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# Physico- Chemical Analysis Of Agricultural Soil Collected From Mehsana District, Gujarat

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## Abstract: -

Soil surveying and analysis are crucial operations in soil research, and characterisation of their properties is a critical step in determining soil quality. Purpose of this study is to look into the physical and chemical characteristics and determine the soil fertility of various agricultural lands in Mehsana district by evaluating soil characteristics. Parameters such as pH, electrical conductivity, calcium, magnesium, sulphur, organic carbon, accessible potash, phosphorous, copper, iron, manganese, and zinc were used for characterization of soil sample. For the study, five representative locations were chosen. Samples were taken from each location and direction of the area. It is concluded from analysis that potash, phosphorous, Nitrogen and Organic Carbon are in low amount. Copper, zinc, manganese, Iron, Boron, Sulphur high in amount. Other parameters are in moderate amount.

**Keywords: -** Soil, Soil quality, Physico -Chemical characteristic, Soil fertility, Mehsana

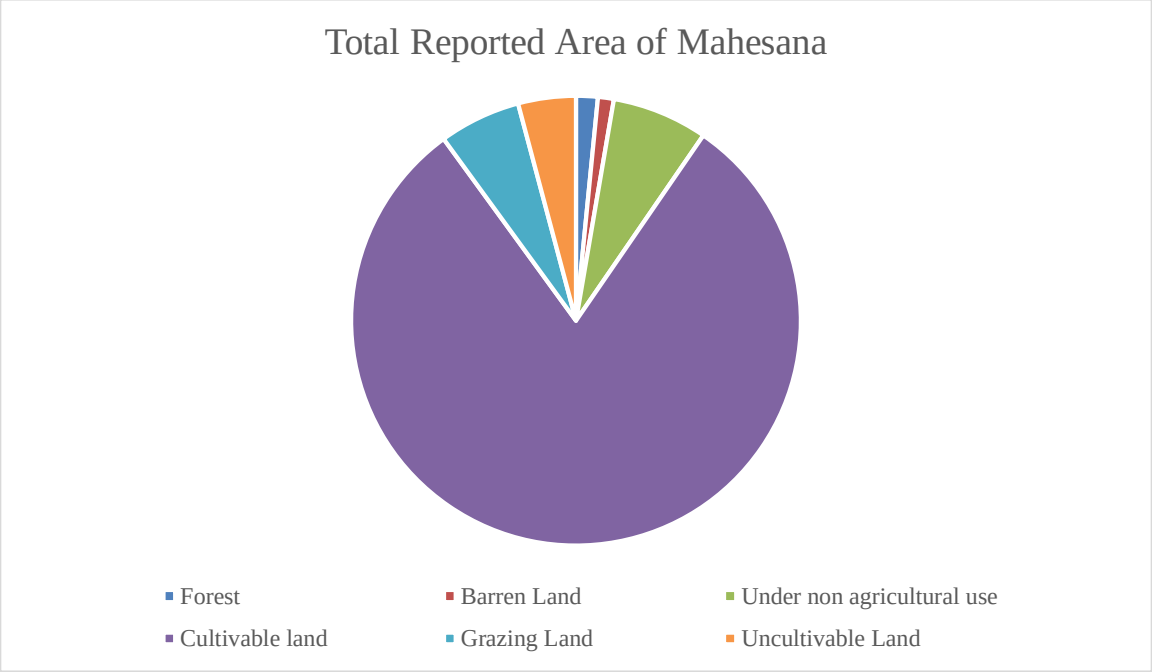
## Introduction: -

Life layer of plants is formed by soil, which is a key component, a medium of unconsolidated nutrients and materials. It is a vital component of the biosphere's life support system. Agricultural chemists use physicochemical studies of factors to better understand plant growth and soil management (Kanimozhi *et al*., 2011). Various factors such as total Organic Carbon, Phosphorus, Potash, pH measurement, estimations of Calcium, Magnesium, Sulphur, Copper, Zinc, Manganese, Magnesium, and Electrical Conductivity are studied using soil analysis. Carbon, Hydrogen, Oxygen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur, Iron, Manganese, Zinc, Copper, Boron, Molybdenum, Chloride, and Nickel are all vital and essential elements for plant growth. Carbon, Hydrogen and Oxygen are obtained by plants from air and water, while the remaining elements are obtained from the soil. Supplemental fertiliser treatments are required when soil cannot deliver the amount of these nutrients required for adequate growth. The concentration of N, P, K,

