RESEARCH REVIEW International Journal of Multidisciplinary 2021; 6(1):23-29

Original Article

https://doi.org/10.31305/rrijm.2021.v06.i01.005

Double Blind Peer Reviewed Journal

https://www.rrjournals.com/

Investigation on Physico-Chemical Parameters of Soil from Washim district of Maharashtra (India)

*Undal V. S.

Ghulam Nabi Azad Arts, Commerce and Science College, Barshitakali Dist. Akola (MS) India

ABSTRACT

Soil is a natural body of mineral and organic material differentiated into horizons, which differ among themselves as well as from underlying materials in their morphology, physical make-up, chemical composition and biological characteristics. It's a significant resource element which sustains the biotic component of environment. There is large soil type diversity in present study area because of physical and climatic diversity. The current study objectively conducted to analysis the physico-chemical properties of soil sample of Washim district. Eight surface soil samples were collected (0-20 cm depth) within the vicinity of Washim District and analyzed for their physicochemical properties using standard methods. The following soils of 11 different characteristics were examined. It found colour diversity among collected soil samples such as black, brown and red, however sandy, sandy loam, silty clay, loamy were the textures recorded in selected study region. The highest mean value of physico-Chemical parameters were 4.16, 41.25 , 0.48, 8.15, 1.32, 204.7, 29.25, 9.12, 55.2, 7.17 and 38.7 respectively recorded in Moisture, Temperature, Electrical conductivity, pH, Organic carbon, TDS, Phosphorous, Calcium carbonate, Calcium, Magnesium and Alkalinity. The objective of this work is to study and evaluate relation between soil properties and few macro-nutrients by using correlation analysis with focusing to examine the quality of soil in selected region. It concludes that the statistical methods such as correlation analysis can provide a scientific basis to some extent for controlling and monitoring the agriculture soil fertility management in order to exploit the soil productivity.

Keywords: *Soil, Organic carbon, Agricultural field, Correlation analysis, Organic pollutants*

Article Publication

Published Online: 17-Jan-2021

***Author's Correspondence**

Undal V. S.
Ghulam Nabi Azad Arts, Commerce and Science College, Barshitakali Dist. Akola (MS) India

molbio.vinod[at]gmail[dot]com

1. Introduction

Soil is the dynamic link between the biosphere and lithosphere and constitutes a practically non-renewable (very low rate of formation) natural resource, with a key role for the environment and for the agriculture (Moraetis *et al.*, 2016). Its unconsolidated or loose covering of fine rock particles that covers the surface of the earth. Soil properties that are sensitive to changes in the management can be used as indicators (Andrews *et al.*, 2004). The quality of a soil depends on external factors, such as land use and soil management practices, ecosystem and environmental interactions, socioeconomic and political priorities. Selected physical, chemical, and biological properties of soil are used instead to quantify soil quality functions related to specific goals (Nepal and Asheshwar, 2018). The soil is naturally occurring porous medium that supports the growth of plant roots by retaining air, heat, water and nutrients; and provides mechanical support to the plant. Soil provides a reservoir of nutrients required by crops, but not necessarily at optimum levels of immediate availability to plants (Patel, *et al.*, 2014). The characterization in relation to evaluation of fertility status of the soils of an area or region is an important aspect in context of sustainable agriculture production. Because of imbalanced and inadequate fertilizer use coupled with low efficiency of other inputs, the response (production) efficiency of chemical fertilizer nutrients has declined tremendously under intensive agriculture in recent years (Vijayakumar *et al.*, 2011). Some factors such as altitude, parent rocks, vegetation and anthropogenic activities influence the physicochemical properties of soil and water like pH, organic matter, cation exchange capacity (CEC), soil texture and water chemistry. Soil pH affects nutrients availability and the optimal condition for this is at pH 5 to 7 (Arp and Krausse, 2006). The potential for elements present in soils and sediments to be mobilized/ immobilized and be redistributed depends on several factors such as organic matter, type and amount of clay, pH and the prevailing redox conditions; and pathways (Manga *et al.*, 2017). Apart from nutrients release through weathering processes, soil characteristics are further affected by atmospheric deposition, drainage outflow, biomass removal, and other processes such as cation exchange and organic matter decomposition, while pronounced interrelations exist between all factors mentioned above (Stutter *et al*., 2003).

