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RESEARCH ARTICLE :

Studies on physical and chemical properties of soil profiles in village Baragaon nandur, taluka Rahuri, dist- Ahmednagar of state Maharastra

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SUMMARY : Soil profile studies was conducted in Baragaon Nandur Village, four soil orders *viz.*, two entisols, one inceptisols, vertisols were analyzed for soil physical and chemical properties which are derived from basalt, basaltic alluviam and slightly conditioned by topography. These orders were shallow (entisols), moderately deep (inceptisols), very deep (vertisols).The available moisture content at 33 kPa and 1500 kPa for Entisols (A) soil series is 28.55 and 15.35 per cent, respectively. In Inceptisols it was ranged from 37.15 to 39.38 per cent at 33 kPa and 23.00 to 23.20 per cent at 1500 kPa while in Vertisols it was ranged from 42.89 to 49.39 per cent at 33 kPa and 22.89 to 30.09 per centat 1500 kPa. and in Entisols (B) it was ranged from 31.06 to 32.88 per cent at 33 kPa and 18.93 to 20.67 per cent at 1500 kPa, respectively.The pH of the soils (1:2.5 soil: water suspension) ranged from 8.23 in Entisols (A), 8.11 to 8.25 in Entisols (B), 8.13 to 8.42 in Inceptisols and 8.12 to 8.38 in Vertrisols.the EC value of Entisols (A) was 0.24, while in Entisols (B) it was ranged from 0.31 to 0.42 dSm^{-1}. In Inceptisols it was ranged from 0.28 to 0.53 dSm^{-1}.In case of Vertisols, EC value ranged from 0.24 to 0.48 dSm^{-1}. The highest nitrogen content was observed in Entisols (B) (326.50 kg ha^{-1}) followed by Vertisols (295.82 kg ha^{-1}) followed by Entisols (A) (254.01 kg ha^{-1}) and Inceptisols (228.92 kg ha^{-1}). The depth wise available P content in Entisols (A) was 8.50 kg ha^{-1}. In Inceptisol it was ranged 12.95 to 15.68 kg ha^{-1}, in Vertisols it was varied from 7.39 to 15.91 kg ha^{-1}. And in Entisols (B) it was ranged from 4.43 to 11.92 kg ha^{-1}.Available K content in Entisols (A) was 281.0. In Entisols (B) it was ranged from 196.0 to 313.6 kgha^{-1}, In case of Inceptisols it was ranged from 258.5 to 393.4 kg ha^{-1}. Vertisols ranged from 202.3 to 494.5 kg ha^{-1}.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.

KEY WORDS :
Entisols, Inceptisols, Vertisols, F.C, P.W.P, pH, EC, N.P.K.

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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, 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 farms 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, texure, 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 Nanduris 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 Nanduris derived from the igneous rocks *viz.* Basalt (Deccan trap) which is basic in nature containing mainly feldspars, augite and small amount of titaniferrous magnetite mineral. In the vesicular rocks the any of daloidal cavities are filled with mineral like zeolite and quartz. The soils of Village Baragaon andurare 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-aired 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 32.9^0C and 18.8^0C, 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 BaragaonNandur, 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

Table A : Standard analytical methods used for physical and chemical analysis of soil samples

Sr. No.	Parameters	Method used	Reference
Physical properties			
1.	Field capacity (FC)	Pressure plate method	Richard (1968)
2.	Permanent wilting point (PWP)	Pressure plate method	Richard (1968)
Chemical properties			
1.	pH (1:2.5)	Potentiometric	Jackson (1973)
2.	EC (1:2.5)	Conductometric	Jackson (1973)
3.	Available nitrogen	Alkaline permanganate method	Subbiah and Asija (1956)
4.	Available phosphorus	0.5 M $NaHCO_3$ (pH 8.5)	Watanabe and Olsen (1965)
5.	Available potassium	(N NAmmonium acetate)	Jackson (1973)

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. Each soil sample was analysed for following physical, chemical properties of soil.

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.

Physical properties of soil profile :

Details of data regarding the physical properties are presented in Table 1.

Moisture content :

The available moisture content at 33 kPa and 1500 kPa for Entisols (A) soil series is 28.55 and 15.35 per cent, respectively. In Inceptisols it was ranged from 37.15 to 39.38 per cent at 33 kPa and 23.00 to 23.20 per cent at 1500 kPa while in Vertisols it was ranged from 42.89 to 49.39 per cent at 33 kPa and 22.89 to 30.09 per cent at 1500 kPa. and in Entisols (B) it was ranged from 31.06 to 32.88 per cent at 33 kPa and 18.93 to 20.67 per cent at 1500 kPa, respectively. It was observed that available water capacity of Entisols (A) was 13.2, Inceptisols was ranged from 14.15 to 17.78 Vertisols was ranged from 19.30 to 21.00 and in Entisols (B) it was ranged from 10.39 to 13.95. The Inceptisols and Vertisols having high water holding capacity this could be due to very fine nature of smectitic clays with higher content of total clay and medium to deep profile depth. A linear relationship between clay content and moisture retention was also observed by Balpande ***et al.*** (2007) and Nagar ***et al.*** (1995) water retention at 33 kPa and 1500 kPa depends upon clay, COLE, smectitic mineral content of soil. (Ashok kumar and Prasad, 2010).

