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FARMLAND SOIL CHEMICAL CHARACTERIZATION OF SOME VILLAGES OF JODIYA REGION OF JAMNAGAR DISTRICT

Chemistry

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ABSTRACT

Physico-chemical study of soils of various villages was carried out based on different parameters like pH, Electrical conductance (EC), total organic carbons (OC) and Available Nitrogen (N). An average of 10 representative samples were collected form each village and the nutrient quality was analyzed using reported analytical techniques. Based on the result data the soil fertility index was calculated. EC and N showed low fertility range while the soils were more of alkaline in nature. The OC was found in medium and high range. This fertility report may help the farmers to predict the type and amount of fertilizer to be used during crop productions, which ultimately would be beneficial economical management of the farmers.

KEYWORDS

soil analysis, macronutrients, fertility index

INTRODUCTION

Agriculture is the main backbone for any country's economy and soil is a critical element for life support systems. Various biological, chemical and geological processes have linkages with ecological functions of soil [1]. Ever since the evolution of human race we have adopted different cultivating techniques for the plants, corps etc. to withstand our daily needs of food and influenced the success of civilizations [2]. To overcome the disadvantage of time, farmers try to increase the crop cultivations by using various soil amendments like harmful chemical fertilizers which may result in reduction of soil fertility in long terms. Soil plays a very important role in the growth of crops as soil is composed of many organic and inorganic minerals necessary for the good yield of respective crop. The growth of the plant also depends on other natural factors like climate and water availability or water supply, quality of seeds, population pressures, climate change, encouraging/protecting desirable plants, plant protection etc. affect high percentage of yield. Soil has major components which are essential for the growth of plant or crops or agricultural products [3]. The soil is composed of nutrients classified as macro and micro-nutrients [4].

For the growth of plant generally accepted 17 essential elements are required [4]. This element includes non-mineral elements like Carbon, Hydrogen and Oxygen, and mineral elements classified as primary which include Nitrogen (N), Phosphorous (P) and Potassium (K), and secondary macronutrients which include Calcium (Ca), Magnesium (Mg) and Sulphur (S). The primary macronutrients (N, P and K) are needed in higher quantity by the plants form the soil. The secondary macronutrients are typically available in enough quantity from the soils and hence are needed in very smaller quantities by the plants. Use of various soil amendments like inorganic chemical fertilizers, organic sources like compost results in excess nutrients can pollute surface and ground water [5]. Thus, it is very important to monitor the level or amount of nutrients present in the agricultural soils. Due to socioeconomic constraints the farmers are forced to use locally available organic material as a source of nutrients for intensive cultivation, which may result in nutrient imbalance. Also, frequent use of certain fertilizers may lead to loss of soil fertility [6].

In this study, we report analysis of such agricultural soils of Jodiya Taluka of Jamnagar District. The study was focused on analysis of macronutrients like Nitrogen and OC along with parameters like pH and Electrical Conductance (EC). Total of 170 representative samples were collected from the villages of Jodiya Taluka with 5 to 15 samples per village. The data collected was summarized to calculate soil fertility index. This would help farmers to identify the status of soil and use of fertilizers to maintain the health of their soil.

METHOD AND ANALYSIS

Study Area

Jodiya taluka is located at about 27 m altitude above sea level. It is situated at the North-eastern part of Jamnagar District and close to the Guld of Kutch.

Soil Sampling

The area was cleared from any visible impurities like dried plants etc. A pit of about 30 to 40 cm was dug and sample was collected as this is where the roots absorb the nutrients. During the sampling randomly 5 to 6 sampling was carried out from one farmland in a zigzag manner. The proposed soil samples were analyzed for physico-chemical properties using the standard procedures [7]. Details of the samples is a shown in table 1.

pH

Commonly, ions in any solution can be represented by either gram/liter or milliequivalent/liter. But when concentration of hydrogen ion is determined by above terminology there are complications in both calculations. Thus, Sorenson's gave a terminology of pH to determine the potentiality of hydrogen ion concentration. Thus, pH value is the measurement of the hydrogen (or hydroxyl) ion activity of the soil-water system indicating whether the soil is acidic, neutral or alkaline.

Table – 1 Sample Analysis Details

No	Village samples		E.C	PH	OC	N
1	MADHAPAR	5	0.39	8.14	0.73	198.22
2	BALAMBHA	10	0.54	8.40	0.66	217.17
3	RANJITPAR	10	0.35	8.13	0.38	173.01
4	SAMPAR	10	0.26	8.27	0.73	220.38
5	MANPAR	5	0.54	8.56	0.31	163.78
6	MEGHPAR	10	0.37	7.82	0.61	205.42
7	TARANA	10	0.37	8.39	0.46	184.44
8	JIRAGADH	10	0.67	8.12	0.48	187.30
9	JASHAPAR	10	0.35	8.48	0.36	170.15
10	RASNAL	10	0.34	8.04	0.53	194.27
11	DUDHAI	15	0.50	8.57	0.44	181.16
12	JAMSAR	15	0.50	8.14	0.70	219.07
13	BHIMKATA	10	0.48	7.46	0.56	198.73
14	MANAMORA	10	0.32	7.66	0.77	229.26
15	KOTHARIYA	10	0.30	8.02	0.86	242.57
16	MAVNUGAM	10	0.32	8.13	0.74	224.79
17	AMBALA	10	0.26	8.21	0.62	208.27
	MEAN		0.40	8.15	0.58	201.06
	HIGH		0.67	8.57	0.86	242.57
	LOW		0.26	7.46	0.31	163.78

pH meter was used to determine the pH of the soil solution. The pH meter was first calibrated using a 4.0 pH and 7.0 pH standard solution. The soil sample was prepared by taking 10.0 gm soil in a 50 ml glass beaker. 20 ml distilled water was added to the beaker and it was shaken for 30 minutes with 80 rpm rotation in a rotary shaker. The pH combined electrode was dipped in the soil solution. The meter reading was noted after the display reading is stabilized.