The dissolution and incorporation of heavy metals into the food chain depends on the physicochemical properties of soils, especially pH. Soil pH and other soil properties are especially important in soil processes responsible for solubility of heavy metals in soil and their transportation (Matthews-Amune and Kekulus, 2013). It is very necessary that soil should be in healthy condition, means it's all physico-chemical parameters should be balanced. Polluted or disturbed physico-chemicals parameters of soil would be a great hazard to plants and animals (Tale and Ingole, 2015). The objective of this work is to study and evaluate relation between soil Physico-Chemical properties and few selected macro-nutrients by using correlation analysis with focusing to examine the quality of soil in Washim region. It concludes that the statistical methods such as correlation analysis can provide a scientific basis to some extent for controlling and monitoring the agriculture soil fertility management in order to exploit the soil productivity.

2. Material and Methods

Study Area

Washim is one of the 11 districts of Vidarbha and was carved out of Akola district on 1st July, 1998. It is situated in the north eastern part of the state abutting Madhya Pradesh and lies between north latitudes 19°61' and 21°16' and east longitude 76°07' and 77°14' and falls in parts of Survey of India degree sheets 55 D, 55 H, 56 A and 56 E. The district has a geographical area of 5140 sq. km. The district headquarters is located at Washim town. For the Administrative convenience, the district is divided in 6 talukas viz, Washim, Karanja, Malegaon, Mangrulpir, Manora and Risod (Fig. 1). The district forms part of Godavari and Tapi basin. Penganga River is the main river flowing through the district. The mean minimum temperature is 12°C and means maximum temperature is 42°C. The normal annual rainfall over the district varies from 872 mm (Risod) to about 966 mm (Washim).The economy of district is primarily dependent on agricultural sector, more than 83 percent persons are engaged in agricultural activity. Ground water quality is good and suitable for drinking and irrigation purpose, however localized nitrate contamination is observed.

The soil of the district is basically derived from Deccan Trap Basalt and major part of the district is occupied by medium black soil of 25-50 cm depth occurring in the plains in entire south western, north eastern and northern parts of the district, whereas the shallow black soil of 7.5 to 25 cm depth occur in restricted hilly parts of the district in central elongated part and the northern peripheral part.

Sample Collection

The eight soil samples were collected from the study area (farmers field) in the month of Jan.-May, 2017. Soil samples were collected randomly at 0 to 15 cm and 15 to 30 cm depths with five plots, five samples from each plot respectively. Soil samples were collected from 8 sites (Fig.1) covering 6 tahasil of Washim district, keeping in view the physiographic characteristic in different cross sections of the area as well as variation in soil texture. Soils were entirely air dried and passed through 2 mm sieve and stored in well sterilized, accurately labeled polythene plastic bags for analysis.

Physicochemical Analysis of Soil Samples

The pH is a very important property of soil as it measures the accessibility of nutrients, microbial activity and physical situation of soil. pH values were note down using instrument pH meter as described by Jackson (1967). For this 25 g soil sample was mixed with 50 ml dH_2O in 1: 2 ratios. The suspension was mixed with the help of glass rod for some time and left for 30 min. The both electrode was inserted into solution and pH was recorded. pH value indicated the hydrogen ion activity of the soil water system and expresses both acidity and alkalinity of the soil. The ion contents of solution determine the current moving ability, therefore gives a apparent idea of the soluble salts present in the soil, will be measure with the help of Electrical conductivity (EC). In current study electrical conductivity of collected soil samples were noted on digital electrical conductivity bridge. The filtered suspensions of soil sample were used for this measurement. The amount of organic carbon in the soil was quantified by using customized standard method (Walkey and Black, 1934) as described by Jackson (1967). The 1g finely ground dry soil samples were passed through sieve and were taken into conical flask. To this 1N Potassium dichromate and con. H_2SO_4 in proper amount were added. The contents were mixed for some time and allowed to set aside for 30 minutes, followed by the addition of dH_2O, phosphoric acid and diphenylamine indicator appropriately. After this, each mixture was titrated against standard ferrous ammonium sulphate till colour changes and blank titration was also carried in absence of soil. Organic matter is required for providing nutrients and water to the plants and along with good physical conditions. The TDS in present study was determined by standard TDS meter. The sample soil was weighed (W1) and dried at 105 o C in hot air oven for 24 h. The final weight (W2) of samples was determined using electronic weighing balance and the moisture content (W1W2) was estimated as % of moisture/g of soil. The different others parameters of collected soil samples were analyzed by below mentioned methods such as determination of Moisture was by weighting method, Electrical conductivity (EC) was by digital electrical conductivity bridge, pH was estimated by digital pH meter, The amount of organic carbon in the soil was quantified by using customized standard method (Walkey and Black, 1934) as described by Jackson (1967).

