Physico-Chemical Assessment of Agriculture soils at Basmath Tahsil of Hingoli district in Maharashtra

Indrajit Dukare, Avinash Kadam

Research Scholar, Assistant Professor
School of Earth Sciences, Swami Ramanand Teerth Marathwada University, Vishnupuri, Nanded 431606, (Maharashtra) India.
E-mail: indrajitdukare00@gmail.com

Abstract: A field study was conducted at Basmath for soil and its various contents throughout period of September 2012 to August 2013. A through survey was conducted to examine the quality of some soil samples collected from agricultural farmlands around Basmath city of Maharashtra state, India. The soil is mainly alluvial in nature. Data presentation revealed different values of physical and chemical characteristics of soil. The objective of the study was to assess and compare the soil physicochemical properties of this soil. The study was carried on few selected physical and chemical characterization and that to the quality soil and its nature. The standard analytical methods were applied for analysis of soil.
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Key words: Soil quality, Chemical analysis, UV-spectrophotometer

1. Introduction

Over the last 10 years, soil quality has been one of the topics of greatest interest in soil science, so much so that a database such as the Soil Science CAB Abstracts w Database (CAB International Publishing) supplies more than 1500 publications that use the term 'soil quality' as a key word. This interest has been focused on defining the concept of soil quality and on searching for reliable ways for evaluating this quality. With regard to the definition of soil quality, in recent years the key involvement of the soil in crop production and in water and atmospheric purification has been recognized, thus emphasizing the role of the soil both for production and for environmental quality. This has led to a profusion of definitions of soil quality, but that of Karlen et al. (1997): "soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation", is widely accepted.

Cultivation of agricultural soils has until relatively recently predominantly been achieved by inverting the soil using tools such as the plough. Continual soil inversion can in some situations lead to a degradation of soil structure leading to a compacted soil composed of fine particles with low levels of soil organic matter (SOM). Such soils are more prone to soil loss through water and wind erosion eventually resulting in desertification, as experienced in USA in the 1930s (Biswas, 1984).

Soil may be defined as a natural body, synthesized in profile form a variable mixture of broken and weathered minerals and decayed organic matter, which covers the earth in a thin layer and which supplies, when containing the amounts of air and water, mechanical support and imparts sustenance for plants. Partial heterogeneity in nutrient availability affects not only the spatial patterning of vegetative cover but overall community structure and productivity. The importance of the soil as a reservoir of nutrients and moisture for the production of forage and plant species has been recognized since the beginning of the forest management as a science. Grasslands have deep soils that are very nutrient rich because of the large amount of plant tissue (biomass) that dies off and is added to the soils through decomposition every year (Kodesova, 2009; Lawrence et al, 2000).

Vegetation distribution and development largely depends on the soil conditions (Schoenholtza, 2000). Nutrient limitation occurring in the soils is one of the most important factors affecting the structure of plant communities. On the other hand, the changes in vegetation can cause shifts in the soil properties because individual plants concentrate biomass in soils beneath their canopies and modify biogeochemical processes occurring in the soils (Sarkar, 1988). Chemistry of soil covers chemical reaction and process in the soil pertaining to plant and animal growth and human development (Jana, 1996; Manchanda and Kudrat, 2002). Soil chemical processes are fundamental to the evolution of geoderma, the biosphere and the human environment.

A through survey was conducted to examine the quality of some soil samples collected from agricultural farmlands around Basmath Tahsil of Maharashtra state, India. This paper traces development of the concept of soil quality, explores use of soil chemical and physical properties as determinants of soil quality, and presents challenges and opportunities for agriculture soil scientists to play a relevant role in assessment and advancement of sustainable agriculture man argument by developing the concept of soil quality as an indicator of sustainability.

2. Material and Methods

2.1 Study Area

The present study deals in Basmath tehsil of Hingoli district. It lies between 190 19’ 12’’N and 770 19' 12’’E. Mean sea level rewarded in between 540 and 364meter. Study area occupies 932.38 sq.km of area Also Basmath tehsil comprise 151 villages.

