

# Assessment of Physico-Chemical Characteristics of the Soil of Tribal Area of District Dhar, M.P. India

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**Abstract:** *Crop yielding is controlled by soil. In the sustainable agricultural production fertility of soil is an important character. Soils are making dynamic and complex ecosystem which support the biotic community and it make healthy and rich biodiversity. In the soil biotic and abiotic interaction takes place in the nature. In different factor soil is building elements which play vital role to flourishing the healthy ecosystems. In all over the world soil are subject to unprecedented levels of natural and human disturbances. It affected the soil quality and natural balance. We have solving these problems by knowledge and natural processes understanding in which included dynamic phenomenon occurring in the natural system. A Physico-Chemical characteristic of the soil is very important because it affected soil productivity. The present paper provides the insight view about soil quality spectrum along the Physico-Chemical characteristic which is based on various parameters e.g. pH, Electric conductivity, texture, moisture, temperature soil organic matter, available nitrogen, phosphorus and potassium. It provides awareness to farmers and increases their economic productivity in the tribal area.*

**Keywords:** Soil, Dhar, Physico-Chemical characteristics, soil productivity

## 1. Introduction

Soil word is originate from Latin word "Solum" which means clay where is the plant growing. The branch which deals science is called pedology or edaphology. It is essential to study soil along with plant study. For plant and animal soil is natural habitat. Human begins found mineral and nutrition form soil. Soil study provides many benefits from agriculture. Soils fixed the roots from the land and provide mechanical support to the plants. The basic needs of humans are fulfilled by soil. In our farming it is very important. An eminent position in the global cultivation of crops, vegetable and fruits etc. is occupied by agriculture .this is achieved because of Physico-Chemical characteristic of the soil and it is crucial for proper implementation of the other management practices. All agricultural productions and development of forest depends upon Physico-chemical parameters of the soil used for it. Straight off a day's need of soil testing is increased due to interest of the public in the caliber of products obtained from it and different practices carried for their output (Kekane, et.al.2015). A good soil quality increases water retention capacity, plant productivity sequestration, waste remediation and other functions. Vegetation distribution and development largely depends on the soil condition (Kardol et. al. 2006). The soil quality analysis includes an analysis of parameters and processes which effects on soil to operate efficiently as a component of a sound ecosystem (Tale & Ingole 2015). Maintenance or enhancement of soil quality is a more important criterion for analysis and sustainability of soil ecosystems (Schoenholtz 2000).

## 2. Study Area

Dhar District population is 2184672. Dhar district of Madhya Pradesh, India is located between the latitude of 22° 00 to 23° 10' North and longitude of 74° 28' to 75° 42' East and altitude of 588 m. above sea level. It is bounded by Ratlam to the North, Ujjain to the Northeast, Indore to the East, Khargone to the Southeast, Barwani to the South,

Alirajpur to the Southwest and Jhabua district to the West. The total area of district is 8153 sq. km. of which forest encompasses 1370 sq. km. covering 15.79 percent of its geographical area. The temperature exhibits a great variation. Summer season temperature ranges 41°C to 45°C. Average minimum temperature varies from 22°C to 32°C. Most of the area is drained by Narmada, Chambal, Man, Mahi, Karam, Bag, Hathani rivers. Besides these, small seasonal rivers like Khadi, Khuj, Bagedi, Balwanti, Gangi, Chidi, Nalganga flow only during rainy season. Archaean system, Bijawar group, Vindhyan system and Deccan traps of rocks have been found in Dhar. Major part of the district is covered by the Deccan trap locally called Malwa trap. Granite ( 70-77% silica, 11-13% alumina, 3-5% potassium oxide, 3-5% soda, 1% lime, 2-3% total iron, and less than 1% magnesia and titania), Mg rocks existing on either side of Narmada area of Archaean age. Dhar District is divided into 13 Tehsils, 472 Panchayat and 1429 Villages. Dhar district Total population is 2184672 according to census 2011.

## 3. Methodology

Soil sample is collected randomly in depth of up to 15 cm in v shape form different farmers fields of tribal district Dhar, M.P. India .it was mixed and ½ kg of composite from fields a different village was taken for analysis. Sample is bringing in to laboratory dried in room temperature. Sample is crushed with roller and sieved. Dried soil sample were put into polybag for analysis. Density was determined by clod method (Black, 1965). Water holding capacity is measured by piper (1966). pH is measured in 1:2.5 soil –water suspension by potentiometer method. Conductivity is determine by Conductivity Bridge and expressed as dSm-1 (Jackson 1973).With the help of wet oxidation method organic carbon is determine (Walkley and black 1934). Macronutrient (N, P, K, potassium, ammonium acetate) is calculate by methods suggest by Subbiah and Asija (1965); Bray and Kurtz (1945); Hanway and Heidal, (1952). Micronutrients (Fe, Mn, Zn, and Cu) are determined by

DTPA extraction and atomic absorption spectrophotometer (Lindsay and Narvell, 1978). S, CaCl<sub>2</sub>, Ca and Mg complex is calculated biometric titration method (Chesnin and Bray 1951). **Soil nutrient index:** Soil test information can be compiled area wise in the form of soil test summaries which indicate the number of samples falling in the category of low, medium and high status of N, P and K, this information are used to work out from **Nutrient Index (NI) or Parker Index**, which in turn used to develop soil fertility map of an area.

$$NI = \frac{NL + 2Nm + 3Nh}{NL + Nm + Nh}$$

Where NI, Nm and Nh are the number of samples falling in the category of low, medium and high nutrient status and are given weight age of 1, 2 and 3 respectively.