Determination of Calcium Carbonate ($CaCO_3$), Determination of Calcium (Ca), Measurement of Alkalinity were calculated by Titration Method, however the calculation of Magnesium (Mg) content was noted by EDTA titration method (APHA, 1998; Trivedy *et al.*,1998; Ganorkar and Chinchmaiatpure, 2013; Chaudhari and Jichkar, 2012; Zaiad, 2010; Olsen, *et al.*, 1954). The color of the soil was decided by both external observation of sample and field inspection at the time of collection.

Fig.1. General map of Washim district for soil sample collection

Table-1: Collection site of different soil sample from Washim.

S.N.	Soil sample	Collection site	Colour	Texture
1	S1	Washim: on way of Washim- Hingoli road	Black	Loam clay
2	S2	Washim: on way of Washim Hingoli road	Faint Black	Sandy loam
3	S3	Risod: on way of Washim Risod road	Blackish	Silty clay
4	S4	Mangrulpir: on way of Mangarulpir - Shelubazar road	Black	Loam clay
5	S5	Karanja L.: on way of Karanja L. - Amravati road	Medium black	Loamy
6	S6	Manora: on way of Mangarulpir - Manora road	Brownish	Silty clay
7	S7	Malegaon: on way of Washim- Malegaon road	Faint Black	Sandy loam
8	S8	Malegaon: on way of Washim- Patur road	Reddish	Sandy loam

3. Results and Discussion

The present study was conducted in order to characterize the physico-chemical properties of eight soil sample from different areas of Washim district. Total 11 characters were taken into consideration apart from colour and textural properties (Table 1 and 2). It found colour diversity among collected soil samples such as black, brown and red, however sandy, sandy loam, silty clay, loamy were the textures recorded in selected study region.

Table-2: Physico–chemical properties and nutrient status of soil characteristics

S.N.	Soil parameter		S1	S2	S3	S4	S5	S6	S7	S8
1	Moisture %	Mean	2.31	2.51	3.08	3.88	3.13	4.16	3.41	3.02
		SD	± 0.03	± 0.05	± 0.22	± 0.03	± 0.37	± 0.04	± 0.05	± 0.17
2	Temp.(^oC)	Mean	33.25	41.25	37	34.77	29.05	29.32	38.75	40.25
		SD	± 1.70	± 3.30	± 1.63	± 0.25	± 0.82	± 0.28	± 1.70	± 2.50
3	E.C. (dSm-1)	Mean	0.23	0.33	0.25	0.43	0.18	0.37	0.21	0.48
		SD	± 0.02	± 0.01	± 0.01	± 0.02	± 0.02	± 0.02	± 0.00	± 0.02
4	pH	Mean	7.47	8.15	6.82	7.01	7.59	7.90	7.30	8.02
		SD	± 0.17	± 0.26	± 0.09	± 0.08	± 0.17	± 0.16	± 0.16	± 0.17
5	Org. C. %	Mean	0.94	1.09	0.87	0.81	1.03	0.88	1.32	0.71
		SD	± 0.03	± 0.08	± 0.03	± 0.01	± 0.04	± 0.01	± 0.025	± 0.03
6	TDS	Mean	115.7	165.7	146.7	204.7	182.7	190.7	128.7	137.5
		SD	± 4.11	± 3.30	± 4.11	± 3.30	± 2.55	± 4.92	± 3.30	± 5.73
7	Phosphorous (kg/hect)	Mean	17.27	21.25	28.75	22.75	29.25	22.25	23.57	21.57
		SD	± 0.33	± 0.12	± 3.30	± 2.50	± 4.11	± 3.30	± 0.41	± 0.41
8	$CaCo_3$ (%)	Mean	8.57	5.12	6.27	6.82	5.67	5.87	9.12	5.37
		SD	± 0.17	± 0.33	± 0.17	± 0.33	± 0.57	± 0.33	± 0.41	± 0.25
9	Calcium (%)	Mean	50.3	46.5	55.2	40.7	42.7	40.2	52.7	46.5
		SD	± 0.26	± 0.41	± 0.08	± 4.11	± 0.33	± 0.08	± 0.77	± 0.41
10	Magnesium (%)	Mean	6.27	5.00	2.88	7.17	3.57	3.42	6.05	4.42
		SD	± 0.35	± 0.73	± 0.57	± 0.49	± 0.25	± 0.35	± 0.45	± 0.29
11	Alkalinity (%)	Mean	20.7	32.7	29.2	18.3	28.25	35.4	21.7	38.7
		SD	± 3.59	± 1.70	± 1.68	± 0.25	± 2.5	± 0.33	± 1.70	± 3.30