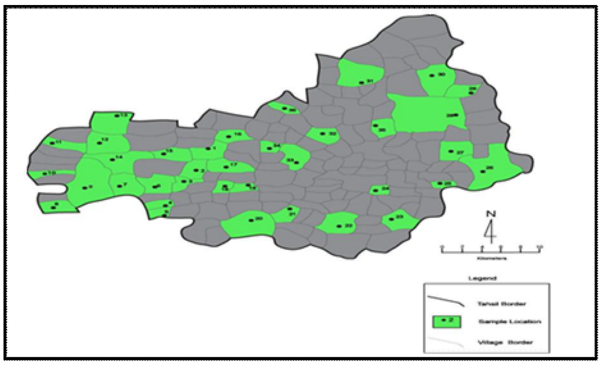

Figure 2.1: Soil Location Map of Study Area

2.2 Sample Collection

The soil samples were collected from agricultural farmlands by using a corer and were brought to the laboratory in a polythene bags which are properly labeled and analyzed. Determining the pH, first the soil samples were mixed thoroughly, air dried and passed through a mesh sieve. The samples were used for subsequent physico-chemical and biological analysis by following methods.

2.3 Determination of the physico-chemical parameters of the soil samples

1] Soil pH:

The pH of the soil was determined in 1:5 soils: water suspension with the help of a pH meter.

2] Electrical conductivity (EC):

The EC of the soil was determined in 1:5 (soil: water) suspension with the help of a Soil Conductivity meter.

3] Moisture:

The soil is dried in an oven at 150oC. The difference in the initial and final weight of the soil determines soil moisture.

4] Organic matter (OM):

Organic matter content of soil samples were calculated from organic carbon by multiplying it by Von Bemmlen factor.

5] Alkalinity:

Soil alkalinity is due to presence of soil minerals producing sodium carbonate upon weathering .It was determined by titrating the soil suspension with a strong acid using methyl orange as an indicator.

6] Chloride:

The chloride is an essential ion for plant growth. The chloride present in the sample was determined in 1:5 soils: water suspension by Argentometric method.

7] Calcium (Ca) and Magnesium (Mg):

Exchangeable Calcium and Magnesium were determined in ammonium acetate leachate by titration method (Jackson 1973).

8] Sodium (Na) and Potassium (K)

Exchangeable Sodium and Potassium determined by flame photometric method.

9] Available Phosphorus

Available phosphorus determined by extracting it with sulphuric acid by stannous chloride method by spectrophotometer (Trivedy and Goel, 1998).

Results and Discussion

The mean values of different Physico-chemical parameters viz. pH, EC, alkalinity, chlorides, magnesium, calcium, sodium, potassium, moisture content, organic matter and phosphorus of soil from 36 different sites were represented in figures. The values of these parameters were also showed graphically in figure too.

3.1 pH

The pH range normally found in soils varies from 3 to 9. Various categories of soil pH may be arbitrarily described as follows: strongly acid (pH < 5.0), moderately to slightly acid (5.0 - 6.5), neutral (6.5 - 7.5), moderately alkaline (7.5 - 8.5), and strongly alkaline (> 8.5).

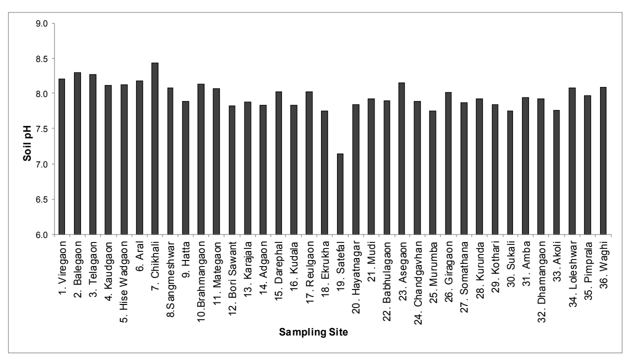

Fig 3.1: Graphical representation of pH of soil

Importance of pH lies in its influence on availability of soil nutrients, solubility of toxic nutrient elements in the soil, physical breakdown of root cells, cation exchange capacity in soils whose colloids (clay/humus) are pH- dependent, and on biological activity. At high pH values, availability of phosphorus (P) and most micronutrients, except boron (B) and molybdenum (Mo), tends to decrease.

