



Physico-Chemical Study of Farmland Soil Samples in Nanded Region of Marathwada

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Abstract:

All fundamental needs of human beings and other living organisms are fulfilled by soil. It is one of the most important resources of universe. Interest in soil chemistry developed due to its unique property to produce and sustain crops. Soil takes eminent position in cultivation of crops. The physical and chemical properties of soil are very important to understand because soil productivity depends upon these factors. This, physico-chemical study of soil is based on various parameters like pH, electrical conductivity, moisture, texture, temperature, organic matter, nitrogen, phosphorus and potassium contents of soil.

Keywords: Soil, physicochemical, nutrients, electrical conductivity.

Introduction:

Soil acts as a key element for food production on which life sustains on this earth. Soil ecosystem provides various functional services, such as maintenance of soil fertility, promoting ecosystem stability, and regulating climate change [1]. It is well recognized that anthropogenic disturbances like excess use of chemical fertilizers greatly affect soil physical and chemical properties, and biochemical activities. The term soil has been originated from “solum” a Latin word meaning the earthy material in which plant growth occurs [2-3]. Soil is a complex matter and comprises minerals, soil organic matter, water, and air. These factors greatly influence soil texture, structure, and porosity [4]. These properties subsequently affect air and water movement in the soil layers, and thus the soil’s ability to function. Therefore, soil physicochemical properties have a great influence on the soil quality. Soil testing provides information regarding nutrient availability in soils which forms the basis for the fertilizer recommendations for maximizing crop yields [5]. Soil fertility map for a particular area can prove highly beneficial in guiding the farmers, manufacturers in ascertaining the requirement of various fertilizers in a season and making projections for increased requirement based on cropping pattern [6].

Furthermore, the procedure used in the present work can be applied in many areas that are similar characteristic with the study area of the present work. The objective of the present work is to analysis and discusses the suitability of soil for urban development and to find its environmental impact on Nanded district.

Material and Methods:

Study Area:

Nanded district is the region of Marathwada, the part of Maharashtra state. In this district and hence in Nila village, the main crops are turmeric, soyabean, sugarcane, cotton etc. The Nila is located 19.1485° North latitude and 77.3191° East longitudes. The soil samples were collected from ten sites of Nila village.

Method:

The present study deals with the analysis of soil samples from field which were collected in a period of April 2023. From the selected sites, samples were collected as per procedure described in methods manual, soil testing in India [7]. The soil samples were dried in oven at 60⁰ C and passed through ~2 mm mesh sieve, stored in polythene bags. Samples used from 'Nila region' are named as S1, S2, S3, S4, S5, S6, S7, S8, S9 and S10.

All the reagents and chemicals used were of A.R. grade purchased from S.D. Fine Chemicals. All the solutions of standards and samples were prepared from deionized water. Processed soil samples were analyzed for nutrient availability by following standard analytical techniques [8]. The physical, chemical and biological parameters were analyzed as per Standard Methods.

Results and Discussion:

A long-run farming practices were observed to change soil physico-chemical properties to some extent. It was observed that the soil under farming regimes is neutral to slightly alkaline (pH = 7.3 to 7.8) in nature. pH is an important property of soil that determines the acidity or alkalinity, which effects the chemical reactions between water and soil minerals. Under such alkaline conditions the solubility of minerals decreases creating nutrient deficiencies in the soils. Plant growth is therefore limited by unavailability in iron, manganese, zinc, copper and boron. Another indirect effect occurs through the activity of microbes. Most of the micro-organism's function at their best within a pH range 6.0 to 7.5 [9]. If soil reaction is changed beyond this range, the micro-organisms become functionless. Consequently, the supply of some of the essential plant nutrients like nitrogen is considerably reduced.

Electrical conductivity is the expression of presence of ions in soil. Health of soil can be determined by measuring electrical conductivity of soil [10]. Fertile soil is having rich concentration of anions and cation in them. The electrical conductivity of soils varies depending on the amount of moisture held by soil particles. High amount of ionic content leads to high electrical conductivity in soil. The soils under analysis were found non saline. For the sample S6 and S8 EC is more which concludes that it is very slightly saline.

Moisture is a most important physical property of soil. The absorption of nutrients is depending on the moisture of the soil [11]. The water content of soil is also much related to its texture and structure. The soil moisture commonly depends on void ratio, particle size, clay minerals, organic matter and ground water condition.

