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CADASTRAL LEVEL SOIL FERTILITY MAPPING IN KHAIRWADGI-1 MICRO-WATERSHED OF LINGASUGUR TALUK, RAICHUR DISTRICT

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ABSTRACT

Soil fertility parameter viz., pH, Electrical Conductivity (EC), available macro and micro nutrients were determined in surface soil samples taken at cadastral grid intervals from all mapping units of the Khairwadgi-1 micro-watershed of Lingasugur Taluk and Raichur district under The World Bank assisted KWDP II, Sujala-III project on "support for improved programme Integration in rainfed areas" and having total area of 487.59 ha and lies between 76°22′ - 16°30′ North latitudes and 76°24′- 16°10′ East longitudes and average rainfall of this region is 680 mm. Based on soil analysis, fertility maps were prepared at scale (1:8000) using GIS . The surface soil samples have Soil reaction from neutral (pH 6.5-7.3) to moderately alkaline (pH 7.8-8.4) and electric conductivity was non saline. Organic Carbon content was ranges from low (<0.5%) to medium (0.5-0.75%), available Nitrogen was low in entire micro watershed, Phosphorous and potassium content was medium and available sulphur content also low in entire micro-watershed. The available Iron was deficient (<4.5ppm) to sufficient (>4.5ppm), Manganese content was sufficient, Copper was sufficient (>0.2ppm) and available zinc content was deficient in all the parts of micro-watershed.

INTRODUCTION

Soil fertility plays an important role in increasing crop yield. The adoption of high yielding varieties that require high amounts of nutrients has resulted in deficiency symptoms in crops and plants due to imbalanced fertilization and poor inherent fertility status. Hence, it is necessary to know the fertility (macro and micro nutrients) status of the soils of the watersheds for assessing the kind and amount of fertilizers required for each of the crop intended to be grown. Geographic information system (GIS) is a powerful tool which helps to integrate many types o spatial information such as agro-climatic zone, land use, soil management, *etc.* to derive useful information (Adornado and Yoshida 2008). Furthermore, GIS generated soil fertility maps may serve as a decision support tool for nutrient management (Iftikar *et al.* 2010). A number of studies on soil fertility mapping have been documented (Ravikumar *et al.* 2004). In India the land resources available for agriculture are shrinking. Our aim of optimizing the utilization of land resources with intensification of agriculture resulted either in the fast depletion of nutrients or occasionally in their accumulation. It is therefore important to monitor the fertility status of soil from time to time with a view to monitor the soil health. For the sustainable use of the natural resources, a detailed character of land resources giving its potential and constraints becomes pre-requisite for planning. The site specificity of agricultural research and technology results is largely measured from differences in two environmental variables such as soil and climate. At present, most systems of land evaluation are interpretative classification. A general evaluation, based on limitations of land characteristics, is best illustrated in the USDA land capability classification. The paper deals study of soil fertility status of khairawadgi -1 micro-watershed at cadastral level for suitability of crops.

MATERIALS AND METHODS

Study sites

Khairwadgi-1 micro watershed is located in Lingasugur taluk of Raichur district, Karnataka state and having total area of 487.59 ha and lies between 76°22′ - 16°30′ North latitudes and 76°24′ - 16°10′ East longitudes and average rainfall of this region is 680 mm. The location of the study area was furnished in (Figure 1.) bounded by Ashihala, Kilarahatti and Kannapurahatti villages. The cadastral map, remote sensing data products from IRS and Google at the scale of 1:8000 was used in conjunction with the cadastral map to identify the landforms and other surface features. The Imageries helped in the identification and delineation of boundaries between hills, uplands and lowlands, water bodies, forest and vegetated areas, roads, habitations and other cultural features of the area (Figure 2. and 3.) Google earth/IRS Imagery of the village area). Apart from the cadastral maps and imageries, top sheets of the area (1:50,000 scale) were used for initial traversing, identification of geology and landform, drainage features, present land use and for the selection of transects at village level.

