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Morphological, Nutritional and Mineralogical Status of Soil Samples Collected From Tembha Site, Shahada Tehsil, Nandurbar District

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ABSTRACT

Soil samples were collected from Tembha (A) site of Shahada Tehsil of Nandurbar District, Maharashtra, India. For this study five samples from Tembha site was collected and analyzed for physico- chemical parameters such as pH, Organic carbon O.C., electrical conductivity EC, Exchangeable cation such as calcium, magnesium, sodium and anions chloride and sulphate, Sodium absorption ratio SAR, exchangeable sodium percentage. The constitution of soil morphological study includes the color, texture, consistency, depth and structure. The results of total and available N, P and K total Fe, Mn, Cu and Zn contents in the soils were reported as a part of nutritional status of the soil. Mineralogical identification of powder soil samples were carried out by using powder X-ray Diffraction (XRD) technique. The XRD results revealed the presence of various minerals. SEM/EDS analysis of soil sample also carried out.

Keywords: Morphology, Nutritional, XRD, SEM.

INTRODUCTION

Soil serves as a substrate supporting plant growth, as a nutrient reservoir, and as the site for many biological processes involved in decomposition and recycling of plant and animal products [1-3]. Soil integrates, transforms, stores and filters material relevant to its environmental and management conditions in the spatial context [4]. It is also a medium that is challenged by changing environmental and management conditions [5]. Soil resource is non-renewable thing in human time scales [6]. The importance of soils to humankind is documented by the many ancient and old civilizations, some of which vanished because mismanagement destroyed the soils on which they depend [7]. Study of mineralogical composition of soil is important parameter to the proper understanding of soil development, fertility status as well as improvement of management practices for economic crop production. The types of mineral present in soil have an impact on availability of major, secondary and micronutrients to the crops. Soil mineralogy is determined routinely because of its strong influence on soil behavior, its use in soil classification, and its relevance to soil genetic processes [8,9].

MATERIALS AND METHODS

Morphology: Measurements of soil depth take place from the soil surface. The measurement of soil depth is takes place from the surface. Bouyoukis hydrometer method is used for Particle size analysis. Soil color is resolute for both dry and damp samples by means of the Munsell notation as hue, value and chroma. Soil Structure test needs some knowledge from the observer Test. Soil sample was taken from the soil surface horizon and griped it gently and the geometric shape of the macro aggregates was Guised and examined.

Physico Chemical Characteristics: Physico chemical characteristics were determined by using standard reported methods.

Nutritional Status of Soil: Micronutrients Cation Fe, Mn, Cu, and Zn were estimated by Atomic Absorption Spectroscopy method and Following methods were used for the estimation of different nutrients:

Calcium and Magnesium : Versenate (EDTA) method.
Available Phosphorous : By Olsen's method
Available nitrogen : By alkaline $KMnO_4$ method
Available Potassium : Flame Photometer Method

XRD and SEM Analysis: Identification minerals are takes place by X-ray diffraction (XRD) method, elemental composition of soil sample are detected by EDAX method and soil images are analysed by scanning electron microscopy (SEM) method.

RESULTS AND DISCUSSION

Morphological Characteristics of Soil Series: The constitution of soil morphological study includes the colour, texture, consistency, depth and structure.

Table 1. Morphological Characteristics of Soil samples collected from Tembha soil series.

A) Series: Tembha

Sr. No.	Depth (cm)	Soil Color		Texture	Structure	Consistency	
		Dry	Moist			Dry	Moist
A1	192	10YR 3/1	10YR 2/1	sic	Angular blocky to sub-angular blocky	mh	fi
A2	190	10YR 3/1	10YR 2/1	sic	Angular blocky to sub-angular blocky	mh	fi
A3	192	10YR 3/1	10YR 2/1	sic	Strong medium angular blocky	mh	fi
A4	190	10YR 3/1	10YR 2/1	sic	Medium coarse angular blocky	mh	fi
A5	188	10YR 3/1	10YR 2/1	sic	moderate coarse columnar	h	vfi

A1- The color of soil at dry condition is brownish black and at moist condition black. Texture is silty clay. The structure of soil is angular blocky to sub-angular blocky. Consistency- when dry it is moderately hard and firm when moist, and clear smooth boundary. Very deep soil (192 cm).

