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Spatial Distribution of Secondary Nutrients under Different Land Use System in Hebburu Micro-Watershed of Ajjampura Sub-Watershed, Tarikere Taluk, Chikkamagaluru District

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ABSTRACT

To know the spatial distribution of secondary nutrients under different land use system in Hebburu micro-watershed the study was conducted at UAHS, Shivamogga. Under different land use system total 158 soil samples were collected grid wise viz., coconut, arecanut, onion, chilli, ragi, oilseed/ pulse, uncultivable land and other horticultural land use were analysed for their fertility status. The distribution of secondary nutrients viz., exchangeable Ca, exchangeable Mg and available sulphur values in soils ranged from 170 to 52.25 and 0.30 to 26.80 80 cmol (p^+) kg^{-1} and 0.26 to 9.51 mg kg^{-1}. The secondary nutrient status in soils were mapped by GIS technique.

Key words: *Watershed, Secondary nutrients, Fertility map, Land use system*

INTRODUCTION

The ability of soils to supply secondary nutrients to plants indefinitely is subject to the law of conservation of matter and is therefore dependent upon nutrient cycling. Continued crop removal of Ca, Mg, and S requires replenishment just as surely as primary nutrients, but most likely less frequently. Calcium and magnesium are often supplied by mineral weathering, either of natural soil materials, ground limestone added to correct soil acidity. Sulphur is often added to soil as either atmospheric deposition (associated with air pollution) or as impurities in fertilizers, particularly common P fertilizers. To demonstrate that this classification is more responsive to soil ability to supply nutrients than plant requirements, it should be noted that plant requirements for Ca, a secondary nutrient element, is greater than for P. Calcium is found as a principle exchangeable cation in most soils and an important soluble cation in the soil solution.

Ca, Mg and S deficiency are seen in the coarse textured soils with low organic matter status or in highly weathered soils. Calcium is the major cation in the middle lamella of cell walls, of which calcium pectate is the principle constituent.

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Thus, Ca provides mechanical strength to plant tissues. Magnesium is an essential constituent of chlorophyll pigment in plants and acts as an activator of enzymes concerned to energy metabolism. Frequently, Ca and Mg are grouped with potassium (K) and referred to as the basic cations. Calcium and Mg are present in soils as exchangeable, soluble and non-exchangeable forms. These forms of Ca and Mg are in dynamic equilibrium with each other. The nature of clay minerals present in soil influences the Ca and Mg availability in soil. Being cations, both Ca^{2+} and Mg^{2+} ions are subjected to cation exchange by adsorbing on the clay and organic surfaces. Soils usually contain less Mg than Ca because Mg^{2+}ions are not adsorbed strongly by clay and organic matter surfaces leads to lesser availability of Mg in soil than Ca. Sulphur is one of the severely limited nutrients in rainfed semi-arid tropical soils because of low organic-matter content in soil and coarse soil texture. Under intensive crop rotations including oil crops, S uptake can be very high, especially when the crop residue is removed from the field along with the product. This leads to considerable depletion of S in soils, if the corresponding amount of S is not applied through fertilizer.

The distribution and forms of secondary nutrients accumulated in soils and their availability to plants has become important in recent years due to continued use of secondary nutrients free fertilizers and low rate of secondary nutrients fertilizer application. Keeping these points in view, the present investigation entitled, "Spatial distribution of secondary nutrients under different land use system in Hebburu micro-watershed of Ajjampura sub-watershed, Tarikere taluk, Chikkamagaluru District" was undertaken.

MATERIAL AND METHODS

Description of the study area

The present investigation was carried out to study the distribution of physical, chemical properties of soil and secondary nutrient status under different land use system in Hebburu micro-watershed covering 95 percent of area under Ajjampura sub-watershed of Tarikere taluk, Chikkamagaluru district representing Southern Transition Zone of Karnataka, covering an area of 1037.59 ha and lies between 13° 45′ 06″ N and 13° 45′ 28″ N latitude, 75° 59′ 40″ E and 76° 00′ 27″ E longitude. The selected study area, the Hebburu micro-watershed (MWS-code: 4D3E4P2b) lies on the SH-24, about 72.4 km away from the UAHS, Shivamogga and approximately 4 km from the hobli of Ajjampura, Tarikere taluk, Chikkamagaluru district (Karnataka). The average elevation of this area is 800.58 m above the Mean Sea Level (MSL). The relief is normally having nearly level (0 to 1%) to very gently sloping (3-5%) in the dominant black soils. The basalt, granite and schist rocks majorly cover the Hebburu micro-watershed area. The predominant mineral noticed in the area is chlorite schist. In order to study the distribution of secondary nutrients in Hebburu micro-watershed under different land use *viz.*, coconut, arecanut, onion, ragi, chilli, oilseeds/pulses (horsegram, castor and groundnut), uncultivable land and other horticultural land use (mango, marigold, banana and potato) systems were identified.