Soil analysis

The Soil samples were collected using a hand holds GPS to a depth of 0-25cm at a grid 300 meter interval. The air-dried samples were ground with a wooden pestle and mortar and passed through (<2 mm) and analyzed for chemical and fertility parameters. The pH (1:2.5) and Electrical Conductivity (1:2.5) soil and water of soil were measured using standard procedures. Organic Carbon (OC) was determined by Walkely and Black (1965), Wet Oxidation method as described by Jackson (1973), Available nitrogen was determined by modified alkaline permanganate method as described by Subbiah and Asija (1956), Available phosphorus was determined by Olsen *et al*. (1954) method as described in Jackson (1973), Available potassium was extracted with neutral normal ammonium acetate (pH 7.0) and the content of potassium in the solution was estimated by Flame Photometer (Jackson,1973), Available sulphur was extracted from the soil using 0.15 per cent calcium chloride solution and was determined by turbidometry method as outlined by Black (1965) using Spectrophotometer at 420nm and Available Micronutrients (Fe, Zn, Cu and Mn) were extracted by DTPA reagent using the procedure outlined by Lindsay and Norvell (1978), Variability of data was assessed. Soil fertility maps were prepared using ARC GIS 10.4 employing kriging as the interpolation method.

RESULTS AND DISCUSSIONS

Soil fertility data generated has been assessed and individual maps for all the nutrients for the micro watershed have been generated using kriging method. The total area covered about 487.59 ha of the micro-watershed and sample collected during Jan-Feb, 2017, the analytical values for different parameters were used to generate Soil fertility map of the village, which are briefly described below.

The soil fertility analysis (Figure 4.) of the Khairwadgi-1 micro watershed for soil reaction (pH) showed that 177 ha (36.26%) was neutral, 246 ha (50.45%) was slightly alkaline and 15 ha (3.15%) was moderately alkaline. This may be because of calcareousness nature of these soils. Electrical conductivity of entire micro watershed area was non saline <2 dSm^{-1} (Fig 5.) in 438 ha (89.86%),the micro watershed has 438 ha area that are non alkaline in reaction, these areas need application of gypsum and wherever calcium is in excess, iron pyrites and element sculpture can be recommended.

The organic carbon (Figure 6.) of the soils showed that 53ha (10.78%) was low (<0.5%) and 386 ha (79.08%) was medium (0.5-0.75%).Low OC in these soils is attributed to rapid rate of decomposition due to high temperature and lack of addition of FYM and crop residues.(Prabhavati *et al,* 2015)

Macronutrients

Available nitrogen showed that (Figure 7.) was low (<280 kg/ ha %) in 438 ha (89.86%), which could be attributed to low amount of OC as major portion of the N pool is contributed by organic matter (Prasuna Rani et al. 1992). The reason might be low rainfall and low vegetation cover, facilitating faster degradation and removal of organic matter leading to N deficiency reflecting the trend in OC observed in these soils under prevailing climatic conditions. Hence, there is an urgent need to increase the dose of nitrogen for all the crops by 25 per cent over the recommended dose to realize better crop performance.

Available phosphorous content (Figure 8.) was medium(23-57 kg/ha) an area about 438 ha (89.86%), hence for all the

Table 1: Major and secondary nutrient status (%) in 0-15 cm soils of Khairwadgi-1

Nutrients	Percentage Low	Medium	High
Nitrogen (kg/ha)	89.86	-	-
Phosphorus (P_2O_5 kg/ha)	-	89.86	-
Potassium (K_2O kg/ha)	-	89.86	-
Sulphur (ppm)	89.86	-	-

Table 2: Micronutrient status (%) in 0-15 cm soils of Khairwadgi-1

Micronutrients (ppm)	Percentage Below the critical level/marginal	Above the critical level
Zinc	-	89.86
Iron	18.38	71.48
Copper	-	89.86
Manganese	-	89.86

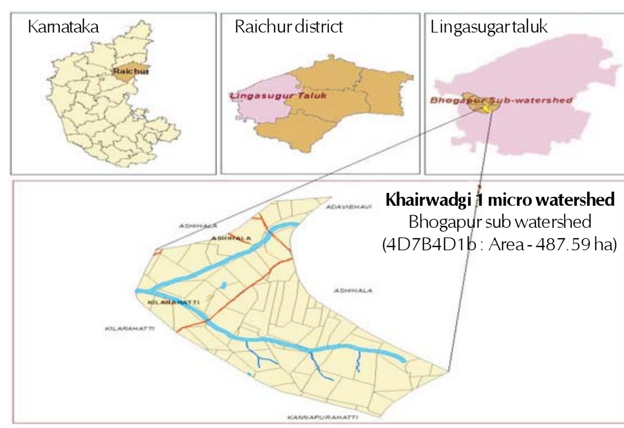

Figure 1: Location of Khairwadgi-1 micro watershed in Lingsugar taluk, Raichur district