Chemical properties of soil profile :

Details of data regarding the chemical properties is presented in Table 1.

Soil reaction (pH) :

The pH of the soils (1:2.5 soil: water suspension) ranged from 8.23 in Entisols (A), 8.11 to 8.25 in Entisols (B), 8.13 to 8.42 in Inceptisols and 8.12 to 8.38 in Vertrisols *i.e.* moderate alkaline in reaction. In general, no definite depth wise trend in respect of soil pH was observed. The similar observations were also reported for Entisols, Inceptisols and Vertisols soils of Maharashtra by Anantwar ***et al.*** (2000). In Vertisols, the pH in most cases increases with depth and become alkaline in the sub surfaces. This might be due to bicarbonate precipitated as $CaCO_3$due to high evaporative demand under semi-arid conditions.

Electrical conductivity (EC) :

It was observed that the EC value of Entisols (A) was 0.24, while in Entisols (B) it was ranged from 0.31 to 0.42 dSm^{-1}. In Inceptisols it was ranged from 0.28 to 0.53 dSm^{-1}.In case of Vertisols, EC value ranged from

0.24 to 0.48 dSm^{-1} with average mean value 0.34 dSm^{-1}.From above observation it is revealed that EC value of Inceptisols and Vertisols are near about same but more than Entisols. In general, the lower sub-surface horizons of different soil series have slightly higher soluble salts than surface (Ap) Horizon. The higher EC value in subsurface layer might be indicated more salts accumulation as compared with surface horizon. The variation of electrical conductivity of Entisols, Vertisols and Inceptisols soil series confirmed the impact of topography on soluble salts accumulation in surface and subsurface horizon. Similar values of EC for shrink and swell soils of India were also reported by Sohan Lal ***et al.*** (1994) and Anantwar ***et al.*** (2000).

Available nitrogen :

The data on available N, P, and K content of the soil orders are given in Table 1. The highest nitrogen content was observed in Entisols (B) (326.50 kg ha^{-1}) followed by Vertisols (295.82 kg ha^{-1}) followed by Entisols (A) (254.01 kg ha^{-1}) and Inceptisols (228.92 kg ha^{-1}). Although a variation in available N content in these soils was observed, all the soils were categorized as low to moderate in nitrogen content. In general, the depth wise decrease in available N content in all the soils probably due to decrease in organic carbon content with depth.

Available phosphorus :

The depth wise available P content in Entisols (A) was 8.50 kg ha^{-1}. In Inceptisol it was ranged 12.95 to 15.68 kg ha^{-1}, in Vertisols it was varied from 7.39 to 15.91 kg ha^{-1}. And in Entisols (B) it was ranged from 4.43 to 11.92 kg ha^{-1}.The available P content was ranged from very low to moderate. In case of Inceptisols and Vertisols available P content was moderate in surface layer. It might be due to pre-sowing fertilizer applications. Depthwise decrease in available P content was observed in all the soil orders.

Available potassium :

Available K content in Entisols (A) was 281.0. In Entisols (B) it was ranged from 196.0 to 313.6 $kgha^{-1}$, In case of Inceptisols it was ranged from 258.5 to 393.4 kg ha^{-1}. Vertisols ranged from 202.3 to 494.5 kg ha^{-1}. Maximum K content was observed in Vertisols on the surface horizon (494.5 kg ha^{-1}) while minimum K content was observed in Entisols (B) in lower horizon (196.0 kg ha^{-1}). K content was ranged from moderate to very high, respectively. Entisols are very low in available K content same result was reported by Ashok kumar and Prasad, (2010) in sugarcane growing soils of Ahmednagar District.

