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Evaluation of Selected Physiochemical Parameters of Soils from Anand and Vadodara

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Abstract:- Physiochemical parameters of soil help define the soil characteristics and the content of various nutrients in the soil. It is also an indication of the fertility of the soil. The various parameters for physicochemical analysis of soil include PH, bulk density, moisture content, available micronutrients, etc. The following study is based upon the analysis of PH, moisture content, and bulk density as physiochemical parameters of soil. Soil samples were collected from different locations of Vadodara city and the Anand district of Gujarat. Results revealed that soil PH was found to be fairly neutral to slightly acidic in all the samples. The lowest moisture content value was found to be from soil samples collected from Anand. The value of bulk density was higher for samples collected from Anand. These results indicate that the studied soil was of good quality with high productivity which is good for better yield and growth of plants.

Keywords:- *Physiochemical, Soil, PH, Bulk Density, Moisture Content, Vadodara, Anand.*

I. INTRODUCTION

The physicochemical properties of the soil employed for agricultural production and forest growth are both dependent on them. The public's interest in the quality of products derived from it and the many procedures used for their output has boosted the need for soil testing on a daily basis. The intrinsic physical and chemical qualities of a substance are known as physicochemical properties. These characteristics include color, boiling temperature, density, volatility, water-solubility, flammability, and many others. The soil quality study includes a review of the properties and processes that influence soil's capacity to operate effectively as a component of a healthy ecosystem. By combining the data sets from the physical condition of subsoil structure and surface soil condition, one can accomplish the soil's physical requirement, a combination of its subsurface and surface structure. This feature indicates areas where root penetration and seedling emergence are likely to be restricted, as well as the free movement of air and water, and the ease of cultivation and other surface management operations (due to poor soil structure). All agricultural productions and development of forests rely upon the physicochemical parameters of the soil used for it. The soil quality analysis includes an analysis of parameters and processes which effects soil to control with efficiency as an element of a sound ecosystem [1] [2].

The physicochemical features of soil have a significant impact on soil quality. The texture of the soil, in particular, may have a big impact on a lot of other things. Moreover, one of the most essential physical qualities of soil is its texture. Soil texture, for example, is commonly used to define the size distribution of mineral particles and is regarded as one of the most important elements determining soil organic matter accumulation. Moreover, Chemical qualities are generally related to chemical bonding to mineral particles, reducing enzyme, and decomposer degrading ability [3].

PH: The most vital property of soil is its PH level, it affects all alternative parameters of soil. Therefore, PH is taken into account when analyzing any sort of soil. If the PH is less than six it is said to be acidic soil, the PH varies from 6-8.5 it's a normal soil, and more than 8.5 then it's recognized as alkaline soil [4].

Moisture content: It is the amount of water contained in a material, like soil, is known as soil moisture; it is one of the most important soil qualities. Absorption of the nutrient mostly depends on its moisture content. It also depicts its impact on the texture of the soil and the amount of water and heat energy exchanged between that of the land surface and the atmosphere via evaporation and plant transpiration controlled by soil moisture. As a result, soil moisture is crucial in the formation of weather patterns and the creation of precipitation. [2].

Bulk Density: It is a standard of soil compaction. It is modified by crop and land management practices that have an effect on soil structure, organic matter, soil cover, and/or absorptivity. It is generally indicated in g/cm3. Moreover, it is based on soil texture and the densities of organic matter particles and packing arrangement, as well as their soil minerals (sand, silt, and clay). Root development is restricted in soils with a bulk density greater than 1.6 gm/cm^3.For optimal air and water mobility through the soil, soil with a low bulk density usually below 1.5 gm/cm^3 is preferred. [5].

II. MATERIALS AND METHODS

A. Collection of Plant material and Soil

The soil samplewas collected from two different cities named Anand (Latitude 22.5645° N, Longitude72.9289° E) and Vadodara (Latitude 22.2726°N, Longitude73.1878° E) situated in the state of Gujarat. However, soil samples were collected from three different areas from these cities. From Anand, soil for area 1 was collected from Bhadran, Area 2 soil from Mota Bazar, and Area 3 from Giriraj Street. Similarly, from Vadodara, Area 1 from Alkapuri, Area 2 from Subhanpura, and Area 3 from Sayaji Baug.

B. PH content of Soil

Requirements: PH paper strips, tripod stands, beakers, soil samples, spatula, water, funnel, and filter papers.

