

RESEARCH ARTICLE :

Studies on morphological properties of soil profiles in village Baragaon nandur, taluka Rahuri, dist-Ahmednagar of state Maharashtra

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SUMMARY : Soil profile studies on entisols, inceptisols and vertisols in Village Baragaon Nandur was carried out during the year 2015-16. four soil orders viz., two entisols, one inceptisols, vertisols of village Baragaon Nandur were analyzed for soil morphological properties which are derived from basalt, basaltic alluvium and slightly conditioned by topography. These orders were shallow (entisols), moderately deep (inceptisols), very deep (vertisols) and have depth 22 to 120cm, and have their colour munsell notation in 10YR/7.5YR in hue with value ranges from 5 to 7 and Chroma ranges from 1 to 4. The structure of Entisols (A) and Entisols (B) are weak fine subangular blocky. While Inceptisols showed medium subangular blocky structure at surface horizon and it was changed to medium angular blocky structure at subsurface and Vertisols showed coarse hard subangular blocky at surface horizon and it was changed to medium strong angular blocky at subsurface horizon. but angular blocky type structure is a common feature in slickenside zone of vertisols and inceptisols. The textural class of Entisols (A) was silty clay while Entisols (B) showed clay loamy texture throughout the profile from surface to subsurface horizons, While Inceptisols and Vertisols showed clay textural class throughout the solum. The consistence of the Vertisols and Inceptisols was very hard when dry, moderately firm to moderately very firm when moist. The present investigation was undertaken to generate comprehensive information about the characteristics of soil for evolving proper soil and water management strategies so as to maximize and sustain agriculture production.

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BACKGROUND AND OBJECTIVES

Soils are considered as the integral part of the landscape and their characteristics are largely governed by the landforms in which they are developed. Topographic maps, aerial photographs and remote sensing data provide

useful tools for geomorphic analysis of the region and help in the soil survey and mapping (Pandey and Pofali, 1982).

The life supporting systems of a country and socio-economic development of its people depends on the soils. More than ever before,

a renewed attention is being given to soils due to rapidly declining land area for agriculture, declining in soil fertility and increasing soil degradation, land use policies and irrational and imbalanced use of inputs (Kanwar, 2004). All the above factors call for a paradigm shift in research away from the maximum crop production to the sustainability of the crop production system without degradation of soil health and environmental quality. Systematic study of morphology and taxonomy of soils provides information on nature and type of soil, their constraints, potential, capabilities and their suitability for various uses (Sehgal, 1996).

Soils of Maharashtra State have been broadly classified as 1) The laterites and lateritic soils 2) The costal saline and costal alluvium soils 3) Shallow medium and deep black soil 4) Gray and red soils of mixed parent materials and 5) Saline, saline-alkaline and non-saline-alkaline soils (Raychaudhari and Chakravarty, 1943).

Soil is a vital natural resource and 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. Soils of Maharashtra State are categorized as poor in fertility and vary widely in genetic, morphological, physical, chemical and biological characteristics (Challa *et al.*, 1995). The nutrient deficiencies started appearing in different areas due to introduction of intensive production systems after green revolution period. It is due to net removal rates of micronutrients by crops being higher under intensive productivity regimes (Kanwar, 2004). The nutrient deficiencies situation was further increased by the discontinuous and diversified use of organic manures and chemical fertilizers.

A soil profile is a historic record of all the soil farming processes and forms the unit of study in pedological investigation. It also helps in soil classification and forms the basis for practical studies of soils. A study of soil profile is important from crop husbandary point of view, since it reveals the surface and subsurface characteristics and qualities, namely depth, texture, structure, drainage conditions and soil-moisture relationships, which directly affect plant growth. It helps to classify the soils and to understand soil-moisture-plant relationships.