A2- The color of soil at dry condition is brownish black and at moist condition black. Texture is silty clay. The structure of soil is angular blocky to sub-angular blocky .Consistency -when dry it is moderately hard and firm when moist, and clear smooth boundary. Very deep soil (190 cm).

A3- The color of soil at dry condition is brownish black and at moist condition black. Texture is silty clay. The structure of soil is medium coarse angular blocky. Consistency - when dry it is moderately hard and firm when moist, and clear smooth boundary. Very deep soil (192 cm)

A4. The color of soil at dry condition is brownish black and at moist condition black. Texture is silty clay. The structure of soil is medium coarse angular blocky to sub-angular blocky. Consistency- when dry it is moderately hard and firm when moist, and clear smooth boundary. Very deep soil (190 cm).

A5- The color of soil at dry condition is brownish black and at moist condition black. Texture is silty clay. The structure of soil is moderate coarse columnar. Consistency- when dry it is hard and very firm when moist and sticky; and irregular boundary. Very deep soil (188 cm).

Physico-Chemical Characteristics of the Tembha Soil Series: The surface soil was collected for characterization of different physico chemical properties of salt affected soil of Shahada Tehsil. These physico-chemical properties are pH, Organic carbon O.C., electrical conductivity EC, Exchangeable cation such as calcium, magnesium, sodium, and anions chloride and sulphate, SAR, ESP, are estimated and characterized by different analytical method. The estimated data are presented in table 2.

Table 2: Physico-Chemical Characteristics of the Tembha Soil Series.

Series	O.C. %	pH	EC (dS/m)	Meq /L					SAR	ESP
				Ca^{2+}	Mg^{2+}	Na^{+}	Cl^{-}	SO_4^{2-}		
A1	0.72	8.91	1.290	11.93	8.52	30.92	0.444	0.290	13.74	15.98
A2	0.86	8.94	0.966	13.53	6.03	31.9	0.364	0.265	13.93	16.17
A3	1.12	8.91	1.300	17.8	10.3	37.0	0.420	0.285	13.96	16.21
A4	0.77	8.63	1.450	19.0	8.0	34.0	0.456	0.315	13.12	15.33
A5	0.83	9.00	1.020	13.0	9.3	32.8	0.304	0.290	13.83	16.08
Average	0.86	8.84	1.2052	15.05	8.43	33.32	0.397	0.289	13.716	15.95

Nutritional Status of Soil Series: The surface soils were analyzed for characterization of different nutrients present in salt affected soil of Shahada Tehsil. These nutrients are primary nutrients such as nitrogen, phosphorous, and potassium, micro-nutrients such as iron, copper, manganese, zinc and boron, estimated and characterized by different analytical method. The estimated data of these nutrients are presented in table 3.

Table 3: Nutritional Status of Tembha Soil Series

Soil Series	**Available Nutrients (Kg/h)**			**Available micronutrient (ppm)**				
	N	**P**	**K**	**Fe**	**Cu**	**Mn**	**Zn**	**B**
A1	322.56	8.96	442.40	7.83	0.70	6.39	1.11	0.6
A2	383.04	10.30	478.24	8.92	0.62	16.39	0.66	0.8
A3	501.76	10.30	468.16	7.9	0.52	14.08	0.96	0.7
A4	342.72	15.23	442.40	7.53	0.92	15.05	0.84	0.62
A5	369.6	21.95	448.00	8.07	0.75	15.36	0.92	0.51

Available nitrogen: Available nitrogen of the Tembha (A) soil series ranges from 332.56 to 501.76 Kg ha^{-1} at A1 and A3 soil location respectively. Among all the 5 soil samples A3 soil location has highest available nitrogen content, but according to standard rating the available nitrogen of this soil location is still medium in range.

Available phosphorous: Available phosphorous of this Tembha (A) soil series ranges from 8.96 to 21.95 Kg/ha at A1 and A5 soil location respectively. Among all the 5 soil samples A5 soil location has highest

available phosphorous content. The average available phosphorous contains of this soil series is 13.348 Kg ha^{-1}. It is medium according to standard rating of available phosphorous.