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It is one of the most important parameters of soil. If a particular soil has a PH of greater than 7 then the soil is on the alkaline side. If it lies between the ranges of 6-8.5 then it is considered ideal for vegetation growth. A PH of greater than 8.0 is considered alkaline type soil, if it is less than 6.0 it is acidic. Any change in the PH results in changes or imbalance in the other soil parameters. The PH can also affect the microbial action of soil as certain microbes cannot survive at PH above a particular level. This way it affects the microbial diversity of soil. It also helps to check for the presence of free acids in soils which can hinder the plant growth from inside out. The value of PH varies for different types of soil and may also differ at different locations based on various parameters. Six beakers were taken and different soil samples from both sites were added to them. To each beaker, 2 ml of distilled water was added and properly mixed with a spatula. Then six tripod stands were taken and a funnel was added at top of them. A filter paper was also placed at the mouth of the funnel. The mixture was then added at the top of the funnel and allowed to pass through the filter paper. The filtered liquid was then collected in a beaker at bottom of each tripod stand. The PH paper strip was dipped into the filtered liquid sample and the PH was noted down by comparing it with the color chart [6].

C. Moisture Content of Soil

Requirements: Perforated keen box, soil samples, Petri dishes, water, filter papers, and weighing machine.

The water holding capacity of soils or its moisture content depends on the surface area as well as pore size of soil and the key components which dictate the water holding capacity are organic matter and its texture. It is the quantity of water that the soil holds. It varies from soil to soil. It is the water that the plant holds after the excess water moves past the soil into the water table and is not able to shift water into the roots. It is a very important factor in the field of agriculture. The moisture content is also affected by the amount of organic matter present in the soil. The presence of more organic matter in soil can make the soil moist due to its affinity towards water. The slit and clay soils have more ability to hold water and are moist. This is attributed to their particle size. They have smaller particle sizes and larger areas so they have more moisture content. It also affects the groundwater levels below. In this experiment, six perforated keen boxes were taken and properly washed and dried. Then filter paper was taken and cut to the size of the perforated keen box and fixed at its bottom. The initial weight (W1) of the box was taken using a weighing machine. Then soil was added to the surface of the box. The weight of the box was taken a second time (W2). A petri dish was taken and the perforated keen boxes were placed in it. Water was added to each Petri dish and they were allowed to rest for about 20 minutes. After that, the final weight was taken (W3) [7].

D. Bulk Density of soil

Bulk density is characterized as the compaction of the soil. It indicates the soil's ability to provide support to the plant, moments of solutes and water as well as aeration of the soil. The bulk density of soil is determined by dividing the dry weight of soil by the volume of soil. The space that the pore in soil occupies along with the bulk density determines the positioning of particles in the soil structure. It also affects the shape and size that the soil takes. As we go deeper into the soil the bulk density of soil also increases. This is because the amount of organic matter and the compaction ability of the soil is more in a subsurface layer in comparison to the ground layer. Tillage for agricultural purposes can have a significant influence on soil bulk density since tilling the soil before planting crops can temporarily diminish its bulk density. Since higher bulk density decreases soil porosity it can affect the water moment as well as root penetration. For the experiment, six keen boxes were taken and properly washed and dried. The initial weight (W1) was taken without the lid using the weighing machine. The soil was then added to the top of the box. The weight of the keen boxes was taken again (W2) after the addition of soil. Followed by, keeping samples in the oven for drying for about 20 minutes. After that, the sample was allowed to cool for a minute and the final weight (W3) was noted down [8].

III. RESULTS

Soil samples were collected from different areas of Vadodara and Anand. Physiochemical analysis of parameters like PH, moisture content, and bulk density was estimated based on the standard method [6] [7] [8].

A. Determination of PH content

The results of PH determination are given below (Table 1). Results indicated PH of the various soil samples of area 1, area 2, and area 3, collected from Vadodara and Anand. The result of the determination of PH is depicted in a graphical form below (Fig. 1).

B. Determination of Moisture Content

The results of moisture content determination are given below (Table 2). Results indicated moisture content of the various soil samples of area 1, area 2, and area 3, collected from Vadodara and Anand. The result of the determination ofmoisture content is depicted in a graphical form below (Fig. 2).

C. Determination of Bulk Density

The results of bulk density determination are given below (Table 3). Results indicated bulk density of the various soil samples of area 1, area 2, and area 3, collected from Vadodara and Anand. The result of the determination ofbulk density is depicted in a graphical form below (Fig. 3).

IV. DISCUSSION

The physicochemical parameters of soil are helpful in the determination of the soil quality and nutrients present in the soil. In this study, we collected the soil samples from three different areas of Vadodara and Anand and analyzed the PH, moisture content, and bulk density of soil as its physicochemical parameters.