Study area :

The Village Baragaon Nandur is boundary between region located in between 19° - 21'N latitude and 74° - 35' E longitude and covers total geographical area of 3845 ha. The elevation is 500m above mean sea level. The Village Baragaon Nandur, is situated about 38 km away from Ahmednagar city. Soils of Village Baragaon Nandur is derived from the igneous rocks *viz.* Basalt (Deccan trap) which is basic in nature containing mainly feldspars, augite and small amount of titan ferrous magnetite mineral. In the vesicular rocks the any of daloidal cavities are filled with mineral like zeolite and quartz.

The soils of Village Baragaon Nandur are under the cultivation of Jowar, Bajara, Wheat, Gram, Pigeon Pea, Soybean, Black Gram, Safflower, Sugarcane and Cotton crops. The natural vegetation grown comprises of dry deciduous tree species and some grasses. The climate is usually hot and potential evapo-transpiration (PET) is far excess of the precipitation and is classified as semi-arid tropical. Village Baragaon Nandur, Taluka Rahuri, Dist- Ahmednagar experience a hot spell from the month of March and May, with rains from June to September. The mean annual maximum and minimum temperatures were ranged from 32.9°C and 18.8°C, respectively. The Village Baragaon Nandur has annual precipitation of 517.8 mm. The rainfall is torrential, erratic, scanty and ill distributed.

RESOURCES AND METHODS

The survey and sampling was carried out in Village Baragaon Nandur, Taluka Rahuri, Dist- Ahmednagar. Four soil profile site were selected by using GPS (Global Position System) for study after travelling through the area where inceptisols, entisols, vertisols are present. Recorded of surveyed fields, latitude, longitude and altitude was maintained. Profile were dug at selected sites and detailed morphological examination was carried out as per procedure laid down in USDA soil survey manual. Soil sample were collected horizon wise. The soil samples from selected site were collected by using stainless steel auger to avoid iron contamination. Total 12 samples collected from the different horizons of two Entisols, one Inceptisol, and one Vertisol. Soil samples were brought to the laboratory and air dried under shade avoiding contamination with foreign materials and then crushed with a wooden pestle. The sample is then screened through a 2mm sieve and the pebbles, stones

and roots were rejected. About 0.5 to 1kg of air dried crushed soil sample was put in the plastic sample bottle, labeled and stacked on the open sample racks for analysis. A brief description of standard test procedure followed for various morphological characteristics are described in this section.

1.	Horizon	As per morphological properties	Soil Survey Staff USDA Manual (1975.)
2.	Texture	Hand feeling method	
3.	Structure	By visual	
4.	Consistency	Hand feeling	
5.	Colour	Munsell colour charts	

OBSERVATIONS AND ANALYSIS

The soil profile study was conducted on four soil orders of Village Baragaon Nandur such as two Entisol, one Inceptisol, and one Vertisols. The result of the investigation is described under following heading.

Morphological characteristics of soil profile :

The Morphological features of representative soil profiles Entisols, Vertisols and Inceptisols, were examined in detail. The information regarding morphological

characters is presented in detail in Annexure-II. The Classification and abbreviated morphological features are presented in Table 1.

Soil depth :

The least depth (22 cm) was observed in Entisols (A). In case of Inceptisols it showed 75 cm depth. In Entisols (B) the depth is more than 100 cm and Vertisols showed very deep 120 cm depth. The shallowness in the Entisols (A) might be due to recently formed soil without any subsurface diagnostic horizon and incase of Entisols (B) it was developed on the bank of river with recently formed alluvial parent material showing very high depth but no horizonation. Deep soils formed due to deposition of basaltic material causing deeper soil solums in case of Vertisols and Inceptisols. The depth variability in soil solum also reflects the association of soil characteristics in relation to variability in geomorphic unit. Similar observations were also reported for Indian Entisols, Inceptisols, Vertisols. (Bhattacharjee *et al.*, 1977, Bhattacharyya *et al.*, 1992, Challa, 1995).