Available potassium: Available potassium of this Tembha (A) soil series ranges from 442.4 to 478.2 4Kg ha^{-1} at A1, A4 and A2 soil location respectively. Average Available potassium contents of this soil series is 455.84 Kg ha^{-1}. According to standard rating of available potassium it is also very high.

Micro-nutrients-

Iron (Fe): A-DTPA extractable micronutrient iron of Tembha (A) soil series ranges from 7.53 to 8.92 ppm at A4 and A2 soil location respectively. Average extractable iron contents of this soil series is 8.05 ppm. According to standard rating of extractable iron, the average value also low. The low content of extractable iron in this sodic and sodic saline soil might be attributed to the low release of extractable iron at high pH from their minerals.

Copper: DTPA extractable micronutrient copper of Tembha (A) soil series ranges from 0.52 to 0.92 ppm at A3and A4 soil location respectively. Average extractable copper contents of this soil series is 0.696 ppm. According to standard rating of extractable copper average value also low. The low content of extractable copper in this sodic and sodic saline soil might be attributed to the low release of extractable copper at high pH from their minerals.

Manganese: At Tembha (A) soil series, the DTPA extractable micronutrient Manganese ranges from 6.39 to 16.39 ppm at A1and A2 soil location respectively. Average extractable manganese contents of this soil series is 13.454 ppm. The high amount of extractable manganese in this sodic and sodic saline soil might be due the presence of acidified microzones where very high fertilization is taken place these acidified microzones may improve the Mn deficiency sometime encountered on high pH soil.

Zinc: At Tembha (A) soil series the DTPA extractable micronutrient zinc of Tembha (A) soil series ranges from 0.66 to 1.11 ppm at A2and A1 soil location respectively. Average extractable zinc contents of this soil series is 0.898 ppm. According to normal rating of extractable zinc, the average value also low. Reason of low extractable zinc in this soil is high leaching process, little organic matter and types of minerals present in the soil.

Boron: At Tembha (A) soil series, the available boron varies from 0.51 to 0.8 ppm at A5and A2 soil location respectively. Average available boron contents of this soil series is 0.646 ppm. According to normal soil rating range of available boron has low to medium. The low quantity of
available boron in this sodic soil might be due the presence of low boron content parent minerals. But the amount boron in this soil series is very sufficient for plant growth. Sometime A2 soil locations available boron may be harmful for few plants.

SEM and XRD: Minerals found through SEM/ EDAX analyses include Illite, Kelyanite and Capgaronnite. SEM images and EDAX revealed that few element affinity groups occur; some elements are C, O, Mg, Al, Si, K, Ca, Fe, Br, Zr, Te and Hg. Here the mineralogical relationship is associated these elements are carbon being associated with IMA 2009-010 and other related minerals. O, Na, Si and Ca being associated with Augite, Illite, Marianoite and related weak and trace minerals. K being associated with Illite and other related weak and trace minerals. Fe and Si being associated with Ferdisilicate, Augite, IMA-2009-010, Illite, and other related minerals.Br and Hg being associated with Capgaronnite and other related minerals. The structural determination with help of SEM images suggested that most of the minerals images are bounded layered flakes with different size and shapes such as irregular spherical and squares shape.