Table-3: Correlation among Physico-Chemical parameters of eight agricultural soil samples.

Soil parameters	pH	Moisture %	Temp. (^oC)	E.C. (dSm-1)	Org. C. %	TDS	Phosphorous (kg/hect)	$CaCo_3$ (%)	Calcium (%)	Magnesium (%)	Alkalinity (%)
pH	1										
Moisture %	-0.20411	1									
Temp. (^oC)	0.12409	-0.40451	1								
E.C. (dSm-1)	0.31146	0.34673	0.28440	1							
Org. C. %	-0.01924	-0.14536	0.13080	-0.69990	1						
TDS	0.01242	0.66665	-0.44405	0.34210	-0.25412	1					
Phosphorous (kg/hect)	-0.41328	0.27011	-0.22170	-0.35474	0.08481	0.32935	1				
$CaCO_3$ (%)	-0.48681	-0.06781	-0.01492	-0.46415	0.50321	-0.53221	-0.30797	1			
Calcium (%)	-0.39659	-0.53267	0.51005	-0.47965	0.34611	-0.82188	0.08555	0.46896	1		`
Magnesium (%)	-0.15922	-0.07202	0.22868	0.13761	0.19681	-0.09046	-0.60934	0.59105	-0.07409	1	
Alkalinity (%)	0.68845	0.01295	0.14700	0.40654	-0.35421	0.05707	0.09480	-0.76295	-0.16855	-0.72096	1

Texture of most of the soil was loamy and clay for black soil, silty clay and loamy for red soil and loamy clay of yellow soil (Jain and Singh D, 2014). Soil texture also affects the nutrient supply of the soil (Gupta and Shukla, 1991). The soil moisture commonly depends on void ratio, particle size, clay minerals, organic matter and ground water condition (Yennawar *et al*., 2013). The sandy soil can quickly be recharged with soil moisture but it enable to hold as much water as the soils with heavier textures (Jain and Singh, 2014). According to Snober Bhat the average percent soil moisture of Chandur Bazar taluka of Amravati district were recorded in between 7.886 to 8.85% (Bhat *et al.,* 2011).While it observed moisture content 13.81-26.27% from rain forest and plantation in Ondo state, Nigeria (Oseni *et al.,* 2009). Soil temperature depends on the ratio of the energy absorbed to that lost. Soil has a temperature range between -20 to 60 °C. The highest (41.25 °C) soil temperatures in present investigation were recorded in S2 sample (Table 2). The temperature of the soil is the most important property because it shows its effect on the chemical, physical and biological processes related to growth of plants. Soil temperature changes with season, time of day, and local conditions of climate (Kekane *et al.*, 2015). The EC, % Clay and pH parameters were highly significant with respect to the yield of cotton. The per cent moisture (% M) term is positive, implying that the yield increased as the plant-available water content increased (Kumar *et al.,* 2011).