Soil colour :

The surface and subsurface soilcolour of Entisols ranged from pale brown 10 YR 6/3 to 10 YR 7/4 (very

Table 1 : Morphological characteristics of representative Pedons of Village Baragaon Nandur

Pedon No.	Horizon	Depth	Texture	Structure	Consistency		Colour
					Dry	Moist	
Pedon 1 TypicUstorthent (Entisols A)							
Pedon 1	Ap	0-22	Sic	1f sbk	dsh	mfr	7.5 YR5/2
	Cr	22+	Weathered Basalt	-	-	-	-
Pedon 2 VerticHaplustept (Inceptisols)							
Pedon 2	Ap	0-26	C	2 msbk	dvh	mfi	10 YR 3/2
	B	26-58	C	2 mabk	dvh	mvfi	10 YR 4/1
	B	58-75	C	2 mabk	dvh	mvfi	10 YR 3/1
	Cr	75+	-				
Pedon 3 TypicHaplustert (Vertisols)							
Pedon 3	Ap	0-28	C	3c sbk	dvh	mfi	10 YR 4/1
	Bw	28-66	C	2 mabk	dvh	mvfi	10 YR 3/2
	Bss	66-90	C	2 mabk	dvh	mvfi	10 YR 3/2
	Bwss	90-120	C	2 mabk	dvh	mvfi	10 YR 3/3
Pedon 4 TypicPluventic (Entisols B)							
Pedon 4	Ap	0-30	Cl	1f sbk	dsh	mfr	10 YR 6/3
	A ₂₁	0-68	Cl	1f sbk	dsh	mvfr	10 YR 7/4
	A ₂₂	68-100	Cl	1f sbk	dsh	mvfr	10 YR 7/4
	A ₂₃	100-150+	Cl	1f sbk	dsh	mvfr	10 YR 7/4



Plate 1: Representative profile of Entisols (A) of Baragaon Nandur village



Plate 3: Representative profile of Inceptisols of Baragaon Nandur village



Plate 2: Representative profile of Entisols (B) of Baragaon Nandur village



Plate 4: Representative profile of Vertisols of Baragaon Nandur village

pale brown) in case of Entisols (B) and 7.5 YR 5/2 (brown) in case of Entisols (A). The surface and subsurface colour of Inceptisols ranged from 10 YR 3/1 (grey) to 10 YR 4/1 (very dark grey) and the Vertisols ranged from 10 YR 3/2 (dark grey) to 10 YR 4/1 (dark brown). Bhattacharya *et al.* (1992) studied the Inceptisol pedons of Pune district of Maharashtra and reported that the Inceptisols had hue 10YR, value around 4 to 3 and chroma 4 or less.

Soil texture :

The textural class of Entisols (A) was silty clay while Entisols (B) showed clay loamy texture throughout the profile from surface to subsurface horizons, While Inceptisols and Vertisols showed clay textural class throughout the solum. Entisol (A) developed recently on basaltic parent material while Entisols (B) developed on the bank of river of Village Baragaon Nandur which is deposited by water without developing any surface diagnostic horizon. However, Inceptisols and Vertisols developed on flat topography with the weathering of basaltic parent material.

Soil structure :

The structure of Entisols (A) and Entisols (B) are weak fine subangular blocky. While Inceptisols showed medium subangular blocky structure at surface horizon and it was changed to medium angular blocky structure at subsurface and Vertisols showed coarse hard subangular blocky at surface horizon and it was changed to medium strong angular blocky at subsurface horizon. Vertisols and Inceptisols, showed coarse moderately hard sub angular at surface layer and medium strong angular blocky at subsurface layer (Patil *et al.*, 2010).

Soil consistency :

The consistence of the Vertisols and Inceptisols was very hard when dry, moderately firm to moderately very firm when moist. The consistency observed might be due to high content of swelling and shrinking type of smectitic group of clay and low content of sand. The consistence of Entisols, shallow and deep soil orders was slight hard to hard when dry, moist friable to moist very friable when moist. Variability in the consistency of different soil series indicates the variation in nature and quantity of clay formed under different pedogenic processes.

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