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Evaluation of Soil Fertility Status of Macronutrients and Mapping in Beguru Micro watershed of Tarikere Taluk of Chikkmagaluru District, Karnataka, India

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Keywords

Toposheet, Cadastral maps, Grids and GPS

A B S T R A C T

The investigation was conducted at UAHS, Shivamogga, to know the soil physical chemical, macronutrient status in Beguru microwatershed of Tarikere taluk of Chikkmagaluru district. Surface (103) soil samples were collected grid- wise by using cadastral map of study area and were analyzed for their fertility status. The value of pH, electrical conductivity, and organic carbon was ranged from 5.21 to 9.27, 0.035 to 0.507 dS m^{-1} and 0.39 to 1.28 g kg^{-1} respectively. The available N, P_2O_5, K_2O, were ranged from 150.53 to 470.40 kg ha^{-1}, 11.70 to 58.40 kg ha^{-1}, 138.03 to 472.95 kg ha^{-1}, respectively. The available nitrogen was in medium, phosphorus content varied from low to medium and high in potassium. The exchangeable calcium, magnesium and sulphur ranged from 2.75 to 24.25 c mol (p+) kg^{-1}, 1.50 to 10.75 c mol (p+) kg^{-1} and 14.03 to 48.48 mg kg^{-1} respectively. The exchangeable calcium and magnesium content were sufficient and sulphur content was high. Available micronutrients such as Zinc are deficient but iron, manganese and copper were sufficient in these soils of micro-watershed.

Introduction

More than 58 per cent of Indian population depends on agriculture. Soil is the most vital natural resource of the country and it is the sole of infinite living organisms which supports the life of crop plants by acting as a medium for growth along with providing nutrients, air and water. Soil fertility plays a key role in increasing crop production in the soil. It comprises not only supply of nutrients but also their efficient management. Now-a-days fertility status of soil decreases day by day due to ever increase in human population, intensive cultivation, land degradation and desertification. Every inch of arable land has already been utilized to the maximum extent. The optimal management of these resources with minimum adverse effect on environment is essential.

Therefore, assessment of nutrient status of soils that are intensively cultivated needs to be carried out. Soil testing is usually followed by collecting the soil samples in the fields with geographic reference. Soil available nutrients status of an area using global positioning system (GPS) will help in formulating site specific balanced fertilizer recommendation to understand the status of soil fertility and also helpful for adopting a rational approach compared to farmers practices or blanket use of recommended fertilization, but also reduce the necessity for elaborate plot-by-plot soil testing activities. The present study was carried out to assess the fertility status of soils of Beguru micro-watershed of Tarikere taluk of Chikkmagaluru district of Karnataka.

Materials and Methods

The study area is a Beguru microwatershed, covering an area of 757.24 ha. The district lies in the center of Karnataka between the latitudes 13° 45’ and 51° 92' N and between the longitudes 76° 6' and 57° 41' E. The average rainfall in study area is 797 mm. The survey of India toposheet (57 A/6) was used to prepare base maps covering village of Beguru, this micro-watershed. The cadastral map having parcel boundaries and survey members are produced from KSRSAC Bangalore. The boundary of the micro watershed was obtained from the watershed Atlas prepared by KSRSAC. The survey of India toposheet (57A/6) with 1:50.000 scales was also used along with satellite imagery, Google earth maps for updating the base map. A surface soil sample from 0 to 20 cm was collected at 320 m x 320 m grid samples in the study area. A total of 103 samples were collected from the fixed grid points.

The soil samples were air-dried, ground (< 2 mm) and analyzed for chemical and fertility parameters. The pH (1:2.5) and electrical conductivity (EC) (1:2.5) of soils were measured using standard procedures as described by Jackson (1973). Organic carbon (OC) was determined using the Walkley-Black method (1934). Available nitrogen (N) was estimated by modified alkaline permanganate method (Subbaiah and Asija, 1956). Available phosphorus (Olsen P) was measured using sodium bicarbonate (NaHCO3) as an extractant (Jackson, 1973). Available potassium (K) was determined using the ammonium acetate method (Jackson, 1973). Available sulphur (S) was measured using 0.15% calcium chloride (CaCl2) as an extractant (Black, 1965).

Results and Discussion

Using the field survey, and laboratory analysis results, the soil heterogeneity units were determined using remote sensing and GIS by following the guidelines of Soil Survey Staff (1999). A dbf file consisting of data for X and Y co-ordinates in respect of sampling site location was created. A shape file (Vector data) showing the outline of Beguru village. The dbf file was opened in the project window and in X-field, X-coordinates were selected and in Y-field, Y-coordinates were selected. The Z field was used for different nutrients. The Beguru village shape file was also opened and from the surface menu of Arc view spatial analyst “Interpolate grid option” was selected. On the output “grid specification dialogue”, output grid extend chosen was same as Beguru village shape and the interpolation method employed was spline. Then map was reclassified based on ratings of respective nutrients.

