

Soil Fertility Maps of Villages as Assessment of Soil Fertility Status in Different Cropping Systems of Doddabelavangala Raitha Samparka Kendra (RSK), Doddaballapur Taluk of Karnataka



Agriculture

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ABSTRACT

Soil samples were collected from selected farmers of different cropping system under both irrigated and rain-fed conditions of Doddabelavangala Raitha Samparka Kendra (RSK), Doddaballapur (taluk) of Karnataka to evaluate the status of major and micronutrients as affected by different cropping systems. The fertility maps were prepared for the area and nutrient status was discussed in relation with physiographic position and cropping pattern. The nutrient status did not follow any distinct trend with respect to physiographic units and crops grown. Based on the overall assessment, the nutrient status in these soils was optimum.

INTRODUCTION

Soil test-based fertility management is an effective tool for increasing productivity of agricultural soils that have a high degree of spatial variability. However, major constraints impede wide scale adoption of soil testing in most developing countries. In India, these include the prevalence of small holding systems of farming as well as lack of infrastructural facilities for extensive soil testing (Sen *et al.*, 2008). Soil fertility map of an area, which will help in formulating balanced fertilizer recommendation and to understand the status of soil fertility spatially and temporally. In this context, use of village-level soil fertility maps as assessment of soil fertility status of Doddabelavangala, Doddaballapur taluk of Karnataka which are being intensively cultivated with high yielding crops finger millet, maize, red gram and vegetables was carried out.

MATERIAL AND METHODS

GENERAL INFORMATION OF THE SAMPLING SITE

Doddabelavangala Raitha Samparka Kendra (RSK), comes under Eastern dry zone (Zone - 5) of Karnataka. It is having an geographical area of 17580.47 ha, out of this cultivated area of 11960.0 ha. Under this an approximately irrigated area is about 575 ha and rest are rainfed areas. The area under study is both irrigated and intensively cultivated with commercial crops with main crops being finger millet, maize, paddy, groundnut, red gram, cowpea, oil seed crops like sunflower, castor and vegetables. The climate of the area is characterized by a mean annual rainfall of 815.5 mm most of which is received during July to September (Kharif season).

COLLECTION AND ANALYSIS OF SOIL SAMPLES

One hundred and forty surface (0-15 cm) soil samples were drawn from the different cropping systems of both irrigated and rainfed condition. Soil samples were air-dried in shade, then powdered gently with a wooden mallet and sieved through 2 mm sieve then stored in clean polyethylene containers for further analysis. The samples were analysed for pH, EC, OC, Available nitrogen, Available phosphorus, and Available potassium and micronutrients the standard procedure used for analysis is given in Table - 1.

PREPARATION OF SOIL FERTILITY MAPS

RESULTS AND DISCUSSION

The results of the investigation carried out to assess the status of major nutrients and micronutrients viz., primary nutrients nitrogen, phosphorus, potassium and micro nutrients (Zn, Fe, Cu, Mn and B) in the soils on different cropping systems of Doddabelavangala Raitha samparka Kendra as range, mean and standard deviation in Table - 2 and Fig.1.

General properties of soils of the area:

Soil reaction (pH): The pH of the surface soil ranged from 5.50 - 7.80 with an overall mean of 6.95 and about 17.00, 77.00 and

6.00 per cent were found to be acidic, neutral and alkaline respectively (Table 3). The pH of the soils in a portion of Doddabelavangala Raitha samparka Kendra (11960.0 ha) was acidic to neutral (5.50 - 7.80) similar results were observed by Acharya *et al.* (1988) with significant decrease in pH of an *Alfisol* as a result of continuous manuring over the initial value.

Electrical conductivity (EC): The electrical conductivity of the soil ranged from 0.10 to 0.30 dS m⁻¹ with a mean of 0.11 dS m⁻¹. In all the samples, the major area was under normal electrical conductivity there is no injurious levels of salt concentration were observed in the soils of Doddabelavangala Raitha samparka Kendra.

Organic carbon (OC): The overall organic carbon status of the soil ranged from 0.32 to 1.54 per cent with a mean value of 0.89 % and fall under low, medium and high category. Dudal (1965) has reported that organic carbon in Indian soils range sub-humid soils (Jagdish Prasad and Gajbhiye, 1998). However, higher organic carbon content in these soils is owed to its management practices such as addition of crop residues and cropping pattern followed. Similarly 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, nitrogen, phosphorous and potassium content of the soil in long run.

Available nitrogen: The overall available nitrogen status (Table 2) in the surface soils ranged from 211.50 to 462.31 kg ha⁻¹ with overall mean value of 350.25 kg ha⁻¹. 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. As depicted in Table - 3 out of the study area in Doddabelavangala Raitha samparka Kendra, about 62 per cent area was medium in available nitrogen status, while 42 per cent of the area was low in available nitrogen status. 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 (Sasanthakumar Pal *et al.*, 1987).