The temperature of the soil depends on the ratio of the energy absorbed to that lost from the soil. Soil temperature influences soil moisture, aeration and availability of plant nutrients which are necessary for plant growth [12]. Soil temperature strongly affects biological processes such as, seedling emergence and growth, root development, and microbial activity. Soil temperature increases the decomposition of organic matter by increasing microbial activity and it is critical in maintaining the global carbon and nitrogen balance. For given samples temperature ranges from 35° C to 45°C. Soil temperature changes with season, time of day, and local conditions of climate.

Soil organic carbon (O.C) is an important property of soil. If the soil is poor in organic matter, then it enhances the process of soil erosion [13]. If the soil organic matter is present in soil, then this soil is useful for the agricultural practices. Organic matter may be added in the soil in the form of animal manures, compost, etc. The presence of higher content of organic matter in the soil can be another passible reason for lowering of the pH [14-15]. Soils have varying organic compounds in varying degrees of decomposition. In the present study organic carbon was found in the range of 0.27 % - 0.53 % with a mean value of 0.40.

Nitrogen (N) is a crucial ingredient for plant life. It participates in the creation of proteins, nucleic acids, chlorophyll, and enzymes, and is essential for photosynthesis in plants. N has an irreplaceable role in organ construction, material metabolism, fruit yield, and the quality formation of fruit trees [16]. Plants respond quickly to application of nitrogen salts. This element encourages above ground vegetation growth and gives a deep green colour to the leaves. Soil nitrogen is also directly related with soil organic carbon [17]. Nitrogen influences the quality of plants fruit and it increases the fruits protein content. Available nitrogen content in the fields ranged from 140 to 324 kg/ha. Among all samples, sample S4 having very less nitrogen content. So, there is requirement of nitrogenous fertilizers like urea.

Phosphorus (P) is a part of every living cell in plant. It is one of the most important macronutrient essential for plant growth. Phosphorus is most often limiting nutrients remains present in plant nuclei and act as an energy storage. It helps in transfer of energy and plant growth, metabolism [18]. Inorganic phosphate supplied to the soil as a fertilizer is rapidly converted into unavailable form. The available phosphorus in the soils ranged from 6.3 to 69.8 kg/ha.

Potassium (K) is the most abundant inorganic cation, and it is important for ensuring optimal plant growth. K is also very important for cell growth, which is an important process for the function and development of plants [19]. Data pertaining to available potassium ranged from 115 to 743 kg/ha. High concentration of potassium causes soil infertility and affects on matured tissues.

Table 1: Physico-Chemical Properties of Soil Samples from the Study area.

Sample No	pH	Electrical conductivity (mS/cm)	Organic carbon (%)	N (kg/ha)	P (kg/ha)	K (Kg/ha)
S1	7.35	0.39	0.53	324	47.9	335
S2	7.76	0.40	0.38	213	19	415
S3	7.82	0.43	0.28	165	24	743
S4	7.76	0.38	0.27	140	12	312
S5	7.45	0.40	0.44	250	32	489
S6	7.76	0.42	0.33	186	6.3	646
S7	7.66	0.40	0.29	162	33	498
S8	7.78	0.42	0.28	157	69.8	435
S9	7.76	0.40	0.36	200	8.5	598
S10	7.35	0.36	0.53	158	9.4	115

Conclusion:

From the chemistry point of view, soil structure is associated with different nutrient cycle and nutrient storage. It also controls storage of soil organic matter. Present results showed that soil is alkaline in nature. From the study it is concluded that study of soil quality can be carried out by different parameters. Most of the parameters are quite higher or lower than acceptable limits. Therefore, it is very important to put a total ban on the human activities which are responsible for soil quality deterioration. Most of the farmers are using

excessive chemical fertilizers and the too much dose of such fertilizers in few soils has rendered high values of K in most of the samples S3, S6, S7 and S9.

Manure and organic fertilizer application promoted significant soil fertility and improved nutrient status of soil by increasing nutrients like carbon, nitrogen, and phosphorus availability to plants. Use of acidic fertilizers and organic manure can be a remedy which can raise the crop yield. Monitoring of micronutrients in the soils should be done periodically as it can be an efficient way to assess the qualitative and quantitative abundances of the metal concentrations. In conclusion, use of ecological friendly farming practices and application of more organic based fertilizers by the farmers should be encouraged by the Government. Further studies are required to address other possible environmental impacts of this soil type on study area.

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