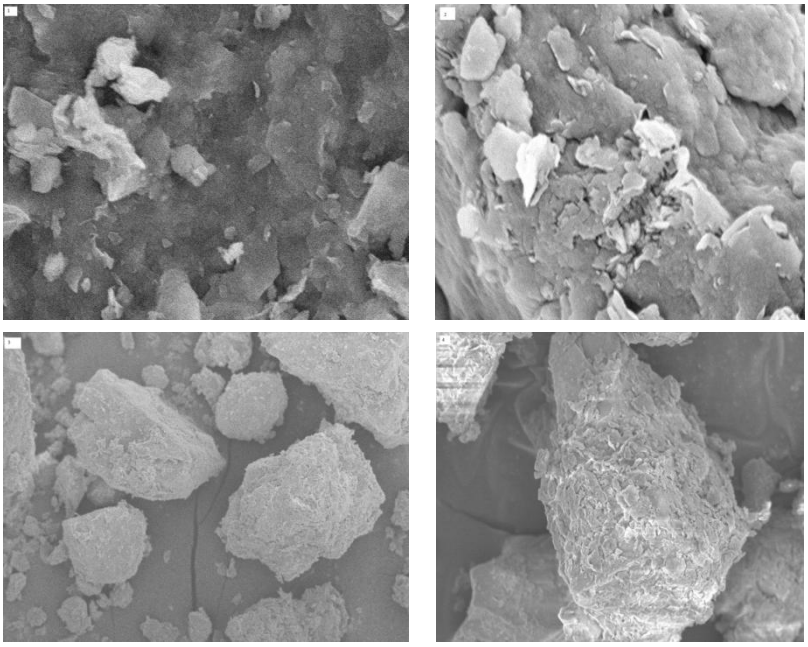

Fig 1. SEM images of Tembha soil sample at different magnitude

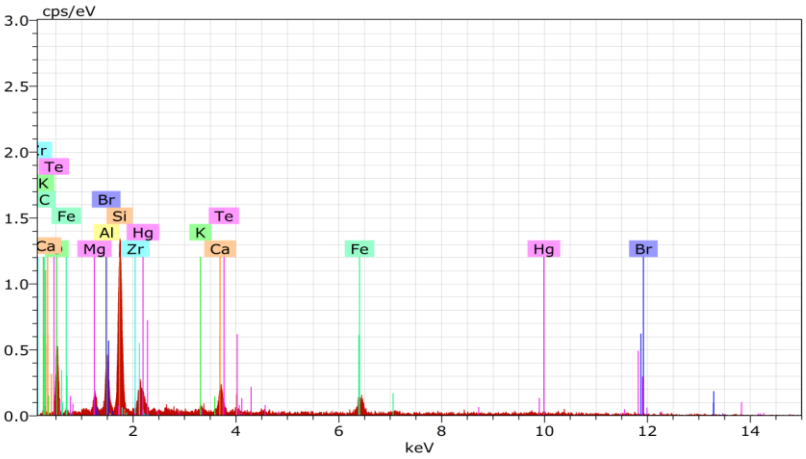

Fig 2. EDAX spectrum of Temha (A) soil series representative sample

Table 4. Status of Soil Mineral According To X-Ray Diffractogram of A Soil Series

Sr.	XRD Peak Intensity and Minerals			
	Dominant	**Medium**	**Weak**	**Trace**
A	Ferdisilicate	Augite	Marianoite	Launheite
	Mayingite	IMA-2009-010	Nickelphosphide	Kelyanite
	_____	Illite	Scapolite	Gibbsite
	_____	Capgaronnite	Magnetite	Tatyanaite

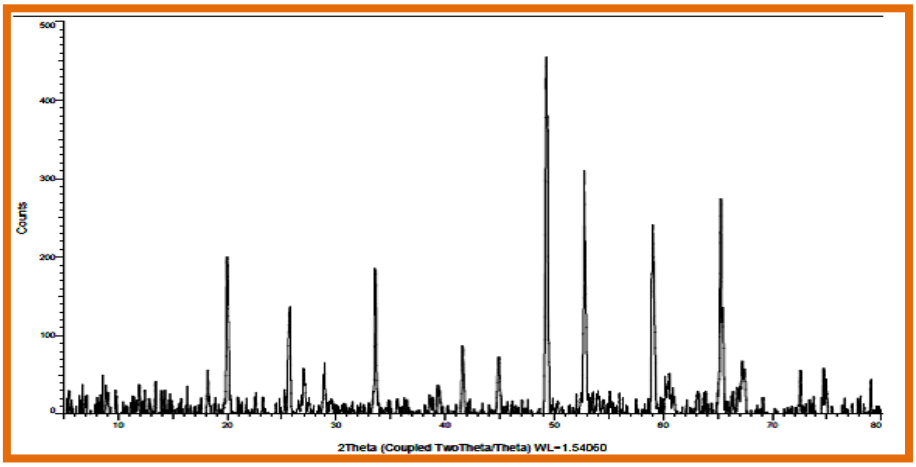

Fig 3. A- X-ray diffractogram of A (Tembha) soil series.