The soil pH of Beguru micro watershed was found to be slightly acidic to alkaline in nature (Table 1) of Beguru microwatershed of Chikkamagaluru district. Soil reaction was slightly acidic to alkaline in soils (range 5.21 to 9.27). The relatively low pH in soils was mainly due to iron hydroxide species which contributed for higher H^+ concentration (Dasog and Patil, 2011). On area basis, 87 ha (11.52 %) was moderately alkaline, 149 ha (19.66 %) slightly acid 263 ha (34.79 %) neutral and 87 ha (11.33%) slightly alkaline nature (Fig. 1).

The electrical conductivity values were very low (0.035-0.507 dS m^{-1}) indicating that the soils of selected micro watershed were non saline in nature (Table 1). This may be due to undulating nature of the terrain coupled with fairly good drainage conditions, which favored the removal of released bases by the percolating drainage water. In all the soil samples electrical conductivity was lesser than 4 dS m^{-1} which was below the safe limit (Shivaprasad *et al.,* 1998). On area basis, total of 713 ha (94.12 %) are non- saline in nature (Fig. 1).

On area basis, 465 ha (61.44 %) of soil samples were medium of soil organic carbon content (SOC) and it ranged from accounting 100 per cent in micro- watershed area. Patil *et al.*, (2011) reported that soils of semi-arid type of climate with temperature prevailing in the area resulted in low to medium organic carbon content. The low organic matter content in the soils was attributed to the prevalence of tropical condition, where the degradation of organic matter occurs at a faster rate coupled with low vegetation cover, thereby leaving less organic carbon in the soils (Sireesha and Naidu, 2013).

The available nitrogen status of the micro watershed ranged from low to medium (150.53 to 470.40 kg ha^{-1}) and the main reason being low organic matter content, low rainfall and low vegetation were reported to cause faster degradation and removal of organic matter leading to nitrogen deficiency (Ashok, 2001). The variation in N content may be related to soil management, application of FYM and fertilizer to previous crop etc. The semi-arid climate, low organic carbon status might have been resulted in low N content. On the area basis majority of soils are low in available nitrogen 472 ha (62.29%) (Fig. 2).

The available phosphorus status in micro watershed area was ranged from low to medium (11.70 to 58.40 kg ha^{-1}). This might be due to variation in soil properties like clay content, CEC and P fixation capacity. The soils show low values of available (Table 1) phosphorus, which may be due to low CEC, clay content and acidic soil reaction of <6.5. About 677 ha which accounted for 89.41 per cent of the micro- watershed area was medium and 36 ha (4.72 %) are low in available phosphorus content (Fig. 2).

Table.1 Physical chemical properties and nutrient content status of Beguru micro watershed of Tarikere taluk of Chikkamagluru District

Parameters	**Range**	**Mean**
pH	5.21-9.27	6.97
EC(dsm^{-1})	0.035-0.507	0.214
OC(g kg^{-1})	0.39-1.28	0.72
N(kg ha^{-1})	150.53-470.40	267.94
P_2O_5(kg ha^{-1})	11.70-58.40	32.50
K_2O(kg ha^{-1})	138.03-472.95	269.38
Ca(cmol p+kg^{-1})	2.75-24.25	10.24
Mg(cmol p+kg^{-1})	1.50-10.75	4.97
S(mg kg^{-1})	14.03-48.48	27.97

Fig.1 pH, EC, OC and available N status of Beguru microwatershed of Tarikere taluk of Chikkamagaluru District