The results of all the relevant soil characteristics are described in table 2. The soils are neutral to alkaline in reaction, noted pH in between 6.8– 8.1, the mean value of pH. The relative high pH of the soils might be due to the presence of high degree of base saturation. A pH value of near-neutral is appropriate for the growth of various bacterial populations. The most suitable range for bioremediation has been recommended to be 6-8 (Saxena, 1990; Mane *et al*, 2006). Additionally it suggested that the extremely high and low values of pH often lead to failure of crop due to ionic strength imbalance (Kumar *et al.,* 2011). Majority of soil sample pH were recorded in and around seven of the current study, however it highest value (8.1) was found in S2 sample which was collected on way of Washim Hingoli road (Table 1). This study recorded minimum 0.72 to maximum 1.33 % of organic carbon. Everyday falling down of leaves may increase the soil organic carbon and thus the total organic matter. Soil organic carbon and organic matter are known to influence the dynamics and behavior of both inorganic and organic pollutants in soils as well as a number of soil chemical and physical properties (Aiyesanmi *et al*., 2008). The phosphorus measures in the study found 17.3 to 29.0 kg/hect. (Table 2). The disparity in the availability of phosphorus in present study might be due to variation in $CaCO_3$ content in the soil, different soil properties and agronomic practices. The parallel outcomes were also reported by Bharambe *et al.* (1999). Total phosphorus content was recorded highest (29.0 kg/hect) for sample 3 and 5 which could be due to the high organic matter content. The soils with high organic matter content have better supplies of organic phosphates for plant uptake than have the soils with low organic content (Miller and Donahue, 2001). In the irrigation soils calcium carbonate occurs in natural state. Soil fertility is not uniformly affected by the presence of carbonates. The ranges of $CaCO_3$ in present investigation were recorded 5.11 to 9.16 % from the collected soil samples (Table 2). These results were in similar almost documented after critical examination. This is attributed to alkaline pH of soil indicative of a tendency of precipitation of $CaCO_3$ during irrigation (Deshmukh, 2012).

Exchangeable calcium (Ca) and magnesium (Mg) contents of soils of the study area showed differences in response to variations in land uses and soil depths. The highest calcium (Ca) content (55.2) was in sample S3, however it lowest (40.2) was recorded in sample S6 (Table 2). The lowest exchangeable Ca recorded for soil of the cultivated land could be due to its continuous removal through crop harvest with no or little organic matter input into the soil (Dereje, 2020). Stutter *et al.* (2003), showed that a strong relationship exists between basic cations (i.e., Ca_2^+, Mg_2^+) and basic parent material in soils. However, the exchangeable calcium was found to be higher than exchangeable magnesium and potassium probably because calcium is more strongly bound to exchangeable sites than magnesium and potassium (Beckett, 1965). In the present analysis the results were in accordance with high content of calcium (55.2%) in S3 soil sample (Table 2). The correlations between available nutrients and physico-chemical properties (Table 3) of soils of farms showed that the pH of soil was significantly positive with soil available alkalinity (0.68). Moreover $CaCo_3$ also showed significant positive value with soil available Magnesium (0.59). Furthermore % of moisture content with TDS (0.66) and soil temperature with percentage of calcium content (0.51) showed significant positive relation value. on the other hand it shows poor negative correlation among Calcium and TDS (-0.82) and Alkalinity with Magnesium (-0.72) .

4. Conclusions

Soil health and fertility are key parameters for sustainable agriculture. Soil testing for available nutrient status and assessment of soil physico-chemical factors affecting their availability is an important tool for managing the nutrient balance and productivity levels in cotton growing soils (Ghode *et al.,* 2020). In recent years, the application of biofertilizers has become a trust for most of developed countries, as far as economical and environmental view points are concerned. Moreover biofertilizers, pest control by biological methods appears to be especially positive tools. Some of the organisms used in biopesticides to target insects. At present situation, the majority of our land resources are degraded might be due to excessive application of chemicals and other few reasons. Therefore, it is essential to preserve the soil health for food security and rising agricultural production. The differences in soil physical and chemical properties of the study area could be attributed to differences in farming practices such as fertilizers application, irrigation methods and the use of pesticides. However cultivating similar crop repetition may be insignificant, therefore suggesting crop rotations for rising and retaining soil health in order to exploit the soil productivity. Present study concludes that statistical methods e.g. correlation analysis can provide a scientific basis for controlling and monitoring agriculture soil fertility management.

References

[1]. Aiyesanmi B. J., Tomori A. F. and Owolabi W. B. (2008) Relative partitioning of some heavy metals in dumpsite soil using chemical speciation technique. Int. J. Chem. Sci., 1(1): 96-104.