The PH of any soil is quintessential for it to support plants and microorganisms. Soil PH is necessary for plant growth since it determines the provision of almost all essential plant nutrients. It influences the uptake and absorption of all the nutrients by the plants. If a soil's PH is very alkaline or acidic the plant roots won't be able to uptake nutrients that can hinder the plant growth. It also affects the

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population of healthy microorganisms that help to make the soil more fertile for the fast growth of plants. If the hydrogen ion concentration of the soil is larger than seven and is alkaline, then the plants cannot grow within that particular soil [9].

Determination of PH			
City	Area 1	Area 2	Area 3
Vadodara	6	7	7
Anand	7	6	7

Table 1: Determination of PH

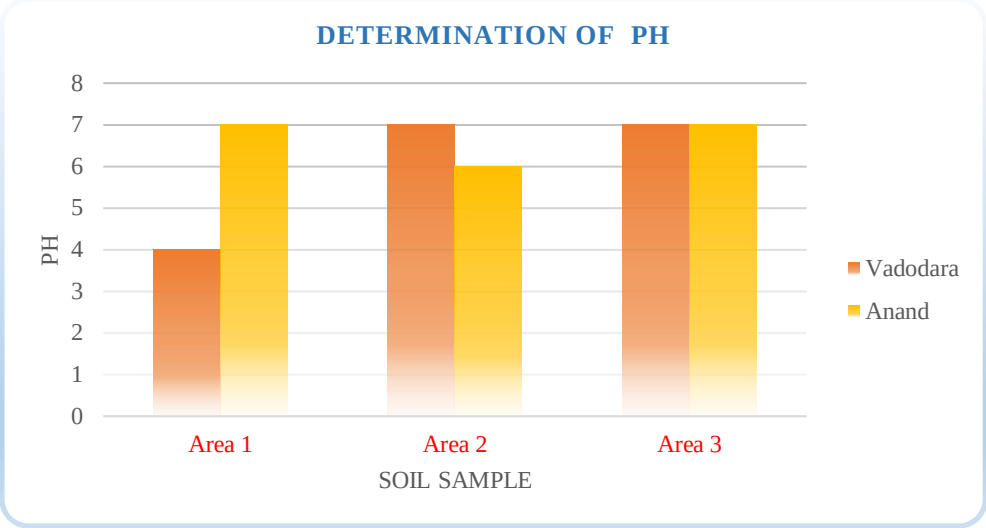

Fig. 1: Determination of PH

Determination of Moisture Content			
City	Area 1	Area 2	Area 3
Vadodara	38.3 gm/cm^3	27.3 gm/cm^3	28.7 gm/cm^3
Anand	23.9 gm/cm^3	32.4 gm/cm^3	29.8 gm/cm^3

Table 2: Determination of Moisture Content

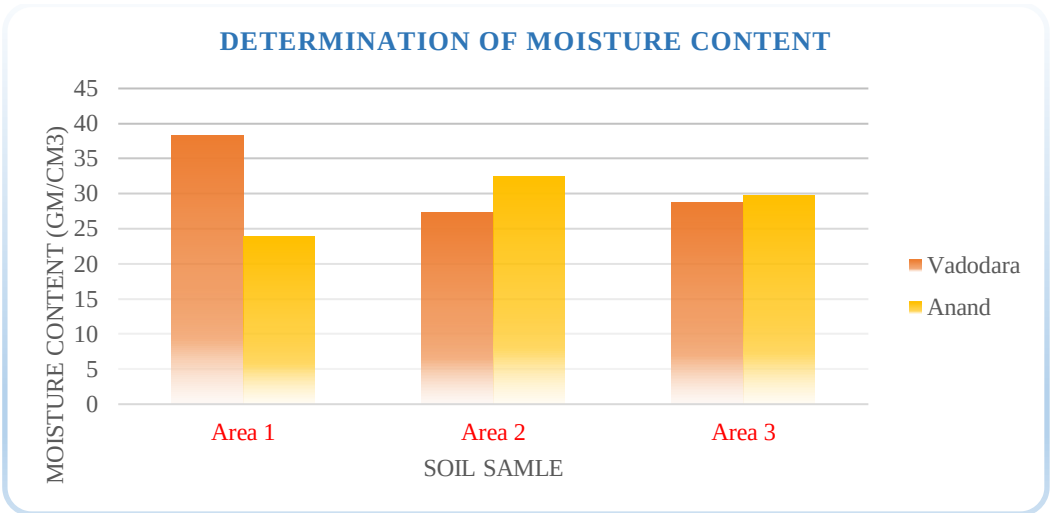

Fig. 2: Determination of Moisture Content

Determination of Bulk Density			
City	Area 1	Area 2	Area 3
Vadodara	1.24 gm/cm^3	1.07 gm/cm^3	0.97 gm/cm^3
Anand	1.34 gm/cm^3	1.23 gm/cm^3	1.25 gm/cm^3

