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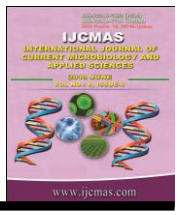

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Assessment of Soil pH, EC and OC in Different Land Use Systems of Doda District, J&K, India

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A B S T R A C T

The present study was undertaken to assess the status of soil pH, EC and OC in one hundred and eighty soil samples collected from different land use systems of district Doda. A soil survey was conducted in the month of April, 2016 to assess soil pH, EC and OC. Composite surface soil samples were collected using stratified random sampling method at a depth of 0-15 cm from Agriculture, Barren lands and at a depth of 1 metre from Forest, Horticulture of district Doda. The exact sample location was recorded using a handheld GPS receiver. Geographic Information System (GIS) and Inverse distance weighting (IDW) technique was adopted to generate prediction maps of these soil properties. Soil pH was moderately acidic to slightly alkaline, EC was (<1dS/m) indicated non-saline condition which is safe for plant growth and development. Organic carbon content was moderate to high ranged from (0.5-1.00 %). Maximum soil pH was recorded under barren land (7.90) followed by agriculture (7.55), horticulture (7.30) and forest (7.21). The Electrical Conductivity under different land use systems ranged from 0.08-0.31 d S m^{-1} under forest, 0.18-0.77 d S m^{-1} under barren land, 0.11-0.45 d S m^{-1} under agriculture and 0.10-0.35 d S m^{-1} under horticulture, respectively. The maximum OC was recorded under forest (1.19 %), followed by horticulture (0.97 %), agriculture (0.87 %) and barren land (0.65 %).

Introduction

Soil is a vital natural resource which should be used judiciously according to its potential to meet the increasing demands of ever growing population. To ensure optimum agricultural production, it is imperative to know best fact about our soils and their management to achieve sustainable production. The quality of soil needs to be looked into because presently the natural resources are being over exploited. Scientific information concerning spatial variability and distribution of soil properties is critical for farmers attempting to increase efficiency of fertilizers and crop productivity (Mabit *et al.*, 2008; Tesfahunegn *et al.*, 2011). Fertilization based on maps with recommendations related to soil fertility may also lead to reduced fertilizer inputs without reducing yield (Jalali,

2007). In the last few decades, geo-statistics has been used extensively to characterize the spatial variability of soil attributes due to its ability of quantifying and reducing sampling uncertainties and minimizing investigation costs (Emery and Ortiz, 2007; Cambule *et al.*, 2014). Geographic information system (GIS) is a powerful tool which helps to integrate many types of spatial information such as agro-climatic zone, land use, soil management etc; to derive useful information (Adornado and Yoshida, 2008). Further GIS generated soil fertility maps may serve as a decision support tool for nutrient management (Iftikar *et al.*, 2010). So the present study was undertaken to assess the status of soil pH, EC and OC in different land use systems of Doda district. The GIS soil fertility maps provide clear information on the patterns and trend with respect to individual soil properties. Soil fertility maps along with a ready database of soil information at district level which will benefit the farmers and planners alike and will help in taking location specific dimensions on nutrient management as well as finalizing course contents specific to that area for future capacity building programmes.

Materials and Methods

A soil survey was conducted at Doda district in the month of April 2016 to assess the soil physico-chemical properties viz., pH, EC and OC under different land use systems namely Forest, Barren lands, Agriculture and Horticulture, respectively. Composite surface soil samples were collected at a depth of 0-15 cm located at a minimum distance of 4-5 km apart, distributed randomly across whole of the district. The samples were air dried, ground in a pestle-mortar and passed through a 2mm stainless sieve for determining various physico-chemical properties of soils of Doda district. Soil pH of the samples was determined in 1:2.5 soil: water ratio (w/v) with the help of glass electrode pH meter (Jackson, 1973). Electrical Conductivity was estimated in 1:2.5 soil: water suspension with EC meter (Jackson, 1973). Organic carbon was estimated by Rapid titration method (Walkey and Black, 1934). The various points on the global positioning system (GPS) device were marked during the field work from the locations and imported to Arc GIS software. The geographical information system software Arc GIS were used to interpolate the results from the point data to the entire region. Maps concerning the distribution of soil pH, EC and OC were generated by using Geographic Information System and Inverse distance weighting (IDW) technique. The process of digitization and generation of soil maps was carried out with Arc-Gis 10.3 software.