[2]. Andrews S.S., Karlen D.L. and Cambardella C.A. (2004) The Soil Management Assessment Framework A Quantitative Soil Quality Evaluation Method. Soil Sci. Soc. Am. J., 68:1945-1962.

[3]. APHA, (1998) Standard Methods for the Examination of Water and Wastewater, (1998) American Public Health Association, 20th edition, Washington. D.C.

[4]. Arp P. A. and Krausse H.H. (2006) Forest Soils Properties and Productivity. Encyclopedia Soil Sci., 2(10):1081.

[5]. Bharambe P.R., Kadam S.G., Shinde S.D. and Shelke D.K. (1999) Characterization of Soils of Majalgaon Canal Command Area (Jayakwadi Project Stage-II). Journal of Indian Society of Soil Science, 4(47):749-754.

[6]. Bhat S. H., Darzi A.B., Dar M.S., Ganaie M.M. and Bakhshi S.H. (2011) Correlation of soil physico-chemical factors with VAM fungi distribution under different agroecological conditions. Int. J. Pharma. Bio. Sci., 2(2):98-107.

[7]. Beckett P.H.T. (1965) The cation exchange equilibrium of calcium and magnesium. Soil Science, 100: 118-12.

[8]. Biswas S. K. (2001) Director of Census Operations, Maharashtra Village and Townwise primary census abstract, Director of Census of India-2001, Series-28, district Census Handbook part -A & B, Washim district.

[9]. Brady C.N. and Weil R.R. (2002) Nature and properties of soils, 2002, 13th Ed. Prentice Hall.

[10]. Chaudhari U.E. and Jichkar P.S. (2012) Investigation of Nutrients and some Parameters from Soil in Warud Taluka, District Amravati, Rasayan J. Chem., 5(2):142-144.

[11]. Deshmukh K. K. (2012) Studies on chemical characteristics and classification of soils from Sangamner area, Ahmednagar district, Maharashtra, India. Rasayan J. Chem., 5(1):74-85.

[12]. Dereje Girma (2020) Effect of Land use Types on Selected Soil Physical and Chemical Properties at Sire Morose Sub Watershed, Central Highland of Ethiopia. International Journal of Engineering Research & Technology, 9(5): 770-779.

[13]. Dongre K. (2013) Ground Water Information Washim district Maharashtra, Govt of India Ministry of Water Resources Rentral Ground Water Board, central region Nagpur, 1-22.

[14]. Ganorkar R.P. and Chinchmaiatpure P.G. (2013) Physicochemical Assessment of Soil in Rajura Bazar in Amravati District (MS), India. Int. J. Che. Env. Phar. Res., 4(2/3): 46-49.

[15]. Ghode M.K., Vaidya P.H., Nawkhare A.D. and Ingole A.J. (2020) Relationship between soil Physico-chemical properties, available macro and micronutrients and yield in cotton growing soils of Nanded district of Maharashtra. Journal of Pharmacognosy and Phytochemistry, 9(3): 2062-2065.

[16]. Gupta O.P. and Shukla R.P. (1991) The composition and dynamics of associated plant communities of sal plantations. Trop. Ecol., 32(2): 296-309.

[17]. Jackson M. L. (1967) Soil Chemical Analysis Prentice Hall of India Pvt. Ltd., New Delhi pp. 205.498.

[18]. Jackson M.L. (1973) Soil chemical analysis. India: Prentice Hall.

[19]. Jain P. and Singh D. (2014) Analysis the Physico-Chemical and Microbial Diversity of Different Variety of Soil Collected From Madhya Pradesh, India. Scholarly Journal of Agricultural Science, 4(2):103-108.

[20]. Kekane S.S., Chavan R.P., Shinde D.N., Patil C.L. and Sagar S.S. (2015) A review on physico-chemical properties of soil. International Journal of Chemical Studies, 3(4): 29-32.

[21]. Kumar S., Iyer A. and Agarwal S. (2011) Cotton yield in relation to Physicochemical properties of cultivated soil of Rajkot region. International Journal of Advanced Engineering Technology, 2: 52-55.

[22]. Manga V.E., Neba G.N. and Suh C.E. (2017) Environmental geochemistry of mine tailings soils in the artisanal gold mining district of Bétaré-Oya, Cameroon. Environ. Pollu., 6(1):52-61.