The measurement of pH shows the acidity and basicity or alkalinity of the soil. From the evidence available, neither a high pH above 8.4 nor a low below 5.0 is favorable for maximum yield of crops. Present findings showed that the pH of the study sites ranges from 7.14 measured at site 19 to 8.43 at site 7 as shown in figure 3.1.

The measurement of pH shows the acidity and basicity or alkalinity of the soil. From the evidence available, neither a high pH above 8.4 nor a low below 5.0 is favorable for maximum yield of crops. Present findings showed that the pH of the study sites ranges from 7.14 to 8.43. The presence of higher content of organic matter in the soil can be another plausible reason for lowering of the pH (Hodges, 1996). Higher levels of organic matter result in a greater number of cation exchange sites which tend to decrease the pH (Naiman et al, 1994; Adam, 2007).

3.2 Electrical conductivity (EC)

Salinity is an important laboratory measurement since it reflects the extent to which the soil is suitable for growing crops. However, with increasing use of irrigation, there will be greater emphasis on EC measurement in the future.

The measurement of electrical conductivity is for measure the current that gives a clear idea of soluble salt present in the soil. Conductivity depends upon the dilution of soil suspension. Present study showed that the EC of the soil from study sites ranges from 220 mmho/cm to 840 mmho/cm. The minimum value was recorded at study site 10 while maximum value was recorded at study site shown in figure 3.2.

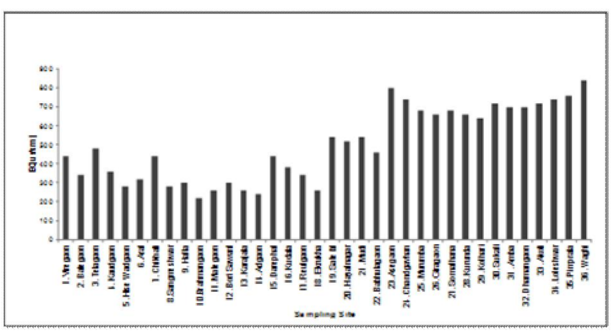

Fig 3.2: Graphical representation of EC of soil

The measurement of electrical conductivity is for measure the current that gives a clear idea of soluble salt present in the soil. Conductivity depends upon the dilution of soil suspension. Present study showed that the EC of the soil from study sites ranges from 220μ/cm to 840 μ/cm. Generally it is believed that higher the concentration of ions in the soil solution more is its electrical conductance. Therefore, the higher value at Site 36 could possibly be attributed to the presence of higher amounts of calcium, magnesium and potassium ions at the site.

3.3 Alkalinity

The alkalinity is normally due to presence of bicarbonate, carbonate and hydroxide compounds of sodium, potassium, calcium and magnesium. Phenolphthalein and methyl orange are the indicators commonly used for alkalinity titrations.

Present study showed that the Alkalinity of the soil from study sites ranges from 2.5 mg/l to 14.5 mg/l. The minimum value was recorded at study site 8 while maximum value was recorded at study site 27 as shown in (figure 3.3).

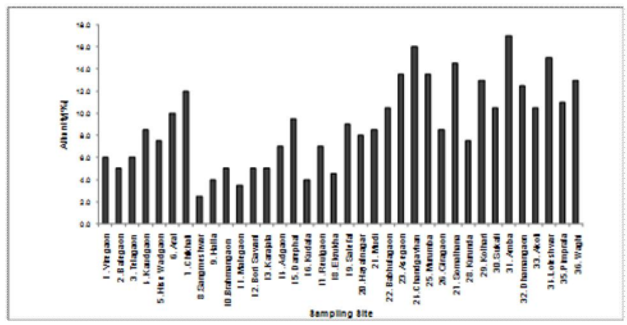

Fig 3.3: Graphical representation of alkalinity of soil

The alkalinity is normally due to presence of bicarbonate, carbonate and hydroxide compounds of sodium, potassium, calcium and magnesium. Present study showed that the alkalinity of the soil from study sites ranges from 2.5 mg/l to 14.5 mg/l.