Results and Discussion

The pH of the soils under different land use systems ranged from 4.65-7.21 under forest, 6.10-7.90 under barren land, 5.49-7.55 under agriculture and 5.12-7.30 under horticulture. The mean value was 6.28 under forest, 6.93 under barren land, 6.31 under agriculture and 6.24 under horticulture, respectively. The maximum soil pH was recorded under barren land (7.90) followed by agriculture (7.55), horticulture (7.30) and forest (7.21). Soil pH was moderately acidic ranged from (5.5-6.0) in north-western and eastern areas of Ghat block. More than 90 percent area of the Gandoh block and south-western areas of Ghat block were having slightly acidic soil pH (6.0-6.5). Northern area of Gandoh, Thathri and western area of Bhaderwah block were having neutral pH ranged from (6.5-7.0). The northern area of the Bhaderwah block (60 percent area) was having slightly alkaline pH range (7.0-7.5) as depicted in (Figure 1). Forest land use system showed lowest pH value (7.21) which can be attributed to acidic nature of decomposing biomass litter while as barren land showed highest pH value (7.90)

which may attributed to the accumulation of $CaCO_3$ and salts(Regmi and Zoebisch, 2004). Under temperate type of climate the mineralization process is slow, results in organic matter accumulation which decomposes slowly and helps in lowering the soil pH due to acid equivalent which may have direct effect on increased soil acidity Pathak *et al.,* (2005). The Electrical Conductivity under different land use systems ranged from 0.08-0.31 under forest, 0.18-0.77 under barren land, 0.11-0.45 under agriculture and 0.10-0.35 under horticulture (Table 1). The mean value was 0.19 under forest, 0.44 under barren land, 0.26 under agriculture and 0.23 under horticulture respectively. EC was (<1dS/m) indicated that all the blocks having non-saline and is safe for plant growth. 80 percent area of the district were having EC range (0.2-0.3) dS/m. Gandoh block and northern area of thathri block (90 percent area) were having EC range (0.3-0.4) dS/m as depicted in (Figure 2).

Table.1 Range and mean of soil physico-chemical properties under different land use systems of Doda district, J&K

Soil property	Forest			Barren land			Agriculture			Horticulture		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
pH	4.65	7.21	6.28	6.10	7.90	6.93	5.49	7.55	6.31	5.12	7.30	6.24
EC	0.08	0.31	0.19	0.18	0.77	0.44	0.11	0.45	0.26	0.10	0.35	0.23
OC	0.45	1.19	0.81	0.21	0.65	0.45	0.35	0.87	0.61	0.47	0.97	0.67

Fig.1 Digital soil fertility maps of soil pH, EC and OC of soils of Doda district, J&K (Map of pH in soils of Doda District)