Table 3: Determination of Bulk Density

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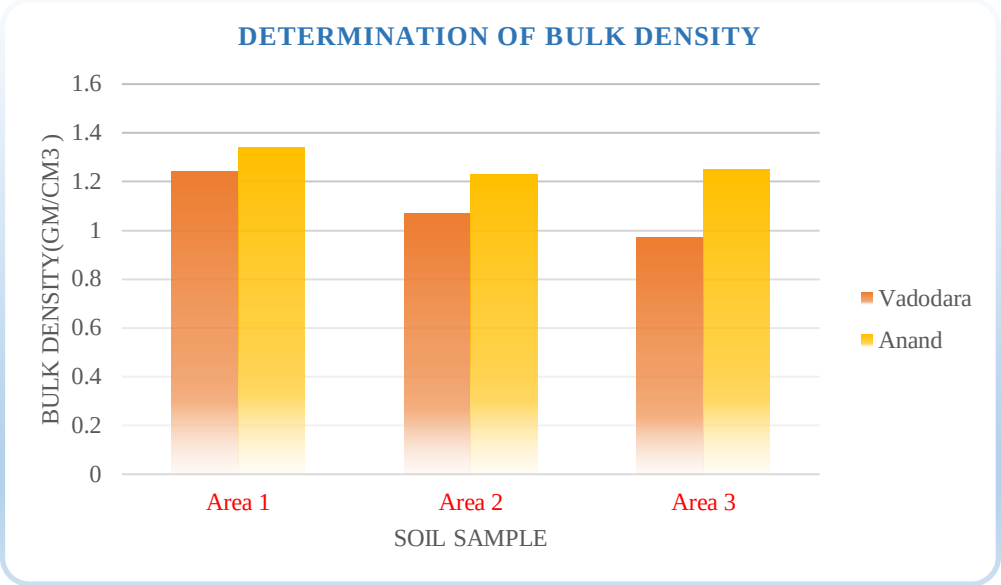

Fig. 3: Determination of Bulk Density

The PH of samples of the soil obtained from Bhadran in Anand and Alkapuri in Vadodarawere found to be 6.0 and 7.0 respectively. The value of PH for soil samples taken from the Subhanpura area of Vadodara was found to be 7.0 and 6.0 for soil samples collected from the Mota bazaar area of Anand. Similarly, the PH of the soil taken from the Sayaji Baug area of Vadodara and Giriraj Street area of Anand was found to be 7.0 in both cases. Overall all the soil samples obtained had a PH of about 7.0 indicating the fairly neutral nature of the soils that may be due to the balance of various electrons system and the nutrients as well as the fairly low use of any chemical pesticides. The lowest value of PH from the entire range was found to be 6.0 from the soil sample collected from the Alkapuri area Vadodara which shows its slightly acidic nature which might be due to the composition of the soil.

A study of the analysis of physicochemical parameters, heavy metals, and micronutrients of soil samples of Kundal Village, Sangli District, Maharashtra was done and soil PH was one of the phytochemical parameters considered for evaluation. PH was taken from seven different sites and it was concluded that the soil PH lied in the range of 7.5-8.8 whereas the values of pH obtained from the various samples from different areas collected from Vadodara and Anand were found to be between the ranges of 6.0-7.0 respectively. This indicates that the PH of different soil samples obtained from different areas of both the sites was on the neutral side in comparison to the PH of the soil samples from Sangli, Maharashtra which was slightly more on the alkaline side. This may be due to the differences in the topography of soil locations as well as different environmental conditions [10].

Moisture content means the water holding capacity of soil which is very important for soil health. In soil science, hydrology, and agricultural sciences, water content has a crucial role in groundwater recharge, agriculture, and soil chemistry. If the wet content of the soil is optimum for plant growth, plants will rapidly absorb soil water. Not all the water, held within the soil, is available to plants. Knowing the soil moisture status permits extremely efficient irrigation, providing the water as and once needed, and eliminating the wasteful use of water once irrigation when required. Roots will penetrate the soil so that the plant will anchor itself and conjointly so that it will access the nutrients and water keep within the soil [11].

