Ramanagara district of Karnataka state which comes under eastern dry zone of Karnataka represents sandy to sandy loamy in nature.

Soil samples were brought to laboratory, processed, later the samples were analyzed for pH (1: 2.5), electrical conductivity, organic carbon, major nutrient (nitrogen, phosphorus and potassium) and micronutrient (Fe, Mn, Zn, Cu and B) content following standard procedures as described in Jackson (1957). Nutrient ranges and mean values of the each nutrient was calculated following standard procedures as described by Gomez and Gomez (1984) [2].

## Results and discussion

The soil chemical properties of the studied area are given in Table 1 and 2.

**Table 1:** Range of soil chemical properties of study area in Kudur hobli of Ramanagara district in eastern dry zone of Karnataka

| Parameters | Ranges from | Mean value |
|---|---|---|
| pH (1:2.5) | 4.41-8.33 | 6.31 |
| EC (dS $m^{-1}$) | 0.10-1.21 | 0.47 |
| OC (%) | 0.12-0.82 | 0.48 |
| N (kg $ha^{-1}$) | 77.77-421.47 | 217.69 |
| $P_2O_5$ (kg $ha^{-1}$) | 5.04-22.67 | 16.67 |
| $K_2O$ (kg $ha^{-1}$) | 39.60-375.60 | 193.76 |
| Mn (ppm) | 2.92-25.24 | 9.44 |
| Fe (ppm) | 1.34-17.26 | 5.63 |
| Zn (ppm) | 0.16-4.99 | 0.75 |
| Cu (ppm) | 0.10-0.88 | 0.39 |
| B (ppm) | 0.20-1.54 | 0.46 |

**Table 2:** Nutrient status of study area in Kudur hobli of Ramanagara district in eastern dry zone of Karnataka.

| **1. Soil pH classes** | **Soil reaction** | **Soil samples (%)** |
|---|---|---|
| a) Acidic | <6.5 | 53.27 |
| b) Neutral | 6.5-8.5 | 56.72 |
| c) Alkaline | >8.5 | 0 |
| **2. Electrical Conductivity** | **EC (dS $m^{-1}$)** | |
| a) Low | <0.8 | 89.71 |
| b) Medium | 0.8-1.6 | 10.29 |
| c) High | 1.6-2.5 | 0 |
| d) Very High | >2.5 | 0 |
| **3. Organic Carbon (%)** | **OC (%)** | |
| a) Low | <0.5 | 48.59 |
| b) Medium | 0.5-0.75 | 45.8 |
| c) High | >0.75 | 3.73 |
| **4. Available Nitrogen** | **N (kg $ha^{-1}$)** | |
| a) Low | <280 | 70.09 |
| b) Medium | 280-560 | 29.91 |
| c) High | >560 | 0 |
| **5. Available Phosphorus** | **$P_2O_5$ (kg $ha^{-1}$)** | |
| a) Low | <22.9 | 100 |
| b) Medium | 22.9-56.33 | 0 |
| c) High | >56.33 | 0 |
| **6. Available Potassium** | **$K_2O$ (kg $ha^{-1}$)** | |
| a) Low | <141 | 6.54 |
| b) Medium | 141-336 | 93.46 |
| c) High | >336 | 0 |
| **7. Available Manganese** | **Mn (ppm)** | |
| a) Deficient | <2.0 | 0 |
| b) Sufficient | >2.0 | 100 |
| **8. Available Iron** | **Fe (ppm)** | |
| a) Deficient | <2.5 | 9.34 |
| b) Sufficient | 2.5-4.5 | 90.66 |
| **9. Available Zinc** | **Zn (ppm)** | |
| a) Deficient | >0.6 | 55.14 |
| b) Sufficient | >0.6 | 44.86 |
| **10. Available Copper** | **Cu (ppm)** | |
| a) Deficient | <2.0 | 6.54 |
| b) Sufficient | >2.0 | 93.46 |
| **11. Available Boron** | **B (ppm)** | |
| a) Deficient | <0.5 | 72.89 |
| b) Sufficient | >0.5 | 27.11 |

**Soil pH:** Surface soil reaction of collected soil samples revealed that soil pH ranges from 4.41 to 8.33. Among the total soil samples 53.27 per cent acidic and46.72 per cent were neutral in pH. It shows that most of the soil samples were slightly acidic to neutral in reaction. Most of the soils are acidic in reaction mainly due to leaching of bases in the gentle slope might have contributed for the lower pH and it also might be due to heavy use of high acid forming fertilizers. These results are in accordance with Nalina *et al*. (2016) [7]

**Electrical conductivity:** Electrical conductivity is a measure of total soluble salts concentration which ranges from 0.10 to 1.21 dS $m^{-1}$ from the total collected soil samples. From the 89.71 per cent were low in electrical conductivity and 10.29 per cent soil samples were medium in electrical conductivity in nature. It reveals that most of the soil samples were low in electrical conductivity. EC values were low which may be attributed to excessive drainage of soils and consequently leaching of salts to downward layers resulting in low salt concentration. Similar results were reported by Poonia and Bhumbla (1973) [8].