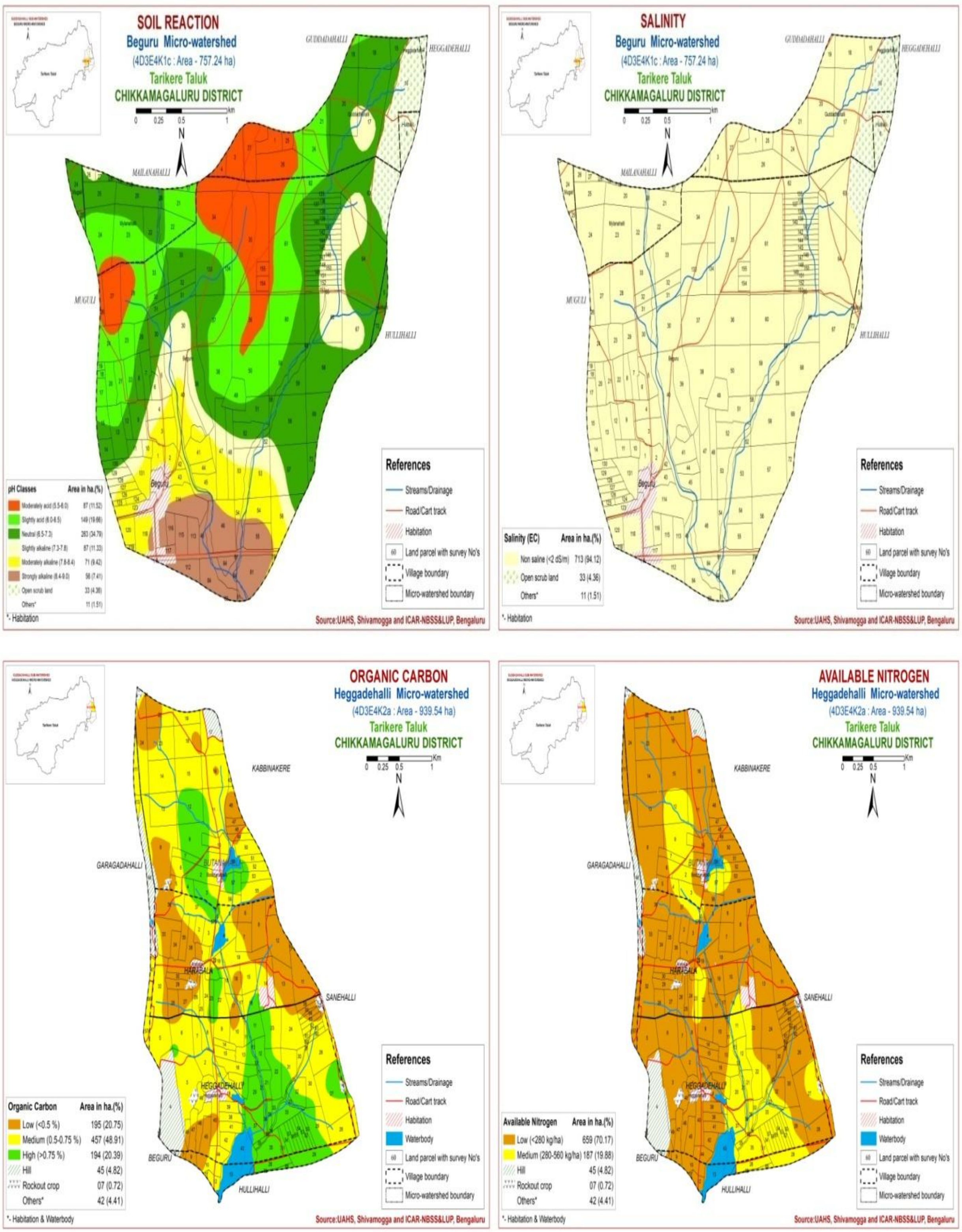
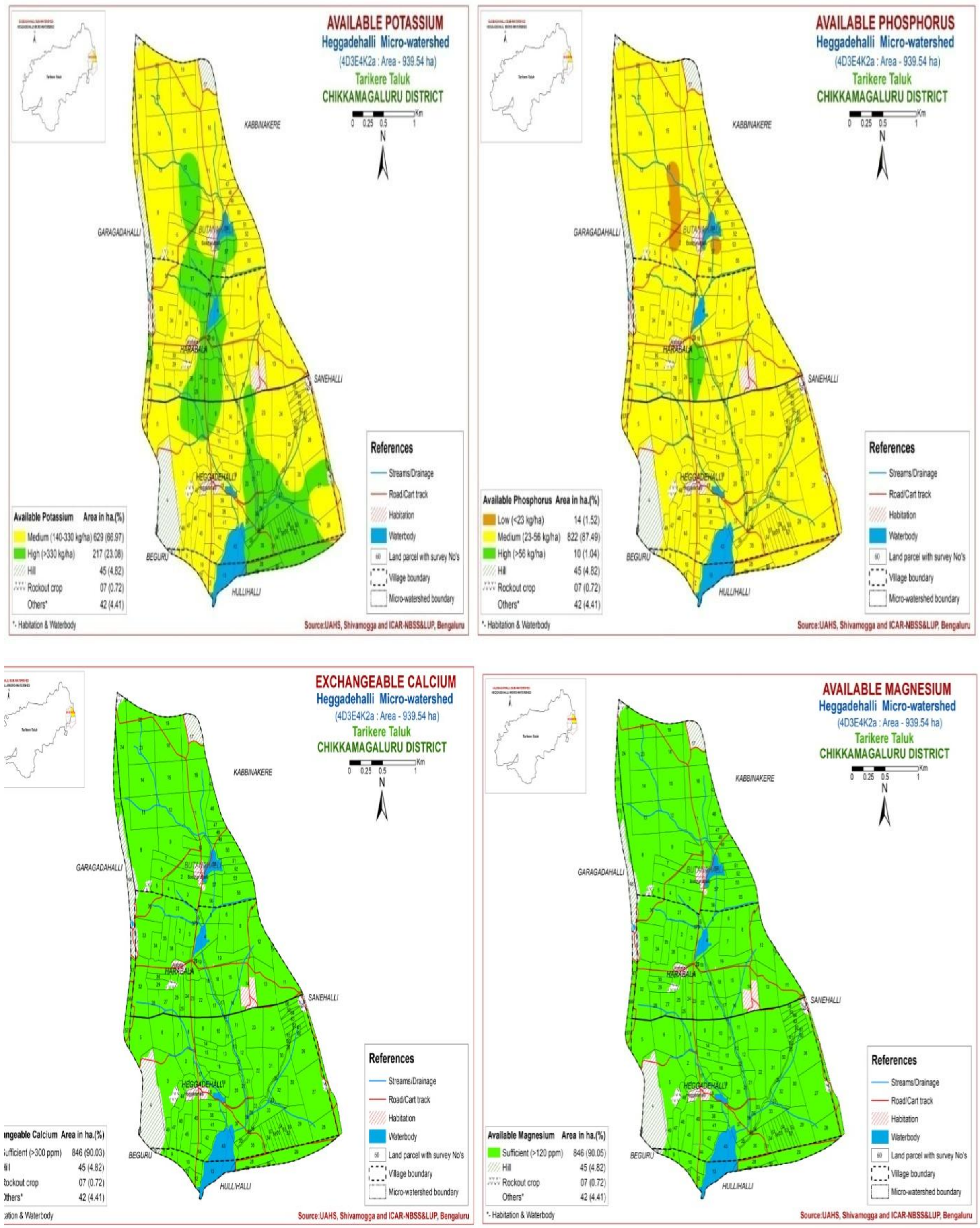


