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Categorization and classification of soils under different land use system in Nagpur district

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Abstract
The present investigation entitled "Categorization and classification of soils under different land use system in Nagpur district" was undertaken during 2018-2020 at Nagpur. The four sites were selected based on different variation in Nagpur. This four representative pedons were selected in four different locations of the study area covering all types of soils. All the four pedons were described for their morphological features in the field and depth-wise samples collected from 20 cm depth interval and labelled properly. Munsell's colour notation of Hue, Value and Chroma were observed for all soil samples.
The results indicated that soils have their colour Hue 10 YR, value with 2 to 6 and Chroma 1 to 4 *i.e.,* the soils were brownish black to dull yellow orange in colour. The soils of Nagpur district were found to be deep to very deep (pedon 1) and categorized as Vertisols is classified as typic Haplusterts whereas the shallow soil (pedon 2) categorized as Entisols and classified as typic Ustorthents. Medium to deep soil (pedon 3) categorized as Vertisols and classified as typic Haplustepts and moderately deep soil (pedon 4) categorized as Vertisols and classified as -typical Haplustepts.

Keywords: Soil, land use system, pedons, morphological charactors, munsell's colour chart, slickensides

Introduction
Soil is a valuable non-renewable resource, which provides essential support to ecosystems. Overexploitation of resources to meet the basic needs has depleted the finite land resources causing land degradation. The global demand for raw materials, industrial inputs and energy has been the main drivers of the depletion and degradation of resources. Sustainable management of land resources is essential for food security, maintenance of environment and general wellbeing of the people. Indiscriminate use of resources coupled with lack of management has, however, led to degradation echoing the concern of planners, researchers and farmers alike. It is essential to enhance the soil productivity to meet the future demand. Soil resource inventory through characterization of the resources provides an insight into the potentials and limitations. The characterization and mapping of different types of soils and their interpretation attains greater importance. Soil survey provides an accurate and scientific inventory of soils, their kind and nature, and extent of distribution so that one can make prediction about their characteristics and potentialities.
Soil resource information plays a critical role in the management of natural resources. To maintain, the present level of soil productivity and to meet the demand of the future, management of soil resources on scientific principles is very important. Therefore, increased emphasis is being laid on characterization of soils, accurate mapping of soils and developing rational and scientific criteria for land evaluation and interpretation of soils for multifarious land uses.
The coupling of soil characterization, soil classification provides a powerful resource for the benefit of mankind especially in the area of food security and environmental sustainability. Soil characterization provides the information for our understanding properties of the soils we depend on to grow crops, sustain forests and grasslands as well as support homes and society structures. Soil classification, on the other hand, helps to organize our knowledge, facilitates the transfer of experience and technology from one place to another and helps to compare soil properties.
The agro-climatic and soil characteristics of any region or place largely determines the degree of success of any cropping enterprise.

Though, this fact is recognized very widely, studies to generate quantified information on the combined influence of agro-climatic and soil-characteristics on crop performance are scattered. Quantitative information on land evaluation helps in better land use planning as yield levels have to be higher to sustain the increasing non-farming population.

The Nagpur district of Maharashtra is experiencing frequent erratic rainfall with continuous depletion of vegetative cover and increase in soil erosion with low crop productivity. The information on detailed characterization of soils, particularly, in soils of Nagpur district of Maharashtra will be of immense use for management of land resources and soil fertility for sustained agricultural production. Therefore, the present investigation has been planned to study the "Categorization and classification of soils under different land use system in Nagpur district" for land resources management for sustained agricultural production.

Materials and Methods

The present investigation entitled "Categorization and classification of soils under different land use system in Nagpur district" was undertaken with object to characterize and classify the soils under different land use system in Nagpur district during 2018-2020.