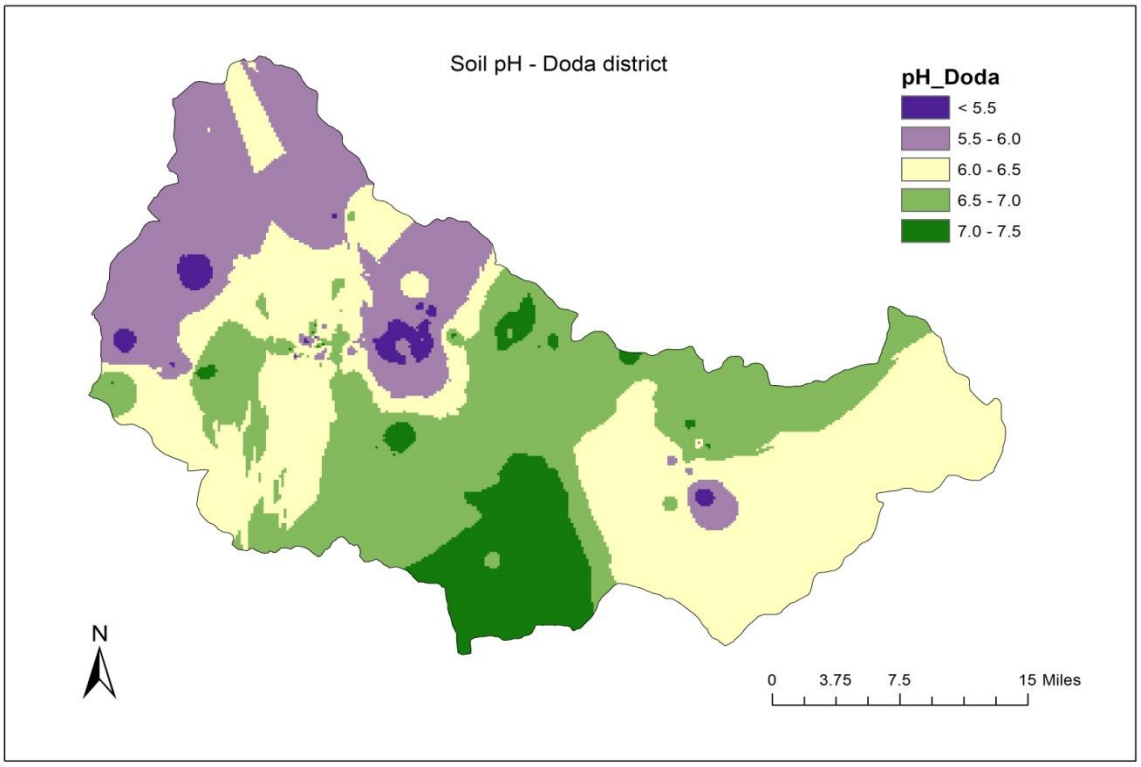


Fig.2 Map of EC in soils of Doda district

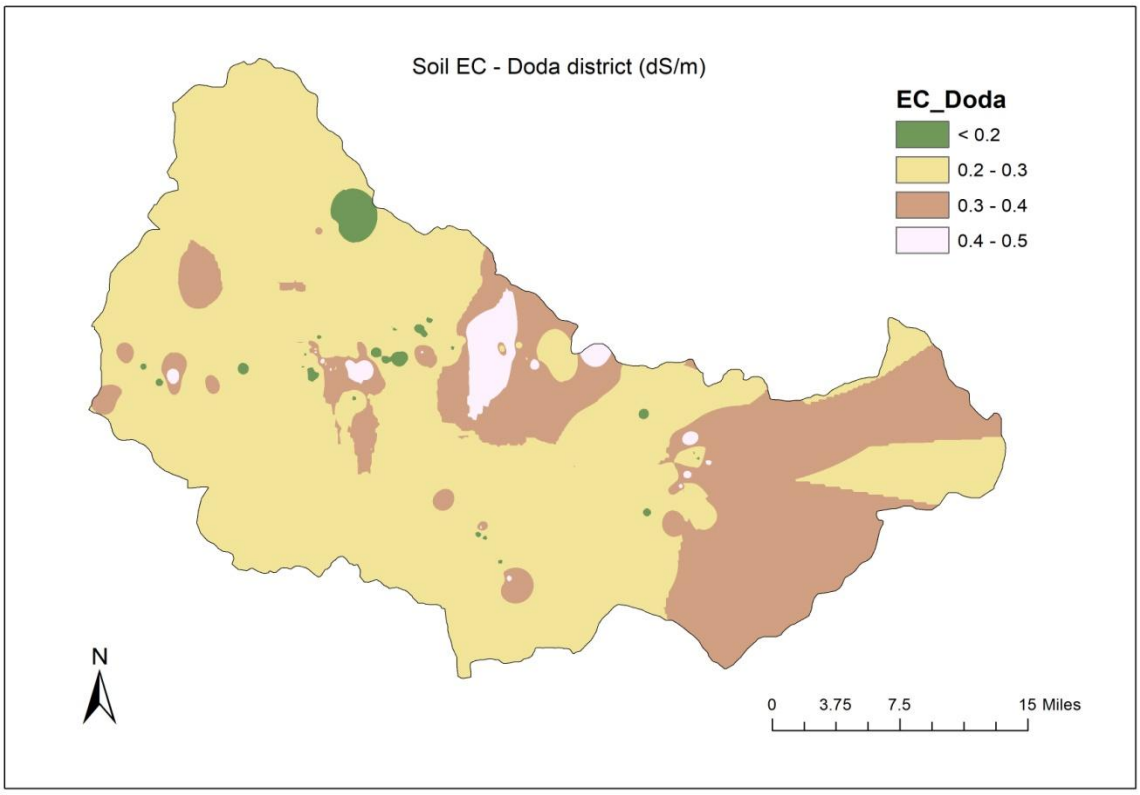
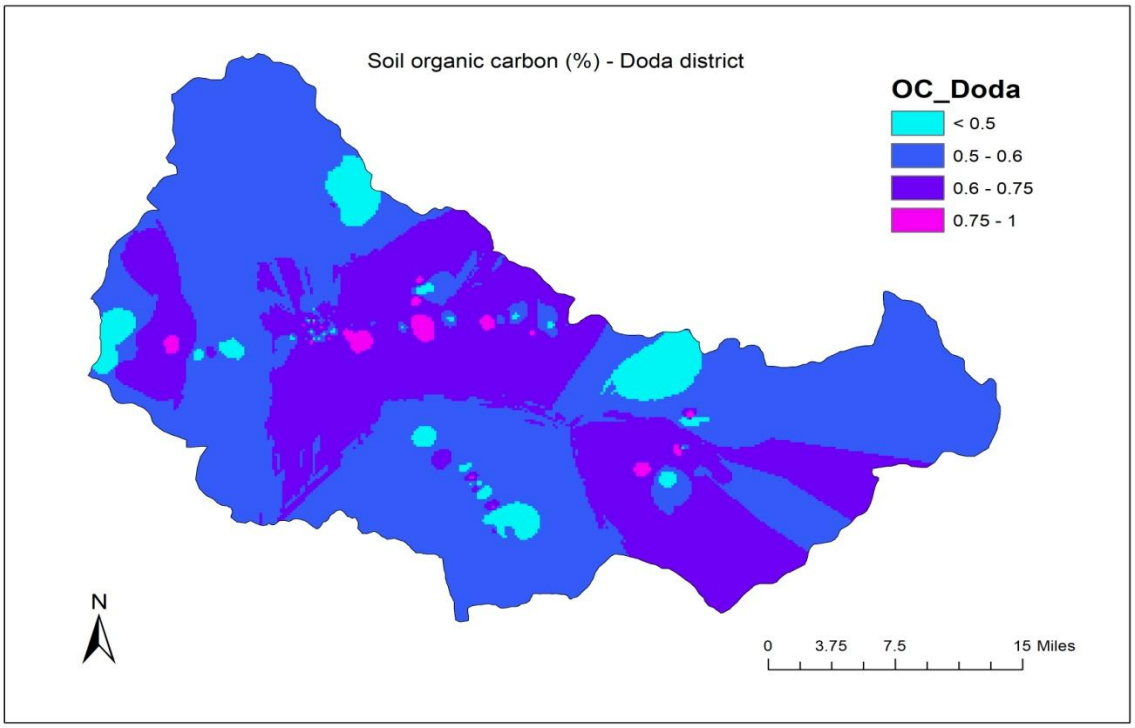