EC

Conductivity is directly related to the soluble ions in any solution.

Depending upon the type and amount of ions resistance is created. Thus, according to Ohm's law resistance and conductivity are inversely proportional to each other. Thus, to determine the presence of soluble ions in a soil-water solution electrical conductivity (EC) is measured.

EC meter is used to measure the EC of the soil solution. Before analysis the EC meter was standardized as per general standardization methods using a 0.1 N KCl standard solution with conductivity of 0.41 mmohs/cm. Soil sample preparation is same as described in pH sample preparation above.

Organic Carbon and Nitrogen

ICAR-Indian Institute of Soil Science, Bhopal, an institute under the Natural Resource Management (NRM) Division of the Indian Council of Agricultural Research (ICAR) has developed a mini laboratory `*Mridaparikshak*' [8] The license for manufacturing and marketing of `*Mridaparikshak'* is with M/s Nagarjuna Agro Chemicals Pvt. Ltd., Hyderabad, India.

The soil sample for analysis of OC and N were prepared using potassium dichromate and sulfuric acid solution. The soil sample of 0.5 gm was weighed and 4 mL 1N $K_2Cr_2O_7$was added. To this solution 8 mL Concentrated H_2SO_4 was added very carefully. The mixture was kept overnight and allowed to cool at room temperature. The resulting solution was filtered using Whatman Filter No. 42. The clear solution was added in the cuvette for analysis. The result was stored in the instrument. The value for Nitrogen was auto-calculated by the instrument.

RESULT AND DISCUSSION

Mathematically is calculated as pH= - log10[H+]. The pH of soil is considered as master variable of soil as it has impact on biological, chemical, and physical properties of soil that affect the plant growth. [9].

The ideal pH range for most of the plants or crops is 6.5 (Slightly acidic) to 7.5 (Slightly alkaline). Although not all the nutrients are directly affected to the pH of soil but it has apparent effect on soil fertility and nutrient uptake. [10]

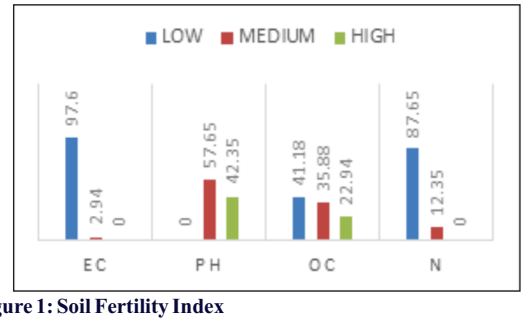

Figure 1: Soil Fertility Index

Table 1 shows mean pH values of villages of Jodiya taluka. The soils of Jodiya taluka were highly alkaline with pH values ranging from 7.5 to 8.5. Overall, the soils of these villages showed higher alkalinity. This can be further justified by the geographical locations of these villages. Being located near to the Gulf of Kutch it is expected more alkaline.

Electrical conductivity (E.C) is the measure of total number of cations and anions in the solution. In soil analysis E.C measures the ions soluble in the soil solution. E.C is generally measured to determine the soil salinity. Thus E.C can greatly influence various chemical, physical or biological processes in soil. [11]

The range of EC measured for Jodiya Taluka was within the range of 0.25 to 0.67 dSm/m. The mean EC reading was 0.40 dSm/m. Thus, Electrical conductivity was found in normal range for Jodiya taluka.

The presence of organic carbon in the soil not only increases its atmospheric benefits but also improves the ecology and function of agriculture soil systems. [12]. The organic carbon soils create better water holding facilities, which helps against root development, sustainability and tolerance against variation in rainfall. [13]. Thus, it would create better physical properties of soil reducing the risk to soil erosion and nutrient leaching.

The organic carbon (OC) was observed in the range of 0.30 % to 0.85 %. The mean value of all villages was found 0.58 % as shown in Table 1. Soil fertility ratings for Organic Carbon (%) is considered as Low for values <0.5, medium for values between 0.5-0.75 whereas high for values >0.75 [14]. This suggest that the mean values of organic carbon for Jodiya taluka villages is in the medium range.

CONCLUSIONS

Representative soil samples from different farmlands were collected and subjected to analysis for macronutrients like N and OC along with EC and pH. Within these samples it was visible that the samples were more alkaline in nature but low conductance was observed. Based on the fertility index and taking into consideration about type of crops to be produced in these farmlands different fertilizer use can be recommended. Further studies like micronutrients can be carried out on these farmlands to get clear idea about recommendations and fertility for desired crop production.

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