It is perceived that the dominant minerals present at Tembha (A) soil series are, Ferrdisilicate and Mayingite at the related d-spacing values 1.84712 A^o and 1.73284 A^o respectively. The medium minerals present at Tembha (A) soil series are, Augite, IMA-2009-010, Illite and Capgaronnite, at the characteristic d-spacing values 1.42780, 1.56296, 4.43485 and 2.66522 A^o respectively. The Weak minerals present at Tembha (A) soil series are Marianoite, Nickelphosphide, Scapolite and Magnetite at the corresponding d-spacing values 2.01708, 2.16878, 3.46409 and 4.866A^orespectively.The Trace minerals present at Tembha (A) soil series are Launheite, Kelyanite, perlialite and Tatyanaite, at the characteristic d-spacing values 1.21022, 3.29587, 1.30120 and 2.2822A^o respectively, revealed from X-ray diffractograms presented in figure 3.

APPLICATIONS

The results are useful for knowing the soil quality.

CONCLUSIONS

The color of Tembha (A) series soil at dry condition is mostly brownish black, texture is silty clay, the structure strong coarse angular blocky to sub-angular blocky to strong medium angular blocky. Physico-chemical study shows that soil is strongly alkaline, EC reveal that soils are generally slightly saline to strongly saline. Organic Carbon (O.C.) ranges from moderately high to very high percentage of organic carbon content status. Exchangeable calcium of A (Tembha) village field soil ranges from 11.33 to 19.0 meq. L^{-1} of A1 and A4 respectively. It is low range in rating of exchangeable calcium and pH. The available nitrogen content varied from 322 to 501 kg $hectare^{-1}$. The available phosphorous was in the range of 8.96 to 21.95 kg $hectare^{-1}$. All micronutrients are present in good amount in all the five samples which is essential for better crop yields. The XRD and SEM results indicated the presence of various minerals, namely Launheite, Kelyanite, perlialite and Tatyanaite. SEM images and EDAX revealed that few element affinity groups occur; some elements are C, O, Mg, Al, Si, K, Ca, Fe, Br, Zr, Te and Hg. Here the mineralogical relationship is associated these elements.

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REFERENCES

[1] B.J. Winhold, S.S. Andrews, D.L. Karlen, Soil quality: a review of the science and experiences in the USA Environmental Geochemistry and Health, **2004,** 26, 89–95.
[2] K.L. Sharma, K. Uttam, S K. Mandal, K.P.R. Vittal, M. Biswapati, G J. Kusuma, V. Ramesh, Long-term soil management effects on crop yields and soil quality in a dry land Alfisol Soil & Tillage Research, **2005**, 83, 246–259.
[3] A. A. Haque, M. Jayasuriya, H. P. W. Salokhe, V. M. Tripathi, P. Parkpian, Assessment of Influence and Inter-Relationships of Soil Properties in Irrigated Rice Fields of Bangladesh by GIS and Factor Analysis, Agricultural Engineering International: the *CIGR E-journal*, Manuscript, LW 07022.Vol. IX, **2007**.
[4] Toth G. Stolbovoy, V. Montanarella, Soil Quality and Sustainability Evaluation – An Integrated Approach to support Soil-Related Policies of the European Union, EUR 22721, EN. Office foe Official Publications of the European Communities, Luxembourg, **2007,** 40p.
[5] H. Jenny: The Soil Resource: Origin and Behavior. Ecol. Stud. 37. Springer-Verlag, NewYork **1980**.
[6] Y. G. Thakre , M. D. Choudhary, R. D. Raut, Mineralogical studies of red and black soils in Wardha region, *Der Pharma Chemicals*, **2014**, 6(1), 407-410.
[7] Kim H. Ton, Principles of Soil Chemistry, Second Edition, Tan.
[8] M.R.Khan and S. Zafar, Physico-Chemical Analysis of Kasur Land Soil Reclaimed After Pretre of Tannery Wastewater, *J Applicable Chem*., 2015, 4 (2), 564-571.
[9] Indra Prasad Tripathi and Arvind Prasad Dwivedi, Multivariate analysis of soil and ground water quality in Sidhi district of Vindhya Plateau, *J Applicable Chem*., 2015, 4 (1), 178-203.

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