Fig.2 Available P_2O_5, K_2O and exchangeable Ca, Mg and available Sulphur status of Beguru microwatershed of Tarikere taluk of Chikkamagluru District



The available potassium content in major portion of the study area was under medium to high category. 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). In this micro-watershed about 627 ha and 86 ha area occupying 82.79 per cent and 11.33 per cent (Fig. 2) were medium and high available potassium respectively.

The exchangeable calcium and magnesium content of micro-watershed area ranged from 2.75 to 24.25 cmol (p^+) kg^{-1} and 1.50 to 10.75 cmol (p^+) kg^{-1} respectively (Table 1 and Fig. 2) was recorded low calcium and magnesium, which might be due to the type of clay as well as due to its accelerated leaching and low organic carbon content. High values of CEC and exchangeable Ca and Mg are an indication of dominance of smectite type of clay mineral as reported by Nandi and Dasog 1992. The Mg content was present in low amount than Ca because of its higher mobility. These results are in conformity with the findings of Sharma and Gangwar (1997).

The available sulphur status ranged from 14.03 to 48.48 mg kg^{-1} which shows high in available sulphur content. The high amount of available sulphur at surface soil samples were mainly because of the acidic reaction low EC and OC values in these mixture of these soils (Ashok, 2001 and Madhan Mohan *et al.,* 2008). On area basis about 709 ha of the study area was high and 04 ha were medium in available sulphur (Table 1 and Fig. 2).

In conclusion, soil pH ranged from acidic to alkaline in reaction (5.21 to 9.27), Salt content was very low indicates soils are non-saline in nature and organic carbon content was medium (0.39 to 1.28 mg kg^{-1}), Available nitrogen low to medium (150.53 to 470.40 kg ha^{-1}). It might be due to low in might be due to low in organic carbon content and is mainly correlated with organic carbon. Available phosphorus content was low to medium (11.70 to 58.40 kg ha^{-1}). These variations of phosphorus in soils are may be due to variation soil properties like clay content, CEC and P fixation capacity. Available potassium content (138.03 to 472.95 kg ha^{-1}) in major portion of the study area was under medium category. The exchangeable Ca (2.75-24.25 cmol (p^+) kg^{-1}) and Mg (1.50-10.75 cmol (p^+) kg^{-1}) content were low and sufficient in available sulphur (14.03-48.48 mg kg^{-1}) content may be due to acidic reaction, low EC and OC values in soils.

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