organic and inorganic elements, and water in soil determines its fertility. Moisture content, specific gravity, and other physicochemical parameters, Nitrogen is a nutrient that is essential for plant development. Phosphate is utilised for root development in plants, whereas Potassium is used for flowering (Sonawane *et al., 2013*). In India, significant qualities of chemical fertilizers are currently utilized instead of organic manures. Crop productivity rises quickly because of this, but soil support quality declines. As a result, a thorough examination of soil properties is required. It is a critical moment to conduct a physicochemical study of soil because, with the increased use of chemical fertilizer in the soil, it is becoming increasingly difficult to regulate the negative effects of chemical fertilizer on the soil, plants, animals, and humans (Kulkarni *et al., 2011)*. Plants absorb a great number of elements, however not all of them are required for plant development. The essential elements are those that plants require for appropriate growth, development, metabolism, and completion of their life cycle. Some of these are required in high quantities, while others are only necessary in trace levels. Macro (primary), secondary and micronutrients are the three divisions of nutrients which are further divided into other divisions. Oxygen, carbon, and hydrogen are included in class 1 of primary nutrients and nitrogen, potassium and phosphorus in class 2 primary nutrients that are major for plant growth. Sulphur, magnesium, and calcium are included secondary nutrients. Boron, zinc, iron, manganese, chloride, copper, molybdenum included in micronutrients.

## Study Area: -

District of Mahesana encompasses 614 villages and 10 talukas are Mehsana, Kadi, Visnagar, Vijapur, Vadnagar, Kheralu, Becharaji, Satlasana, Jotana, and Unjha. Mahesana district covers 5600 square kilo meters. The total reported area of Mahesana is 439153 hectares, of which 1.63% is forest, 1.19% is barren land, 7.18% is under non-agricultural use, 83.88% is cultivable land, 6.12% is grazing land and 4.33% is uncultivable land. However, 79.55% of total reported area is net cropped area and 65.55% of total reported area is irrigated. Temperature ranges from $42^0$ C (max.) to $12^0$ C (min.), with annual rainfall of 800 to 900 mm. The major crops of Mahesana are Potato, Cotton, Tobacco, Oilseeds, Castor seeds, Cumin psylliumse and Anise (National informatics Centre Ministry of Electronics and Information Technology).




A collection of soil samples representing the soils of 5 villages in Mahesana District, North Gujarat which are Valam, Aidhor, Rajpur, Mandali and Unjha.

## Material and Methodology: -

### Soil Sampling

These samples were taken using a systemic sampling approach at a depth of 0 to 15 cm. below the soil's surface. To prepare the samples for testing, they were dried and sieved through a 2 mm sieve. All the samples were examined using India's approved manual-soil-testing methods. Soil samples were collected in polythene bags according to usual technique. All the samples were taken in January 2022, and they were analysed in the lab using established procedures to determine various chemical characteristics. For this investigation, 5 soil samples from various agricultural lands in the Mehsana district. Table 1 shows the details of the soil samples obtained.

**Table No-1 Identification of Soil samples**

| SAMPLE NO. | SAMPLE NAME | NAME OF VILLAGE |
|---|---|---|
| 1. | SMV | VALAM |
| 2. | SMA | AIDHOR |
| 3. | SMR | RAJPUR |
| 4. | SMM | MANDALI |
| 5. | SMU | UNJHA |

**Method for analysis**

All the chemicals and reagents used in the analysis are from S. d. Fine chemicals and are of A R grade. The soil samples were suspended in distilled water (1:4 w/v) and allowed to settle down for analysis of physicochemical characteristics. The pH of the suspension was determined using pH meter (Equip tonics, India). Using a Conductivity metre, the electrical conductivity of the soil was evaluated in the filtrate of the water extract. The presence of organic carbon in soil was tested using the conventional Walkley and Black method of chromic acid wet digestion. The indication in this approach is diphenyl amine. Using turbidity measuring techniques, the available potassium level in the soil was determined.

## Result and Discussion: -

Table 2 shows the Physical parameters such as pH, Electric Conductivity and Organic Carbon.