Available Phosphorus: As depicted in Table - 3, about 13 per cent of the study area was low in available phosphorus content and rest 77 per cent of the area was found to be medium in P content (Table- 3). The overall available phosphorus (Table - 2) ranged from 5.70 to 50.00 kg ha⁻¹ with an overall mean of 42.39 kg ha⁻¹.

Available Potassium: The available S content ranged from 22.40 to 300.00 kg ha⁻¹ with an overall mean value of 173.42 kg ha⁻¹. The soils of the study area were found to be low to medium

in available potassium status. Around 47 per cent of the study area recorded low K values, while rest 53 per cent of the area had medium available potassium content.

Available micronutrients:

The overall DTPA – Zn content ranged from 0.03 to 4.20 mg kg⁻¹ with a mean value of 1.09 mg kg⁻¹. Among the Doddabelavangala Raitha samparka Kendra had deficient in Zn content The DTPA – Fe content varied from 2.60 to 34.48 mg kg⁻¹ with a mean value of 18.30 mg kg⁻¹. On contrary to Zn, Fe was found to be sufficient in Doddabelavangala Raitha samparka Kendra. The availability of Cu ranged from 0.06 to 7.66 mg kg⁻¹ with a mean of 1.48 mg kg⁻¹. The mean Cu status showed that, there is no soil deficient soils of in Cu availability of Doddabelavangala Raitha samparka Kendra showed medium in Cu content. The Mn availability in the soils was varied from 3.22 to 41.59 mg kg⁻¹ with a mean of 9.33 mg kg⁻¹. Similar to Fe, Mn was also found to be sufficient in Doddabelavangala Raitha samparka Kendra. The overall Hot water extract B content ranged from 0.06 to 1.80 mg kg⁻¹ with a mean value of 0.29 mg kg⁻¹. Among the Doddabelavangala Raitha samparka Kendra almost all the soils, had deficient in Boron content.

CONCLUSION: Finger millet and maize are the two important crops of the area on all physiographic units. This probably is the reason why irrespective of landscape units, the nutrient levels were about the same. Due to intensive agriculture practised in the area, the nutrient status did not follow any distinct trend with respect to physiographic units. Based on the overall assessment, the nutrient status in these soils is optimum. The information generated in this study could be used for temporal study of soil fertility to compare the fertility status in future. As some of the nutrients like K is in high range, moderation in its application is advisable. Similar is the case with phosphorus.

Table 1: Methods followed for the analysis of soil and plant samples

Parameters	Methods	References
Soil Analysis		
pH (1:2.5)	Potentiometric method	Jackson, 1973
EC (dS m ⁻¹)	Conductometric method	Jackson, 1973
Organic Carbon (%)	Wet oxidation method	Walkey and Black, 1934
Avail. N (kg ha ⁻¹)	Alkaline potassium permanganate method	Subbiah and Asija, 1956
Avail. P ₂ O ₅ (kg ha ⁻¹)	Olsen's extractant method, Colorimetry	Jackson, 1973
Avail. K ₂ O (kg ha ⁻¹)	N NH ₄ OAC extractant method, Flame photometry	Jackson, 1973
DTPA extractable Fe, Mn, Zn and Cu (mg kg ⁻¹)	Atomic absorption spectrophotometry	Lindsay and Norvell, 1978

Table -2: Overall mean, standard deviation and range of soil properties and nutrient status in samples from Doddabelavangala Raitha Samparka Kendra (RSK),

Property	Mean	SD	Range
pH	6.95	0.51	5.50 – 7.80
EC (ds m ⁻¹)	0.11	0.04	0.10 – 0.30
OC (%)	0.89	0.28	0.32 – 1.54
N (kg ha ⁻¹)	350.25	52.31	211.50 -462.31
P ₂ O ₅ (kg ha ⁻¹)	42.39	11.29	5.70 – 50.00
K ₂ O (kg ha ⁻¹)	173.42	86.86	22.40 – 300.00
Zn (ppm)	1.39	1.09	0.03 – 4.20
Cu (ppm)	2.32	1.48	0.06 – 7.66
Mn (ppm)	22.00	9.33	3.22 – 41.59
Fe (ppm)	13.30	18.30	2.60 – 34.48
B (ppm)	0.73	0.29	0.06 – 1.80

Table 3. Per cent area under different fertility classes of major nutrients in Doddabelavangala Raitha Samparka Kendra (RSK),

Nutrient	Low	Medium	High
N (kg ha ⁻¹)	35 (%)	44 (%)	21 (%)
P ₂ O ₅ (kg ha ⁻¹)	13 (%)	77 (%)	-
K ₂ O (kg ha ⁻¹)	47 (%)	53 (%)	-

Fig. 1: Soil Fertility Status Doddabelavangala Raitha Samparka Kendra (RSK), Doddaballapura Taluk,-



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