#### 4. Result & Discussion

Soil quality is one of the key factors governing the life in ecosystem. Most of factors that govern the variation of Physico-chemical characteristics of soil are agricultural waste, mining, industries etc. a perusal of Physico chemical characteristics of soil indicates significant variation throughout the study.

##### pH

It is most important property of soil and good indicator of nutrient e.g. Fe, Mn, Zn, Cu etc. balance. When pH is less than 6 the soil is acidic and pH range 6 to 8.5 the quality of soil is normal and greater than 8.5 it is said that the soil is alkaline. The relative high pH of the soils might be due to the presence of high degree of base saturation. It maintains fertility of soil and good sing to maintain equilibrium between nutrients in soil. Study said that high pH is affect micronutrients present in soil and low pH value solubility of micronutrient is high while at high pH plant is decline. As we know that pH of soil is increased with depth. The low and high pH leads failure of crop. Soil infiltration problem is associated with high pH.

##### Texture

On the basis of particle size, soil has different texture groups and it directly influence soil water relation, aeration, root penetration as well as nutritional status and its supply is significantly affected electric conductivity. Sandy soil is poor conductivity and low nutrient concentration and low retain moisture, clay soil has high conductivity. Most of the soil texture was loamy and clay for black soil, silts clay and loam for red and loamy clay is yellow soil. Sandy soils have found nutrient defiance and low organic matter along with little resistance to root penetration. Clay soils have low permeability and unsuitable for those crops which is not tolerance prolonged soil wetness. Clay soil contains high organic matters and resists water and wind erosion. It has high cat- ion exchange capacity and Ph buffering capacity. Loamy soil over clay soil, these are highly susceptible to serve soil degradation and it should reduce erosion. Variability in texture may influence soil function.

##### Moisture

Nutrients absorption is depend on moisture content in soil and play important physical role and it is related to texture and structure of the soil. Wetness is depending on soil porosity. So the clay soil has high porosity than sandy soil and having good water holding capacity. It is essential to evaluation of regional soil water balance. Red and black soil having high water holding capacity and sandy soil have enabled for it. Soil moisture is also responsible for decomposing of organic matter. In low moisture contain plants became stressed. Water is present in more in soil it is not available to plant due to high degree of salinity.

##### Soil temperature

Plant growth is depends on temperature which influence biological, physical and chemical process. Climatic condition is affected soil temperature. Sun is the sources of light which produce heat and Physico-chemical process of soil generated heat. High temperature decreases soil pH and seed germination. High temperature and good aeration increases rate of oxidation off organic matter resulting reduction of organic carbon content. Biomass growth is affected due to temperature fluctuates. High temperature and good aeration in the soil increases the rate of oxidation of organic matter resulting reduction of organic carbon content.

##### Conductivity

It is simple and quick method to check soil health and it is measured to present ion in the solution. Conductivity is increased by ion concentration. It is varies from depth off soil. Its range of variation was less in upland profile, probably occurred due to slope of land surface, high permeability and high rainfall, responsible to leach out alkali and alkaline bases. It is measure with soil properties which affect soil texture and other soil characters. Conductivity is used for measurement of salinity of soil and estimate salt concentration in soil. It is dependent upon moisture content into the soil and useful to monitoring mineralization of organic matter in soil. When conductivity is less than 1ds/cm it is normal soil then critical for germination, 2-3 ds/cm critical for growth of salt sensitive crop and greater than 3ds/cm it is severely injuries crops. All samples (100%) were found to be less than one in electrical conductivity.

##### Nitrogen

It is most important fertilizer element. It is responsible for growth of the plant and coloring of leaves. Nitrogen is taken by plants into NO<sub>3</sub> and NH<sub>4</sub>. It is responsible for energy transfer and constituent of chlorophyll, protein and nucleic acid. It is related to carbon. Nitrogen increase fruit production. Soil acidification is the major problem faced by farmers because due to the excessive use of inorganic nitrogen fertilizers in agriculture. The available nitrogen was measured by Jain and Singh 2014 from Madhya Pradesh, India its value ranges from 171.9 ± 1.9 to 193Kg ha<sup>-1</sup> for red and brown soil and 196.9± 5 to 214.8 ±20.9 Kg ha<sup>-1</sup> for black soil, 182.8 ± 18.8 Kg ha<sup>-1</sup> nitrogen investigate in yellow soil. Available N content varied from 242-336 kg ha with an average value of 290 kg ha. 20% samples were low (<250 N kg ha<sup>-1</sup>), 80% were medium (250 to 500 N kg ha<sup>-1</sup>). This is because most of the soil nitrogen is in organic forms. Considering the concept of "Soil Nutrient Index" the

soil of study area were found in category of medium fertility status for nitrogen.