Fig.3 Map of organic carbon in soils of Doda district



The electrical conductivity in all land use systems of study area was within the safe limit below 1 dsm^{-1} for growing of any crop with lowest mean value in forest. It can be due to accumulation of salts in case of barren lands and high amount of decomposing litter in forest (Kiflu and Beyene, 2013). Because of hilly terrains and high amount of rainfall that cause leaching of salts into sub soil below root zone Abbasi and Rassol, (2007). The OC of the soils were ranged from 0.45-1.19 under forest, 0.21-0.65 under barren land, 0.35-0.87 under agriculture and 0.47-0.97 under horticulture (Table 1). The mean value was 0.81 under forest 0.45 under barren land 0.61under agriculture and 0.67 under horticulture, respectively. The maximum OC was recorded under forest (1.19), followed by horticulture (0.97), agriculture (0.87) and barren land (0.65). Organic Carbon content was moderate ranged from (0.5-0.6) percent in major portions of Ghat and Bhaderwah blocks and north-eastern side of block Gandoh (70 percent area). OC was moderately high ranged from (0.6-0.75) in central region of district and northern side of block Gandoh.

Less than 1 percent area of Doda was having high OC content (0.75-1.00) as depicted in (Figure 3). Organic carbon content showed a conspicuous variation between the land use systems, the soils of forest area had the highest values of organic carbon content (1.19%) and lowest values was observed under barren lands. Higher values of OC in forest areas can be attributed to high biomass production and lower decomposition rate at higher altitudes Yitbarek *et al.*, (2013) while lower values in agriculture is due to continuous organic matter oxidation subjected to anthropogenic activities Najar *et al.*, (2009). Lower values of OC in barren lands are due to sparse vegetation and no application of organic residues Mansha and Lone, (2013). Accumulation of more OM in forest soils may be due to higher clay content which forms clay-humus complexes and protect the OM against oxidation and degradation Quiroga *et al.*, (1996).

Thus, it could be concluded from the present study that the soil mapping by using GIS brings out the differences in soil fertility parameters across different land use, climate, and altitude within Doda district and in determining site specific nutrient management to maintain soil health.

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