**Table No-2 Soil Parameters pH, E.C., and Organic Carbon of selected samples from the study area**

| NAME OF ELEMENTS | SMV | SMA | SMR | SMM | SMU |
|---|---|---|---|---|---|
| pH | 8.2 | 7.7 | 7.4 | 7.5 | 8.5 |
| Electric Conductivity (mS/cm) | 0.31 | 0.58 | 0.84 | 0.29 | 0.28 |
| Organic Carbon In % | 0.55 | 0.4 | 0.92 | 0.39 | 0.27 |

pH parameter of collected soil samples varies between the range 7.40 and 8.50. As presented in table-2, pH value indicates soils are neutral to alkaline in reaction. All soil samples are alkaline.

Quantity of moisture contained by soil particles affects the electrical conductivity of the soil. The conductivity of sands is low, that of silts is medium, and that of clays is high. As a result, EC has a significant relationship with the size and texture of soil particles. According to result Electric Conductivity is low in all the soil samples it means all are sandy soil. According to Table No.2 60 % soil samples are contain low organic carbon, 20% contain medium OC and remaining 20% soil sample is high in organic carbon.

**Macro nutrients:**

Nitrogen, potassium, phosphorus, and Sulphur are the macro nutrients of soils, analysis of macro nutrients of these soil samples is given in Table No.3.

**Table No-3 Analysis of Macronutrients (Nitrogen, Phosphorous, Potash and Sulphur) of selected soil samples**

| Name of Element | SMV | SMA | SMR | SMM | SMU |
|---|---|---|---|---|---|
| Nitrogen (kg/hac.) | 436.75 | 262.05 | 611.45 | 262.05 | 174.7 |
| Phosphorous (kg/hac.) | 28.70 | 15.86 | 22.67 | 15.12 | 16.65 |
| Potassium (kg/hac.) | 255.36 | 201.6 | 309.12 | 201.6 | 201.6 |
| Sulphur (Mg/ $kg^{-1}$) | 29 | 50 | 30 | 22 | 22 |

According to above table Nitrogen level high in SMU sample and low in SMR. Phosphorous level high in SMV soil sample and low in SMM sample. SMR sample consist highest amount of Potash and SMA, SMM, SMU samples consist low Potash. SMA sample consist Highest amount of sulphur among 5 samples.

**Micronutrients:**

Copper, Zinc, Manganese, Iron and Boron are the micronutrients of soils, analysis of micronutrients of these soil samples are given in Table No.4.

**Table No-4 Analysis of Micronutrients (Copper, Zinc, Manganese, Iron and Boron) of selected soil samples**

| Name of Element | SMV | SMA | SMR | SMM | SMU |
|---|---|---|---|---|---|
| Copper (ppm) | 1.06 | 1.8 | 1.92 | 0.8 | 1.3 |
| Zinc (ppm) | 1.34 | 0.78 | 2.5 | 0.94 | 0.08 |
| Manganese (ppm) | 8.44 | 15.46 | 8.86 | 8.62 | 7.08 |
| Iron (ppm) | 9.92 | 14.62 | 10.34 | 9.52 | 6.9 |
| Boron (ppm) | 3.79 | 5.96 | 3.21 | 2.69 | 5.23 |

According to above table highest amount of copper element found in sample of SMR and lowest in SMM sample. SMR sample consist highest amount of Zinc element and lowest in SMU. Manganese element is lowest in SMU and high in SMA soil sample. Iron element is high in SMA and low in SMU village soil sample among selected soil samples. Boron element is low in SMM and high in SMA village soil sample among selected soil sample.

**Conclusion: -**

It is concluded from above analysis that all of soil sample is alkaline so it can be neutralized by using acidic fertilizer. E.C. is normal in all the collected samples. All the soil samples contain decreased level of Organic Carbon. Macronutrients like N, and P are low in amount so it can be cure by use of organic fertilizer which are not high in salts, treat plants to bone meal and a supplement that is rich in phosphorus, use water softeners or synthetic fertilizers. Sulphur and potassium is high in amount in all the collected soil samples. Micronutrients like Zn and Cu in sufficient amount and Mn and Fe in excessive amount. The excessive amount of Mn is toxic for some sensitive crops as collected soil is required to decrease the level of Mn. Excessive amount of Iron produces leaf bronzing, which leads to a decrease in rice output or crop failure and excessive production of ROS which disrupt physiological process, as it must be important to cure the Fe poisoning in soil at these five villages which analysis took place.

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