Table 1 : Physical and Chemical properties of Representative Pedons of Village Baragaon Nandur

Pedon no.	Physical properties			Chemical properties				
	F.C	PWP	AWC %	pH (1:2.5)	E.C. (dSm^{-1})	N	P	K
Pedon 1 Entisols (A)								
P_1-0-22	28.55	15.35	13.2	8.23	0.24	254.01	8.87	281.0
Pedon 2 Inceptisols								
P_2-0-26	37.36	23.20	14.16	8.42	0.28	228.92	15.68	393.4
26-58	37.15	23.00	14.15	8.23	0.53	185.02	13.18	269.7
58-75	39.38	21.60	17.78	8.13	0.49	122.30	12.95	258.5
Pedon 3 Vertisols								
P_3-0-28	42.89	22.89	21.00	8.38	0.24	295.82	15.91	494.5
28-66	49.09	29.60	19.49	8.31	0.44	181.88	9.42	414.4
66-90	49.39	30.09	19.30	8.25	0.48	125.44	7.50	427.1
90-120	47.79	28.29	19.50	8.12	0.31	112.89	7.39	202.3
Pedon 2 Entisols (B)								
P_4- 0-30	32.88	18.93	13.95	8.25	0.31	326.50	11.92	313.6
30-68	31.49	19.09	12.40	8.22	0.42	301.05	8.87	246.4
68-100	31.06	20.67	10.39	8.18	0.38	197.21	4.43	201.6
100-150	32.19	19.50	12.69	8.11	0.36	188.16	5.09	196.0

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REFERENCES

Anantwar, S.G., Babrekar, P.G.. Bhaskar, B.P. and Challa, O. (2000). Variability in swell shrink potentials in two transects on basaltic plateau of Wardha District Maharashtra. *J. Indian Soc. Soil Sci.,* **48** : 145-151.

Ashokkumar, H.P. and Prasad, J. (2010). Some typical sugarcane growing soils of Ahmednagar District of Maharashtra, Their Characterization and nutritional status of soil and pant. *J. Indian Soc. Soil Sci.,* 58 : 257-266.

Ashokkumar, H.P. and Prasad, J. (2010). Some typical sugarcane growing soils of Ahmednagar District of Maharashtra, Their Characterization and nutritional status of soil and pant. *J. Indian Soc. Soil Sci.,* **58** : 257-266.

Balpande, H.S., Challa, O. and Prasad, J. (2007). Characterization and classification of grape growing soils in Nasik District, Maharashtra. *J. Indian Soc. Soil Sci.,* **55** : 80-83.

Challa, O. (1995). Gilgai micro relief in swell shrink soils. A case study from Solapur District. *J. Indian Soc. Soil Sci.,* **43** : 649-652.

Chinchmalatpure, A.R., Brinjal, R., Challa, O. and Sehgal, J. (2000). Available micronutrient status of soil on different parent material and landform in a micro-watershed of Wunna catchment near Nagpur (Maharashtra). *Agropedol.,* **10** : 53-58.

Jackson, M.L. (1973). *Soil chemical analysis*, Prentice Hall of India. Private limited New Delhi, p. 498.

Kanwar, J.S. (2004) Address by the guest of honour, 69th annual convention of the Indian Society of Soil Science held at the Acharya N.G. Ranga Agricultural University (ANGRAU). *HydrabadJournal of the Indian Society of Soil Science***52**, 295-296.

Nagar, R.P., Gupta, P.K., Karkansi, P.K., Sharma, S.P. and Saxena, L. (1995). Soil and water characteristics of different soil series of Chambal command area of Rajastan. *J. Indian Soc. Soil Sci.,* **44** : 329-334.

Nelson, D.W. and Sommer, L.E. (1982). Total carbon and organic matter. Methods of Soil Analysis part-II. Page, A.L. (Ed.). *Agron. Mono. No.9 American Society of Agronomy, Madison, Wisconsin*. pp.185-187.

Pandey, S. and Pofali, R.M. (1982). Soil-physiography relationship. Review of soil research in India. Part II. XII International Congress of Soil Science, New Delhi, India, 8-16 February, 1982, pp.572-584.

Raychoudhari, S.P. and Chakravarty (1943). Studies on Indian red soils. *J. Indian Agril. Sci.,* **13** : 252-254.

Richards, L.A. (ed) (1968). Pressure Plate membrane apparatus. *Soil Sci. Soc. America Proceedings.* **25459** : 456-459.

Sehgal, J. (1996). *Pedology,* Concept and applications, Kalyani Publisher, New Delhi. pp,123-125.

Sohan Lal, Deshpande, S.B. and Sehgal, J.L (1994) Soil handbook 18, US. Govt. Printing office Washington, D.C. 139-140.103.

Subbiah, B.V. and Asija, G.L. (1956) A rapid procedure for the estimation of available nitrogen in soils. *Current Sci.,* **25** : 259-260.

Thakur, D.S., Bapat, P.N., Dubey, D.D. and Gupta, G.P. (1999). Clay properties, mineral stabillty and mineralogy of Vertisols of Central India. *J. Indian Soc. Soil Sci.,* **47** : 781-788.

Watanabe, F.S. and Olsen, S.R. (1965). Test of Ascorbic Acid methods for Phosphorus in water and Sodium bicarbonate extract of soil. *Proceedings Soil Sci. Soc. America,* 21 : 677-678.