3.4 Chlorides

In the present investigation, the chloride contents of the soil from study sites ranges from 0.043 mg/l to 0.107 mg/l. The minimum value was recorded at study site 1 while maximum value was recorded at study site 12 as shown in figure.

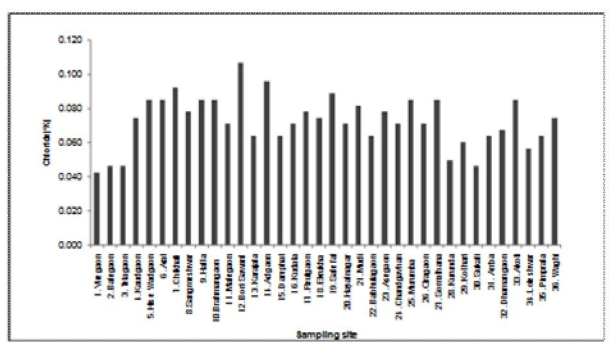

Fig 3.4: Graphical representations of chlorides of soil

Chlorides are the common anion found in soil. In the present investigation, the chloride contents of the soil from study sites ranges from 0.043 mg/l to 0.107 mg/l. Calcium and magnesium are very important elements for plants life. It is the most abundant mineral in soil. These are, however, required in comparatively small amount and are known as secondary nutrients (Iwai, 1961; Ann, 2005). In the present research work the lower calcium concentration was recorded as 0.204 mg/l at site 18 while site 14 showed significantly high concentration of 1.443 mg/l.

3.5 Calcium and Magnesium

In the current research work the lower calcium concentration was recorded as 0.204 mg/l at Site 18 while Site 14 showed significantly high concentration of 1.443 mg/l as shown in figure. 3.5. The low concentration of Mg was recorded as 0.158 mg/l at Site 18 and the higher concentration of Mg was observed as 0.904 mg/l at site 14 as shown in figure 3.5 and 3.6.

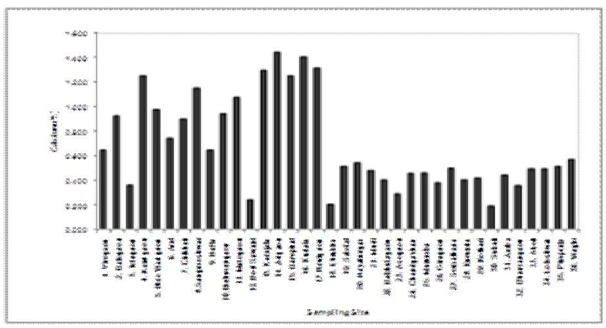

Fig 3.5: Graphical representation of calcium of soil

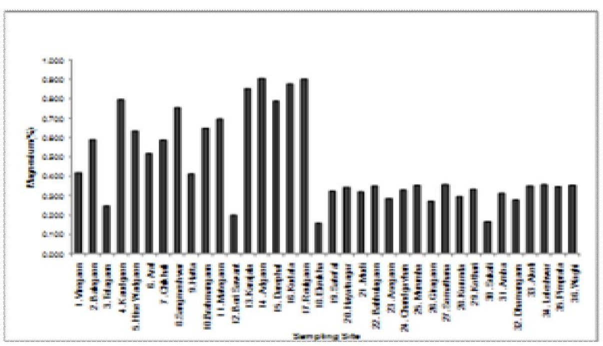

Fig 3.6: Graphical representation of magnesium of soil

3.6 Sodium (Na)

In the present investigation, the lower sodium concentration was recorded as 0.0028 mg/l at Site 17 while Site 23 showed significantly high concentration of 0.034 mg/l as shown in figure 3.7.