It was found that moisture content had the lowest value of 23.9 gm/cm^3 for the soil sample collected from the Bhadran area of Anand district which is helpful in better plant growth. In contrast to this, the value of moisture content was about 38.3 gm/cm.^{3} for a sample of soil collected from the Alkapuri area of Vadodara which is the highest amongst all the samples analyzed. The moisture content values of samples collected from the Giriraj Street area of Anand as well as the Sayaji Baug area of Vadodara were found to be about 28.7 gm/cm^3 and 29.8 gm/cm^3 respectively. This might be due to striking similarities in their geographical locations. The soil samples collected from the Mota Bazar area of Anand had a moisture content of about32.4 gm/cm^3 which was higher in comparison to the soil sample collected from the Subhanpura area of Vadodara which had a moisture content of about 27.3 gm/cm^3 respectively which may be attributed to the soil composition as well as the difference in their locations.

Research on crop yield, plant nutrient uptake, and soil physicochemical properties under organic soil amendments and nitrogen fertilization on Nitisolsis lesser was done in Ethiopia, Africa, and the moisture content of the soil was also considered. It was concluded that the amount of moisture content in the soil sample was found to be about 15.4% to 25% respectively. It was concluded that it is lesser in comparison to the amount of moisture content of the soil sample obtained from the Subhanpura area of Vadodara which is about27.3% and 32.4% for soil sample collected

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from the Mota Bazar area of Anand. So it can be said that the soil health of our samples from Vadodara and Anand is better than that samples from Ethiopia, Africa which is good for plant nourishment [12].

Bulk density shows the soil's ability to carry out soil aeration, water and solute movement, and structural support. High bulk density is an associated indicator of low soil consistency and soil compaction. High bulk density impacts obtainable water capability, root growth, and movement of air and water through the soil. Compaction will rise bulk density and reduce crop yields and vegetative cover obtainable to guard soil against erosion [13].

The bulk density is an important parameter of soil. For the sample of soil obtained from the Alkapuri area of Vadodara and Bhadran area of Anand respectively, the values were found to be 1.24gm/cm^3 and 1.34 gm/cm^{3}and that of the sample obtained from the Subhanpura area of Vadodara and Mota Bazar area of Anand respectively were found to be about 1.07 gm/cm^3 and 1.23 gm/cm^3 respectively. Preceding similarly the bulk density of sample obtained from the Sayaji Baug area of Vadodara was found to be 0.97 gm/cm^3 which is much less when compared with the Giriraj Street area of Anand which had a bulk density of about 1.25 gm/cm^3 respectively. It can be concluded that the value of bulk density was maximum and highest for the sample of soil obtained from Alkapuri area Vadodara and lowest for the sample of soil obtained from Sayaji Baug area of Vadodara. This may be attributed to the presence of various substances and the usage of land in the area.

A study on Soil physicochemical and microbial characteristics of contrasting land-use types along soil depth gradients was done with a bulk density as a parameter considered for evaluation. The bulk density was found to be about 1.1 gm/cm^3 to 1.4 gm/cm^3 which are less than the value of the bulk density of the sample obtained from the Sayaji Baug area of Vadodara and Giriraj Street area of Anand respectively where the values were found to be 0.97 gm/cm^3 and 1.25 gm/cm^3 indicating the good quality of the soil [14].

V. CONCLUSION

The physicochemical analysis of some soil factors likes, PH, moisture content bulk, density was done to assess the efficacy of soil. It was revealed that the PH of all the soil samples from different areas varied from slightly acidic to neutral. The soil samples collected from the Sayaji Baug area of Vadodara and Giriraj Street area of Anand, as well as soil samples collected from the Subhanpura area of Vadodara and Bhadran area of Anand, were found to be neutral when compared with samples of soil collected from Alkapuri area of Vadodara and Mota Bazar area of Anand which was slightly acidic in nature which might be due to application of fertilizers or water discharge in general. On comparing the moisture content of all the soil samples it was revealed that soil samples collected from the Alkapuri area of Vadodara and soil samples collected from the Mota Bazar area of Anand had the highest moisture content. The lowest level of moisture content was that of soil from the Bhadran area of Anand favoring plant growth. The bulk density was more for samples of soil from the Bhadran area of Anand and Subhanpuraarea of Vadodarawhile soil sample from the Sayaji Baugarea of Vadodara had the lowest bulk density allowing good root growth and penetration. Hence it can be concluded that the analyzed soil samples had increased productivity along with the good quality of soil making the soil fertile and rich in all nutrients required for proper growth of plants along with high yield. These physiochemical parameters help to provide valuable information about soil which can help people to grow plants with a better yield on a commercial level.

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