Representative four soil profiles were studied in the field for various morphological characteristics. Analysis of soil by field method i.e., morphological examination of soil profiles was carried out by the procedure suggested by USDA (Soil Survey Staff, 1951) [7]. Special observations regarding cracking depth and slickensides faces were also recorded. The different morphological characters of each pedons were described in the field (Soil Survey Division Staff, 2000) [6] as per the guidelines laid down in USDA Soil Survey Manual (Soil Survey Staff, 1998) [8]. Soil samples were collected in cotton bags from 20 cm depth interval of the pedons under study and labelled properly. Munsell's colour notation of Hue, Value and Chroma were observed for all soil samples (Munsell, 1912) [4]. The detailed morphological description for all the pedons were studied.

Results and Discussion

The morphology refers to the inherent characteristics of the soil such as soil color, texture, structure, consistency, presence or absence of pans, concretion and other such features of soil profile as can be perceived in the field. Prasad and Sahi (1989) [5] reported that morphological characteristics are influenced by the topographic situations. The morphological characteristics have been studied in the field as suggested in soil survey manual and presented in the table 1. The important morphological characteristics are discussed below;

Soil colour

Soil colour is one of the important morphological characteristics used for soil identification in the field and it helps in soil classification. Although it has little bearing on the functioning of the soil, a number of important aspects like wetness, organic matter content and the relative age of the soils can be inferred from soil colour. The black colour of soil usually indicates the presence of organic matter, red colour indicates the presence of free iron oxides common in well oxidized soils and commonly found in humid tropical region (Boul *et al*., 1980) [1].

The soils of the study area have colour in the hue 10YR, value ranging from 3 to 6 and chroma of 1 to 4. The hue, value and chroma denote dominant spectral colour, lightness or darkness of a colour and strength of colour respectively. The data presented in Table 4 indicate that most of the soils were brownish black (10 YR 3/2) to dull yellowish orange (10 YR 6/4) in colour.

Soil texture

The texture is an expression to indicate the coarseness or fineness of the soil and determined by the relative proportions of the various sized primary particles in the soil mass. It is one of the fundamental and permanent characteristics that have direct bearing on structure, porosity and consistence. Texture is capable of being judged to a close approximation by feel in the field, and quantitatively estimating through mechanical analysis of soils in the laboratory. Basalt being the parent material of the study area is known to produce higher amount of clay.

The data presented in Table 1 indicate that texture of pedon 1, 3, and 4 is clay texture soil, whereas the pedon 2 is clay to sandy loam in texture soil. These variations were caused by topographic position, nature of parent material, in-situ weathering, and translocation of clay and age of soils. Krishnan *et al.*, (2004) [2] stated that Entisols of Lakshadweep islands were light textured, predominantly, sandy or loamy sand and occasionally sandy loam in texture. Similar results were also made by Walia and Rao (1997) [10], Leelavathi *et al*. (2009) [3].

Soil structure

Soil structure refers to the arrangement of primary soil particles into secondary particles, units or peds. The secondary units are characterized and classified on the basis of size, shape and degree of distinctness into classes, types and grades respectively. This is recognized as one of the most important properties of the soil mass in that it influences the soil in almost all of its reactions, but especially with regard to aeration, moisture, temperature, permeability and water holding capacity.

The data presented in Table 1, the pedon 1 showed that the medium, weak and sub-angular blocky to angular blocky in structure. Pedon 2 and 4 exhibited medium, weak and sub-angular blocky to moderate, angular blocky in structure. And pedon 3 shows that medium, weak to moderate and sub-angular blocky in structure.

Soil consistence

Soil consistence refers to manifestation of the physical forces of cohesion and adhesion acting within the soil at various levels of moisture. The consistence varied from slightly hard to hard, friable to firm and slightly sticky slightly plastic to slightly plastic in dry, moist and wet conditions of all the studied pedons. (Table no.1).

This qualitative physical behavior of soils, as influenced by dry, moist and wet conditions was not only due to the textural make up but also due to the type of clay minerals present in these soils. Presence of loose, friable and non-sticky and non-plastic or slightly sticky and slightly plastic consistence might be due to negligible or very small amount of expanding clay minerals. Similar findings were also reported by Thangasamy *et al.* (2005) [9] in the soils of Sivagiri micro-watershed in Chittoor district of Andhra Pradesh.