In the present investigation, the lower sodium concentration was recorded as 0.0028 mg/l at site 17 while site 23 showed significantly high concentration of 0.034 mg/l. Sodium is generally regarded as essential nutrient for all higher plants. Sodium is involved in regeneration of phosphoenol pyruvate in C4 plants. Sodium is essential for animals, and herbivores depend on its content into the plants.

3.7 Potassium

Where levels of extractable- Potassium values are less than 100 to 150 ppm; Potassium deficiency is likely and fertilization is required to maximize crop production with irrigation or high Potassium requiring crops, the critical level should be even higher.

In the present investigation, the lower potassium concentration was recorded as 0.0031 mg/l at Site 17 while Site 28 showed significantly high concentration of 0.0206 mg/l as shown in figure 3.8.

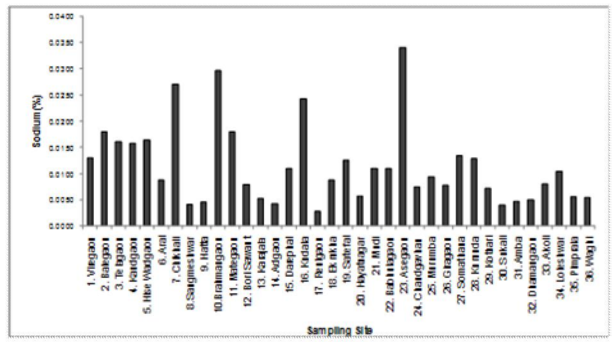

Fig 3.7: Graphical representation of sodium of soil

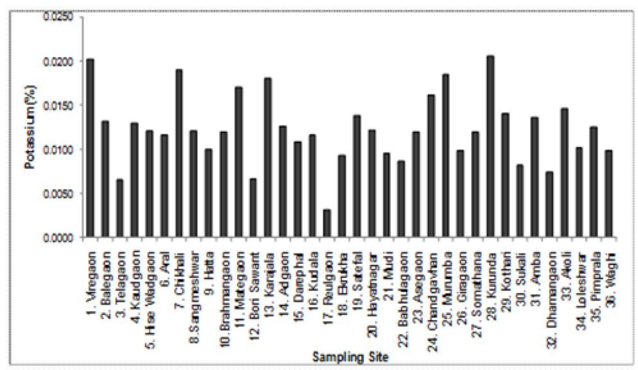

Fig 3.8: Graphical representation of potassium of soil

Potassium is the third essential fertilizer element. Potassium is essential for photosynthesis, for protein synthesis, for starch formation and for the translocation of sugars. This is important for grain formation and is absolutely necessary for tuber development. All root crops are generally give response to application of potassium. In the present investigation, the lower potassium concentration was recorded as 0.0031 mg/l at site 17 while site 28 showed significantly high concentration of 0.0206 mg/l.

3.8 Moisture contents

In the present investigation, the lower moisture content was recorded as 0.43 %l at Site 30 while Site 6 showed significantly high moisture content of

5.28 % as shown in figure 3.9.

In the present investigation, the lower moisture content was recorded as 0.43 %l at site 30 while site 6 showed significantly high moisture content of 5.28 %. The cover, normally plants and litter, shades the soil; that is, it intercepts some of the incoming radiation, heating the cover itself instead of the soil below (Singer and Munns, 1991).

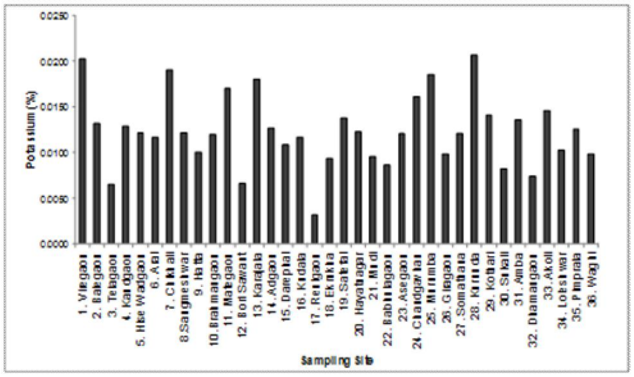

Fig 3.9: Graphical demonstration of moisture content of soil

3.9 Organic matter (OM)

In the present investigation, the lower organic matter content was recorded as 0.378 at Site 34 while Site 3 showed significantly high moisture content of 0.502 as shown in figure 3.10).