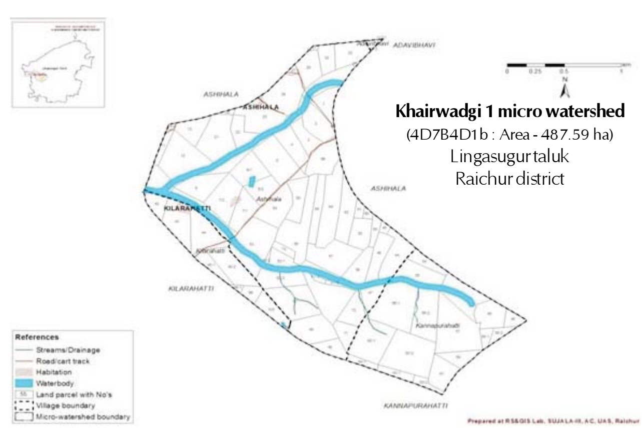

Figure 2: Cadastral map of Khairwadgi-1 micro watershed

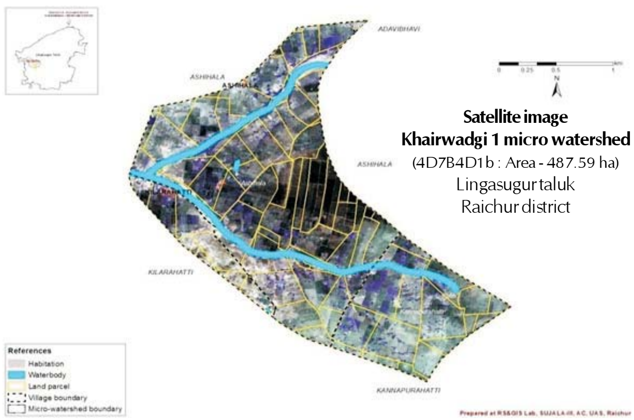

Figure 3: Satellite map of Khairwadgi-1 micro watershed

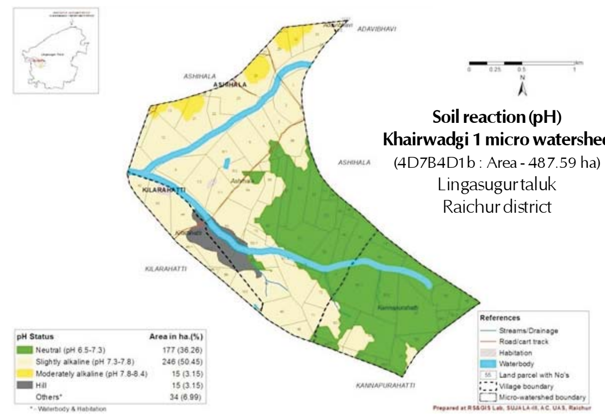

Figure 4: Soil reaction status Khairwadgi-1 micro-watershed

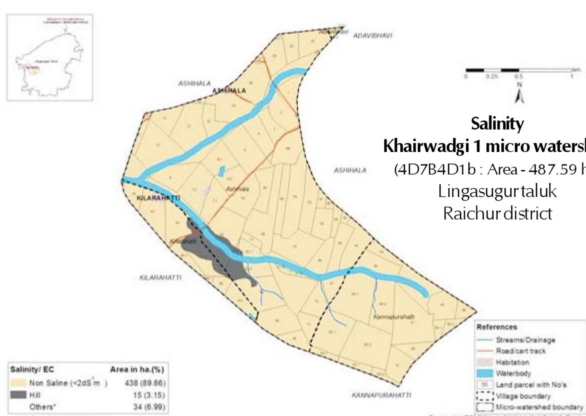

Figure 5: Available soil salinity status in Khairwadgi-1 micro watershed

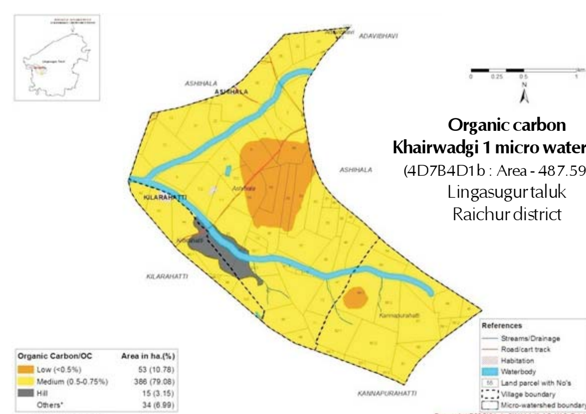

Figure 6: Available organic carbon in Khairwadgi-1 Micro watershed

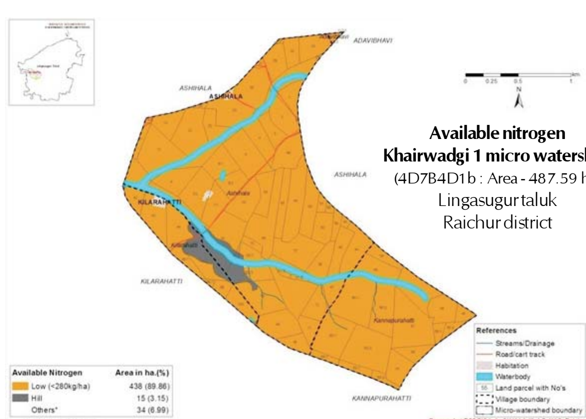

Figure 7: Available Nitrogen status in Khairwadgi-1 micro watershed

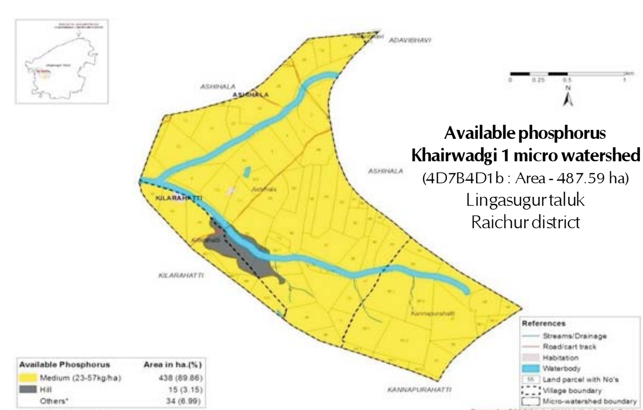

Figure 8: Available phosphorus status in Khairwadgi-1 micro watershed

crops, 25% additional P-needs to be applied, where it is low or medium in available phosphorus content.potassium content (Figure 9.) was medium (>145-337kg/ha) in 438 ha (89.86%), Hence, in all these plots, for all crops, additional 25 % potassium may be applied

Available sulphur content (Figure 10.) was low (<10ppm) in area of about 438 ha (89.86%). The low S is partly due to gypsiferrous nature of S which is non-available in black soils (Balanagoudar and Satyanarayana 1990). These areas need to be applied with magnesium sulphate or gypsum or Factamphos (p) fertilizer (13% sulphur) for 2-3 years for the deficiency to be corrected (Table 1).