Porosity

The pores were observed fine in size and common too few in quantity in different layers of the pedons. High porosity of these soils was due to finer texture of the soils. The porosity in general indicated that the drainage varied from poorly drained to well- drained (Table 1).

Table 1: Morphological characteristic of soil

Depth (cm)	Munsell colour	Texture	Structure			Consistence			Effervescence	Pores		Roots		Nodules	Special Features	
			S	G	T	D	M	W		S	Q	S	Q	S	Q	
Pedon P1: Typic- Haplusterts																
0-20	10 YR 3/4	C	M	2	SBK	SH	FR	SSSP	E	F	C	F	F	F	VF	Cracks 1-2 cm width, Up to 40 cm pressure faces
20-40	10 YR 3/4	C	M	2	SBK	SH	FR	SSSP	ES	F	C	F	F	F	VF	
40-60	10 YR 3/2	C	M	2	SBK	SH	FR	SP	ES	F	C	F	VF	F	VF	
60-80	10 YR 3/2	C	M	2	SBK	H	FR	SP	ES	F	F	F	VF			
80-100	10 YR 3/2	C	M	2	ABK	H	FR	SP	ES	F	F					
100-120	10 YR 3/2	C	M	2	ABK	H	FR	SP	ES	F	F					
PEDON P2: TYPIC- USTORTHENTS																
0-20	10 YR 4/1	C	M	2	SBK	SH	FR	SP	E	F	F	F	C	F	F	
20-40	10 YR 6/4	SL	M	1	SBK	SH	FI	SP	E	F	F	-	-	-	-	
40-80	Weathered parent material															
Pedon-3 Typic Haplusterts																
0-20	10 YR 3/3	C	M	2	SBK	SH	FR	SSSP	E	F	F	M	M	F	F	Slickensides at 5th horizon
20-40	10 YR 3/3	C	M	2	SBK	SH	FR	SSSP	E	F	F	M	M	F	F	
40-60	10 YR 3/4	C	M	2	SBK	SH	FR	SSSP	E	F	F	M	F	F	F	
60-80	10 YR 3/4	C	M	2	SBK	SH	FR	SP	ES	F	F	M	F	-	-	
80-100	10 YR 3/4	C	M	3	SBK	SH	FR	SP	ES	F	F	F	F	-	-	
100-120	10 YR 3/4	C	M	3	SBK	SH	FR	SP	ES	F	F	F	F	-	-	
Pedon-4: Typic- Haplusterts																
0-20	10 YR 2/3	C	M	1	SBK	SH	FR	SP	E	F	C	C	M	F	F	
20-40	10 YR 2/3	C	M	1	SBK	SH	FR	SSSP	E	F	C	C	M	F	F	
40-60	10 YR 3/3	C	M	2	SBK	SH	FI	SSSP	ES	F	C	C	F	F	F	
60-80	10 YR 3/3	C	M	2	ABK	SH	FI	SP	ES	F	F	F	F	-	-	
80-100	10 YR 3/2	C	M	2	ABK	SH	FI	SP	E	F	F	-	-	-	-	

Roots

Roots were abundant in surface layers and decreased with depth. The roots in different pedons were fine, medium to coarse in size and few, very few to common in quantity. Root distribution indicated that vegetation of the area comprises of annuals and grasses.

Conclusion

It can be concluded from the above results that the soils of Nagpur districts were brownish black (10 YR 3/2) to dull yellow orange (10 YR 6/4) in colour and have subangular blocky structure in the upper layer of each pedons whereas, it was angular blocky in the subsurface horizons of most of the deep soil pedons. The soil depth ranged from 20 to 120 cm and accordingly these Soils of Nagpur districts were found deep to very deep soil (pedon 1) categorized as Vertisols and classified as typic Haplusterts. The shallow soil (pedon 2) categorized as Entisols and classified as Typic Ustorthents; medium to deep soils (pedon 3) categorized as Vertisols and classified and Typic Haplustepts and Moderately deep soil (pedons 4) categorized as Vertisols and classified as -Typic Haplustepts.

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