[23]. Mane S.Y., Raje S.D., Disale S.S., Waghmode H.T.B. and Mankar D.D. (2006) Status of soil in pollution prone area of Lote MIDC (M.S.), India. Poll. Res., 25(2): 289-291.

[24]. Matthews-Amune O.C. and Kakulus S. (2013) Investigation of heavy metal levels in road-side agricultural soil and plant samples in Adogo, Nigeria. Acad. J. Environ. Sci., 1(2):31-35.

[25]. "Methods Manual- Soil Testing in India" (2011) Department of Agriculture & Cooperation Ministry of Agriculture Government of India, New Delhi, 1-217.

[26]. Miller R.W. and Donahue R.L. (2001) Soils in our environment. Seventh edition. Prentice Hall, Inc. Upper Saddle River, New Jersey.

[27]. Moraetis D., Lydakis-Simantiris N., Pentari D., Manoutsoglou E., Apostolaki C. and Perdikatsis V. (2016) Chemical and physical characteristics in uncultivated soils with different lithology in semiarid Mediterranean Clima. Appl. Environ. Soil Sci., 1-13. http://dx.doi.org/10.1155/2016/3590548

[28]. Nepal S. and Asheshwar M.R. (2018) Soil quality index and nutrient in Badekhola and Brindaban catchments, Nepal. MOJ Ecol. Environ. Sci., 3(1):54–57.

[29]. Olsen S.R., Cole C.V., Watambe F.S. and Dean L.A. (1954) Estimation of available phosphorus in soil by extraction with $NaHCO_3$, U.S.D.A. Ciraza (Quoted from, Method of soil Analysis, C.A. Black 2nd ed.) 1165 Am. Soc. Agron., Inc. Medision Wisconsin, USA.

[30]. Oseni O.A., Ekperigin M.M., Akindahunsi A.A. and Oboh G. (2009) studies of physicochemical and microbiological propertiesof soil from rainforest and plantation on Ondo state, Nigeria. African Journal of Agriculture Research, 2(11):605-609.

[31]. Patel P.L., Patel N.P., Patel P.H. and Gharekhan A. (2014) Correlation Study of Soil Parameters of Kutch district Agriculture Land. International Journal of Scientific and Research Publications, 4(5): 1-5.

[32]. Patel P.L. (2017) Study of Agriculture Soil through Statistical data analysis of soil Physico-Chemical Parameters of Mundra taluk in Kutch district. KCG- Portal of Journals, 10: 1-8.

[33]. Patel A. H. (2015) Correlation Study of Agricultural Soil Parameters of Tapi District in Gujarat. International Journal of Science and Research, 4(7): 1994-1997.

[34]. Saxena M.M. (1990) Environmental Analysis, Water, Soil and Air Sed. Ed., Agro. Botanical. Publishers, India.

[35]. Stutter M., Langan S. and Cresser M. (2003) Weathering and atmospheric deposition signatures of base cations in upland soils of NE Scotland: their application to critical load assessment. Geoderma, 116(3/4):301-324.

[36]. Subbiah B.V. and Asija G.L. (1956) A rapid procedure for the determination of available nitrogen in soil. Curr. Sci., 25:259-260.

[37]. Tale S. and Ingole S. (2015) A Review on Role of Physico-Chemical Properties in Soil Quality. Chem. Sci. Rev. Lett., 4(13):57-66.

[38]. Trivedy R.K., Goel P.K. and Trisal C.L. (1998) Practical methods in Ecology and Environmental Science, Enviro media publications, Karad.

[39]. Vijayakumar R., Arokiaraj A. and Martin D.P.P. (2011) Micronutrients and their Relationship with Soil Properties of Natural Disaster Proned Coastal Soils. Res.J.Chem.Sci., 1(1): 8-12.

[40]. Walkley A. and Black I.A. (1934) An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Science, 37:29-38.

[41]. Yennawar V.B., Bhosle A.B. and Khadke P.A. (2013) Soil Analysis and Its Environmental Impact On Nanded City, Maharastra. Research Front, 1(1):65-70.

[42]. Zaiad G.M. (2010) Physico-Chemical Analysis of Soils in Al-Khums city, Libya. Journal of Applied Sciences Research, 6(8):1040-1044.