Soil sampling and preparation

The soil samples were collected grid-wise from the farmer's field under different land use covering entire Hebburu micro-watershed of Tarikere taluk, Chikkamagaluru district using village cadastral map. Coordinates of each sampling sites were recorded using GPS (Geographical Positioning System) device. Totally 158 grid soil samples, one from each grid were collected (0-15 cm depth) using soil screw auger.

Laboratory analysis

Exchangeable calcium and magnesium of the samples were determined by using ammonium acetate by complexometric method as given by Jackson[2]. Available sulphur was determined by Turbidometric method by using extractant 0.15 per cent $CaCl_2.2H_2O$ solution as described by Chesnin and Yien[1].

Preparation of fertility map of Ca, Mg and S in Hebburu micro watershed

The analytical data of nutrient status will be used for preparation of secondary nutrients map in Hebburu micro-watershed of Ajjampura sub-watershed, Tarikere taluk, Chikkamagaluru district. The data pertaining to secondary nutrients were subjected to krigging process or methodologies based on which maps were generated using Arc - GIS software[5].

RESULTS AND DISCUSSION

Categorization of soil samples with respect to Ca, Mg and S under different land use: A perusal data presented in Table 1 indicates that per cent soil samples falling in different categories for secondary nutrients. 100 per cent of soil samples are falling in sufficient category of exchangeable calcium and low status of available sulphur in soils under all the different land use (Table 1 and Fig. 1). Nearly 42.86 and 1.35 per cent of soil samples are falling in deficient category in soils under chilli and onion land uses, respectively with respect to exchangeable Mg. The remaining per cent of soil samples are falling in sufficient category of exchangeable Mg in soils under different land use.

Area under different categories of exchangeable Ca and Mg, available S nutrients in Hebburu micro-watershed

Fertility map of available secondary nutrients *viz.*, Ca, Mg and S in Hebburu micro-watershed of were prepared by using Arc-GIS software. A perusal of the data presented in and Fig.2 to 4 indicates that 97 per cent (1006 ha) of the total area of Hebburu micro-watershed had sufficient amount of exchangeable Ca and Mg. As far as spatial distribution of available sulphur in Hebburu micro-watershed is concerned, nearly 97 per cent of total area of Hebburu micro-watershed had low content of available sulphur. The results on the secondary nutrients indicated that all the soil samples tested fall under sufficient category of exchangeable calcium and low status of available sulphur under different land use. Similar results were reported by Srinivasa Raju[4].

Nearly 42.86 and 1.35 per cent of soil samples are falling in deficient category of Mg in soils under chilli and onion land use, respectively. All the remaining soil samples fall under sufficient category of exchangeable Mg in soils under different land use. Similar results were reported by Sharma *et al.*[3] and they attributed it to the presence of high base cations in the soils.

Table 1: Categorization of soil samples with respect to Ca, Mg, and S under different land use in Hebburu micro-watershed

Land use	No. of samples	Exchangeable Ca		Exchangeable Mg		Available S		
		Deficient	Sufficient	Deficient	Sufficient	Low	Medium	High
		<1.5	>1.5	<1.0	>1.0	<10	10-20	>20
		[cmol ($p^{+)}$ kg^{-1}]				(mg kg^{-1})		
Coconut	37*	Nil	100	Nil	100.00	100	Nil	Nil
Arecanut	12	Nil	100	Nil	100.0	100	Nil	Nil
Onion	74	Nil	100	1.35	98.65	100	Nil	Nil
Chilli	7	Nil	100	42.86	57.14	100	Nil	Nil
Ragi	8	Nil	100	Nil	100.0	100	Nil	Nil
Oilseed/ pulses	5	Nil	100	Nil	100.0	100	Nil	Nil
Uncultivable land	7	Nil	100	Nil	100.0	100	Nil	Nil
Other Horticultural land use	8	Nil	100	Nil	100.0	100	Nil	Nil

* The values indicate the percentage samples belonging to each category.