**Organic carbon:** Organic carbon ranges from 0.12 to 0.82per cent soil. From the total samples 48.59 per cent were low, 45.80 per cent were in medium and 3.73 per cent were high in nature. It reveals that most of the soil samples were low to medium in nature. The low OC can be attributed to continuous cultivation, removal of crops residues without return, effects of water and wind erosion which preferentially remove the soil colloids including the humidified organic fractions (Sanda *et al*., 2012) [10].

**Available nitrogen:** Available nitrogen ranges from 77.77 to 424.47 kg $ha^{-1}$. Among the total soil samples 70.09 per cent samples were low in status and 29.91 per cent were medium in nature. It shows that surface available nitrogen were low to medium in nature in Kudur hobli of Ramanagara district. Most of the soil samples were poor or low in available nitrogen was mainly attributed to semi-arid environment with low rainfall and it might also be due to low organic carbon status of the soils in the study area which contributing towards very low or low available nitrogen status of the soils. These results are in accordance with the study of Anil Kumar *et.al*. (2002) [1].

**Available phosphorus:** Available phosphorus ($P_2O_5$) ranges from 5.04 to 22.67 kg $ha^{-1}$. Among the total soil samples, all samples were low in available phosphorus. The low in available phosphorus might be due to sandy type of soils having low clay content and high sand particles, which lead to loss of soluble available phosphorous either by rain or acidification and also might be due to effect of phosphorous fixation by the soil flora and other soil microorganisms (Shivanna and Nagendrappa. 2014) [11].

**Available Potassium:** From the collected surface soil samples, available potassium ($K_2O$) ranges from 39.60 to 302.40 kg $K_2O$ $ha^{-1}$. From the given collected samples, 6.54 per cent were low and 93.45 per cent were medium in available potassium status from the given selected area of Ramanagara district. Most of the soil samples were low to medium in available potassium. Low to medium in available potassium might be due to semi-arid environment with low rainfall and intensive agriculture with maize and vegetable crops may be the reason to decline in fertility of available potassium (Nalina *et al*., 2016) [7].

**DTPA extractable micronutrients (ppm):** From the collected soil samples, DTPA extractable Manganese ranges from 2.92 to 25.24 ppm. Among the total collected surface samples all are sufficient in nature. DTPA extractable iron ranges from 1.34 to 17.26 ppm. From the total samples, 9.34 per cent were deficient and 90.65 per cent were sufficient in nature. DTPA extractable zinc from the collected farmer's field which ranges from 0.16 to 4.99 ppm. Whereas, 55.14 per cent were deficient and 44.85 per cent were sufficient in DTPA extractable zinc. DTPA extractable copper from the collected soil samples ranges from 0.10 to 0.88 ppm, among the total samples 6.54 per cent were deficient in copper and 93.45 per cent were sufficient in DTPA extractable copper. DTPA extractable boron from the given soil samples ranges from 0.20 to 1.54 ppm. From the total collected farmer's field soil samples, 72.89 per cent were low and 27.10 were sufficient in DTPA extractable boron. It reveals that Mn, Fe and Cu were sufficient whereas, Zn and B were deficient from the given collected farmers field soil samples in Kudur hobli of Ramanagara district.

The deficiency of Zn and B could be attributed to low clay content and low organic matter content in soils (Srikanth *et al*., 2008) [13]. Low organic matter content which increases oxidation and precipitation of micronutrients. Similar were observed by Sharma *et al*. (2003) [12] where, the availability increased with increase in organic matter because it protects oxidation and precipitation of micronutrients and it also might be due to presence of granite gneiss parent material which assist fast removal of zinc and boron from the soil solum. The sufficiency of Mn, Fe, Cu nutrients in soil may due to pH of soil, where soil was acidic to neutral in nature and also might be due highly porous nature of tropical soils originated from granite gneiss parent material (Mahendra 2014) [5].

## Conclusion

From this study, it was concluded that frequent use of imbalanced chemical fertilizers to soil without addition of organic inputs may be the reason to steady decline in organic carbon status, available major and micronutrients. Application of organic manures, inorganic chemical fertilizers on site specific recommended dosage based on soil test values can improve the soil quality and nutrient status thereby increased crop productivity.

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