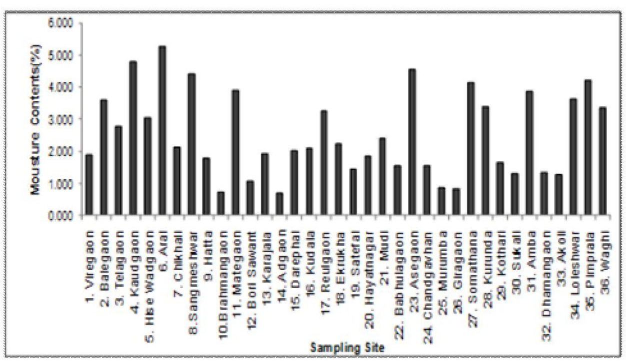

Fig 3.10: Graphical illustration of organic matter of soil

In the present investigation, the lower organic matter content was recorded as 0.378 at site 34 while site 3 showed significantly high moisture content of 0.502. Site 3 recorded high organic matter content with an average value of 0.502% as compared to the other sites which may be attributed to the rich litter deposition and due to the low mineralization caused by relatively lower temperature under the shade of dense trees and therefore to the slow rate of decomposition of organic matter (Moore, 1981). It has been reported that the decomposition rates of organic matter has a tendency to increase as weather warms and to furnish maximum plant growth conditions (Russell, 1950; Bob, 2002). The lower values of organic matter and organic carbon at Site 34 can possibly be a consequence of grazing and leaching.

3.10 Phosphorus

In the present research work, the lower phosphorus content was recorded as 0.01 mg/l at Site 1, 3, 21, 25, 29 and 31 while Site 11 and 33 showed significantly high phosphorus content of 0.0.07 as shown in figure 3.11.

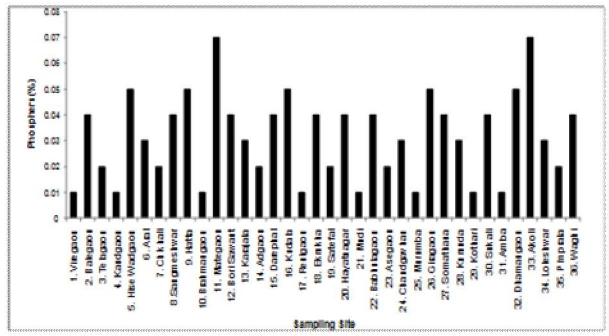

Fig 3.11: Graphical depiction of phosphorus of soil

In the present research work, the lower phosphorus content was recorded as 0.01 mg/l at site 1, 3, 21, 25, 29 and 31 while site 11 and 33 showed significantly high phosphorus content of 0.07 mg/l. 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). The soils with minimum leaching are known to contain high amount of phosphorous as compared to the soils with maximum leaching.

Maharashtra state rich in black cotton soil, The Nanded and Bhokar has black cotton soil, which is rich in calcium and magnesium. The soil is mainly alluvial in nature. The soil present in this region is black cotton soil Shaikh et al., (2012); Yannawar et al., (2013).

4. Conclusion

From this study, it was determined that the Basmath has black cotton soil, which is rich in calcium and magnesium. The soil is mainly alluvial in nature. From the results of the work, it can be concluded that the pH of all the soil samples were slightly neutral. The organic carbon and calcium carbonate are low in all the soil samples. The pH shows the neither a high pH above 8.4 nor a low below 5.0 is favorable for maximum yield of crops. Present study showed that the EC of the soil from study sites ranges from 220 µ/cm to 840 µ/cm.

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Correspondence to:
Mr. Indrajit Balaji Dukare
Swami Ramanand Teerth Marathwada University,
Nanded (Maharashtra) India.
Telephone: 02462-229253
Emails: indrajitdukare00@gmail.com

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