### Phosphorus

It is micronutrient which is essential for growth and development of plant and it is limiting nutrients remains present in plant nuclei and act as energy storage. It helps in transfer of energy. It is essential for photosynthesis. Its deficiency symptoms are purple stem and leaves, poor yield of fruit. It is balance plant nutrients and growth of plants as well as metabolism activity of plants. The soil with minimum leaching is known to contain high amount of phosphorus as compared to the soil with maximum leaching. Available P<sub>4</sub> content varied from 21-32 kg ha<sup>-1</sup>. Due to soil property range is large. Considering the concept of "Soil Nutrient Index" the soil of study area were found in category of high fertility status of phosphorus.

### Potassium

It is involve in physiological process. It is essential for metabolic activity and photosynthesis. It is found in mineral form. The high content potassium on surface soil may be attributed to the application of potassium fertilizers. It decreases with an increase in depth of soil. Potassium reach soil promotes rapid development of plant and cures to insect damage and protect against winter freeze damage. It play important role in nitrogen balancing and controlling water loss in plants. Potassium (K<sub>2</sub>O) in the soils ranged from 300 to 419 kg ha<sup>-1</sup> with an average of 356 kg ha<sup>-1</sup>. According to Muhar *et. al.* 1963. 25% samples were categorized as low (< 125 kg ha<sup>-1</sup>), 67.5% medium (125 - 300 kg ha<sup>-1</sup>) and 2.5% high (>300 kg ha<sup>-1</sup>). 100% samples were high (>300 K<sub>2</sub>O kg ha<sup>-1</sup>) in potassium content (Table-1). The value worked out from nutrient index for Nitrogen, Phosphorus and Potassium and is 1.60, 2.62 and 2.62 respectively, against the nutrient index value <1.5 for low, 1.5 to 2.5 for medium and >2.5 for high fertility status of area (Kumar *et.al.* 2013). Considering the concept of "Soil Nutrient Index" the soil of study area were found in category of high fertility status of potassium.

### Organic matter of soil

It is play important role. If organic matter is poor in the soil it enhances soil erosion process. Animal manures and compost provides Organic matter to soil. It decreased from surface to subsoil due to leveling. It increases water content at field capacity, increases available water content in sandy soil and increases both air and water flows rates through fine textured soil. It supplies essential nutrient and maintained soil structure. It is a source of nitrogen and other essential nutrients for crops. Status of secondary nutrient in soil range is S is 17-29, Ca is 5-10 and Mg is 3-7, respectively. The organic carbon content was low (<0.50%) in 100% soil samples. It enhances the usefulness of soil for agricultural purposes (Table 2). 40 % were medium (10-20 kg ha<sup>-1</sup> S) and 60 % high (>20 kg ha<sup>-1</sup>). This might be due to creation of favorable soil environment with presence of high organic matter. Available Fe content of these soils was ranged from 4-5 mg kg<sup>-1</sup>. 60% samples were sufficient (5-8.9 mg kg<sup>-1</sup>) and 40% deficient iron content in soil. The available Mn content of these soils was varied from 2.24 to 2.85 mg kg<sup>-1</sup>. The available Cu content soil was ranged from 0.30 to 0.54 mg kg<sup>-1</sup>. 80% sample sufficient & 20% samples were

deficient (<0.60 mg kg<sup>-1</sup>) in copper content. When compared to the other micronutrients. Zn content in soils of was ranged from 0.30 to 0.70 mg/kg<sup>-1</sup>. It was noted that 70% sample sufficient & 30% samples were deficient (<0.60 mg kg<sup>-1</sup>).

**Table 1:** Potassium (K<sub>2</sub>O) in the soils & Nutrient index Value

SN	Samples	Category	Range	NIV
1	25 %	low	< 125 kg ha <sup>-1</sup>	-
2	67.5%	medium	125 – 300 kg ha <sup>-1</sup>	-
3	2.5%	high	>300 kg ha <sup>-1</sup>	-
Nutrient index				
1	Nitrogen	Low	1.6	<1.5
2	Phosphorus	Medium	2.6	1.5 to 2.5
3	Potassium	High	2.6	>2.5

**Table 2:** Organic matter of soil of tribal district Dhar, M.P. India

SN	Samples	Category	Range
1	40 %	Medium	10-20 kg ha <sup>-1</sup>
2	60 %	High	>20 kg ha <sup>-1</sup>
3	S		17-29
4	Ca		5-10
5	Mg		3-7
6	Fe		4-5
7	Mg		2.24-2.85
8	Zn		0.3-0.5 mg/kg <sup>-1</sup>
9	Cu		0.3-0.54 mg/kg <sup>-1</sup>

## 5. Conclusion

Intensive inputs depend on conventional agriculture. It is improving food productivity. In recent years crop productivity is very demand in the market so farmers are used excess amount of fertilizers and pesticides which affect soil fertility as well as quality of soil. So it is essential to analysis of soil parameters. Our study helps to farmers to use integrated nutrient management practices.

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