Micronutrients

Available iron content was deficient (<4.5 ppm) an area about

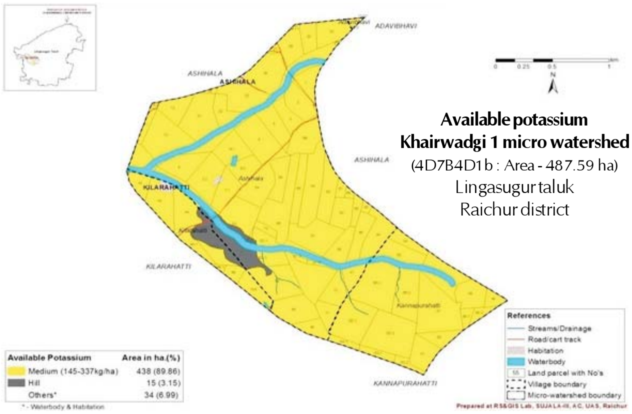

Figure 9: Available potassium status in Khairwadgi-1 village

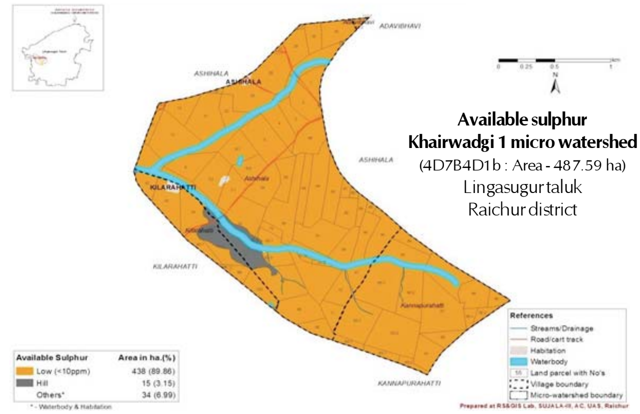

Figure 10: Available sulphur status in Khairwadgi-1 micro watershed

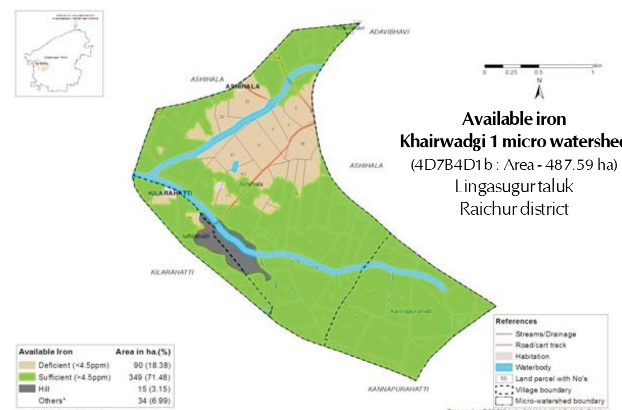

Figure 11: Available iron status in Khairwadgi-1 micro watershed

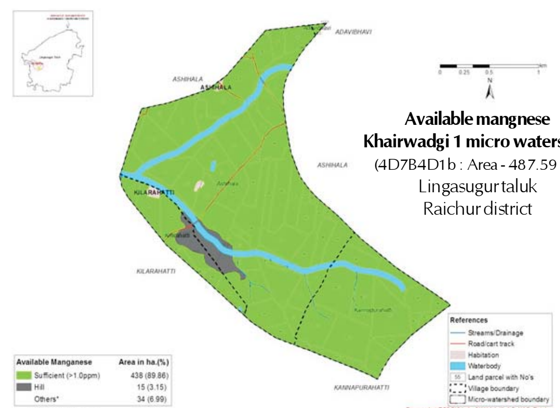

Figure 12: Available manganese status in Khairwadgi-1 micro watershed

Figure 13. Available copper status in Khairwadgi-1 micro watershed

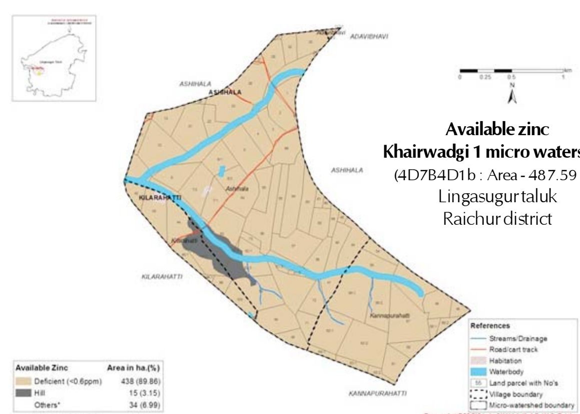

Figure 14: Available zinc status in Khairwadgi-1 micro watershed

90 ha (18.38%) in (Figure 11.) and 349 ha (71.487%) was sufficient (>4.5),available manganese content (Figure 12.) was sufficient (>1.0 ppm) in entire micro-watershed an area about 438 ha (89.86%),available copper content (Figure 13.) was sufficient (>0.2 ppm) an area about 438 ha (89.86%)and available zinc content (Figure 14.) was deficient (< 0.6 ppm) an area about 438 ha (89.86%)(Table 2). The former two are deficient in Zn and the last one is sufficient guided by the critical value of 0.6 mg kg-1 as these soils are alkaline in nature resulting in decreased solubility and mobility (Vijayashekhar *et al*. 2000).

CONCLUSIONS

The surface soil samples have Soil reaction from neutral (pH 6.5-7.3) to moderately alkaline (pH 7.8-8.4) and electric conductivity was non saline. Organic Carbon content was ranges from low (<0.5%) to medium (0.5-0.75%), available

Nitrogen was low in entire micro watershed, Phosphorous and potassium content was medium and available sulphur content also low in entire micro-watershed. The available Iron was deficient (<4.5 ppm) to sufficient (>4.5 ppm), Manganese content was sufficient, Copper was sufficient (>0.2 ppm) and available zinc content was deficient in all the parts of micro-watershed. Thus, soil fertility mapping helps in reducing excess application of fertilizers thereby minimizing input cost and maintain soil health and productivity.

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