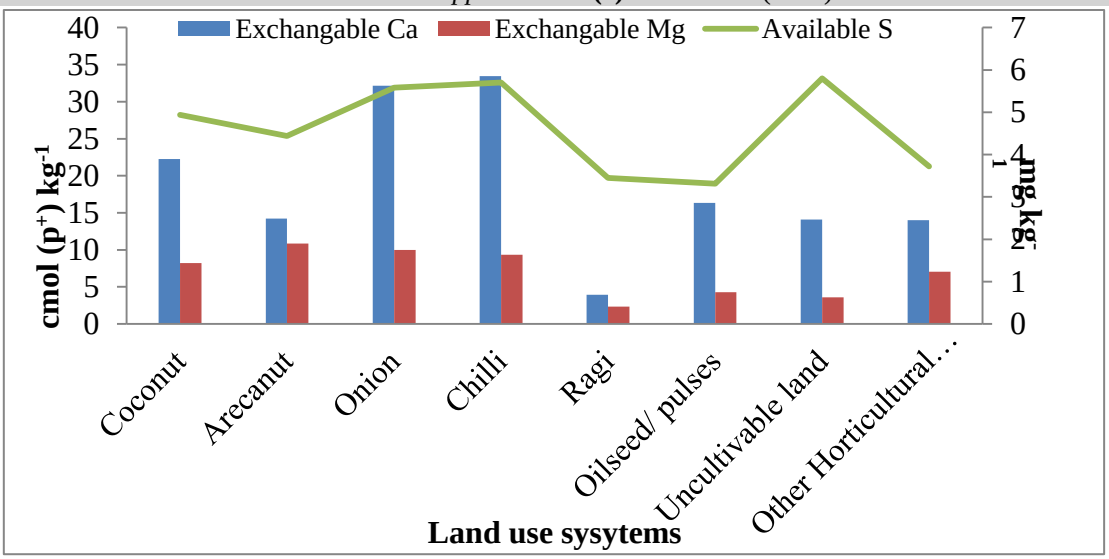

Fig. 1: Secondary nutrient in soil as influenced by different land systems

Fig. 2: Fertility map of exchangeable Ca in Hebburu micro-watershed

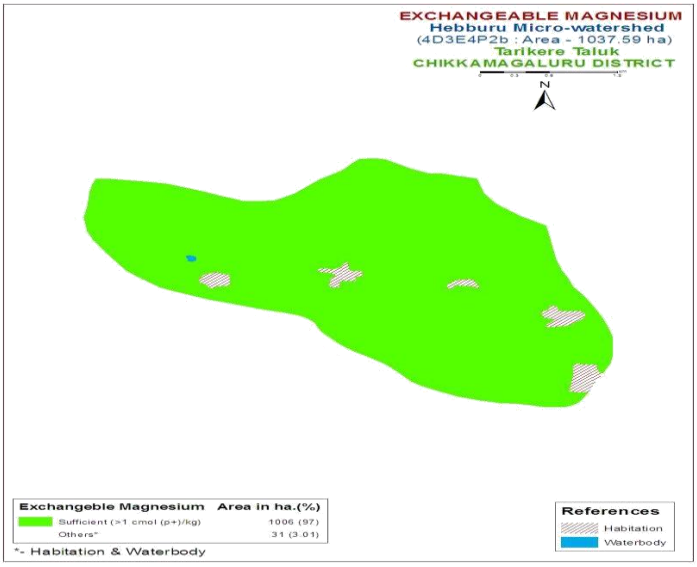

Fig. 3: Fertility map of exchangeable Mg in Hebburu micro-watershed

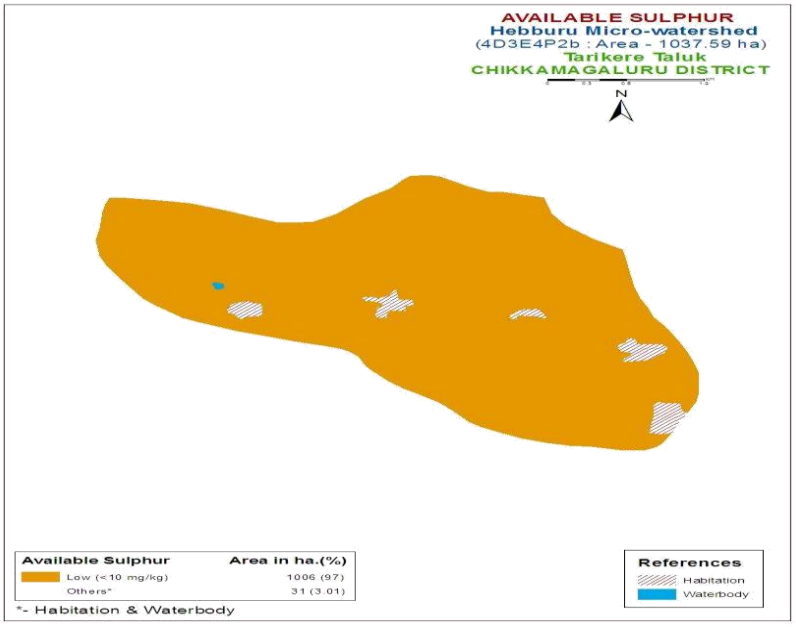

Fig. 4: Fertility map of available S in Hebburu micro-watershed

CONCLUSION

Fertility map of (Ca, Mg and S) showed that the exchangeable Ca and Mg were sufficient in amount and the available S was found low status in soils under different land use in Hebburu micro-watershed.

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