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SPATIAL VARIATION IN SOIL FERTILITY ALONG THE BANK OF HIRANYKESHI RIVER FROM GADHINGLAJ TAHSIL WITH REFERENCE TO SUGAR CANE FIELD

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Abstract: The present investigation deals with to evaluate the soil fertility status of Sugar Cane Field soil from bank of Hiranykeshi River from Gadhinglaj Tahsil. Seven Soil samples were analyzed for various soil fertility parameters like pH. E.C., Available N, P, K, Sulphur, Calcium, Magnesium, Chloride, TDS and Water holding Capacity. During this study it has been found that there was a marked variation in nutrients levels at seven sites. It has also found that the only S_4 & S_6 soil samples Mg content below the normal range. All Macro and Micronutrients are within the normal range.
Keywords: Soil Parameter, Sugar Cane field, Soil Quality and Nutrients.

Introduction

Soil fertility plays a key role in increasing crop production in the soil. It comprises not only in supply of nutrients but also their efficient Management. The fertility status of soil indicates their nutrient supplying capability. Moreover fertility of soil is subject to Man's control however soil degradation is an outcome depletive human activities and their interaction with natural environment (K.K. Deshmukh 2012). The evaluation of soil fertility includes the measurement of available plant nutrients and estimation of capacity of soil to maintain a continues supply of plant nutrients for a crop. The availability of nutrients depends upon various factors such on types of soils, nature of irrigation facilities and pH of organic matter content. Voluminous research works related to such aspects have been done by many researchers (S.K. Gupta et.al 1997). The three primary nutrients elements are N, P, and K also called as Micro nutrients which are not usually available in large enough amount for best growth. So they are most likely to be added to soil by fertilization. Soil commonly suffered from multiple nutrients deficiencies and nutrient imbalances, which leads to the decline in productivity and poor crop yield. So the need for an urgent means of assessing the fertility

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status of these soils is necessary and the way to do so is by laboratory analysis of these soils (Sanda Ahmad R. et.al 2012).

Study Area: Gadhinglaj Tahsil, Maps (Hiranykeshi River)

Experimental

Soil samples were collected from different location of sugar cane fields in and around the bank of Hiranykeshi River. From the selective sites samples were collected in the depth of 20 cm from the surface of land which was taken in polythene bag as par the standard procedure (U.S. Salinity Laboratory Staff 1954, P.R. Hesse 1971). The samples were dried in air and passed through 2 mm sieve. The soil pH was measured by pH meter. The Potassium determination was carried out by Flame Photometer. The micronutrients were determined by Photometer in the Laboratory of Department of AGPM, Devchand College, Arjunnager, Kagal Tahsil (M.S.). The dissolved element in the soil extract was measured by Atomic Absorption Spectrometer. Reagents used for the analysis were LR grade manufactured by S.D. Fine, Loba and Merck Fisher.

Result and Discussion

For evaluation of soil fertility status of the study area pH, E.C., TDS, WHC, Available NPK, Sulphur, Calcium, Magnesium & Chloride were determined and results obtained were shown in Table no. 1.

pH: The soil pH value is measure of soil acidity or alkalinity and directly affect nutrients availability . The solubility of most nutrients varies in response to pH. As acidity increases the losses of these nutrients by leaching increases and their availability to plants decreases. The quantity of some nutrients may rise so greatly under acidic and alkaline conditions that they become toxic to plants (D. Briggs 1977). So soil pH is essential to control between 6.5 to 7.5. In the present study pH ranges from 6.7 to 8.5. The lower value of pH is recorded in the sample S_1 while it was higher in the remaining samples. These higher values are possibly due to presence of soluble and exchangeable Sodium along with HCO^{3-}. High pH values are thus indicative of development of Salinity/ Sodicity in the area. Sample 1 shows acidic behavior.

Electrical Conductivity:

The E.C. values ranges from 0.32 to 0.87 mhos. The higher value of E.C. have been seen in the sample S_2, S_4 & S_6 while remaining samples shows lower values of Electrical Conductivity.

Total Dissolved Solids:

TDS for soil samples were ranges from 0.32 to 0.66. The higher value of TDS has been recorded in the sample S_5 & S_6. The lowest values of TDS were recorded for sample S_1, S_2, S_3, S_4 & S_7.

Water Holding Capacity:

Sandy soil has lower water holding capacity as compared to clay soil. In present study water holding capacity values ranges from 0.37 to 0.61. The sample S_1, S_2, S_3 & S_7 has higher WHC value than sample S_4, S_5 & S_6.

Nitrate Nitrogen:

Nitrogen is an essential plant nutrient; it should be present in the soil in appropriate proportion for growth of plants. The plants absorbed Nitrogen either as Nitrate ion or Ammonium ion. The transformation of the Nitrogen compound in the soils involves the process such as fixation of atmospheric Nitrogen by free leaving and nodule forming bacteria considering unique importance of Nitrogen for the growth of plants attempt has been made to estimate available Nitrate Nitrogen and Ammonium Nitrogen from the soils in the study area.

Deficiency of Nitrogen is almost universal in Indian soil, so Nitrogen application is a must for canopy development and high yields. Reduced Nitrogen's lower the protein content of seeds and vegetative parts. In several cases flowering is greatly reduced Nitrogen deficiency causes early maturity in some crops which results in significant reduction in yield and quantity (J.A. Silva et.al 2000).

Available Nitrate Nitrogen in the soil sample ranged from 217.6 kg/ha to 257.92 kg/ha. Sample S_6 shows higher Nitrogen Nitrate value than the remaining samples.

Available Ammonium Nitrate in the soil samples ranged from 272 kg/ha to 409.9 kg/ha. Samples S_3, S_5, S_7 have higher Ammonium Nitrate values than the remaining.

Potassium:

Potassium available to plant as the ion K^+, it assist in regulating the plants use of water by controlling the opening and the closing of leaf stomates, where water is released to cool the plant. Potassium has been shown to improve disease. Resistance in plant, improve the size of grains and seeds and improve the quality of fruit and vegetable.

Deficiency of Potassium reduced the size of seeds and fruits and the quantity of their production. In some crops stems are weak and lodging is common if K is deficient.

The available Potassium value in the soil ranges from 213.5 kg/ha to 303.5 kg/ha. It was high at sample S_6 & S_1 while soil sample S_2, S_3, S_4, S_5& S_7 was medium.

Phosphorus:

Phosphate ion enters the soil solution either as a result of mineralization of organophosphate or the application of fertilizers. The plant takes available P mostly in the form of $H_2PO_4^-$ from soil solution. Chemisorptions of P occur due to interaction of Phosphate ion with the atoms like Al, Fe & Ca depending upon soil pH (D.S. Orlov 1992).

A phosphorus value ranges from 22.5 kg/ha to 50.16 kg/ha. Only three samples S_1, S_2 & S_7 showed medium P content and soil sample S_3, S_4, S_5 & S_6 showed high P content value.

Sulphur:

Sulphur is an essential component in the synthesis of amino acids required to manufacture proteins. Sulphur is also required for production of Chlorophyll and utilization of Phosphorus and other essential nutrients. It increases the size and weight of grain crops and enhances the efficiency of Nitrogen for protein manufacture. It also increases quality of fiber crops.

An acute Sulphur deficiency causes the entire plant to turn yellow. In crops like corn and small grains, however yellow stripes that turn parallel to the leaf blade are common. Sulphur deficiency is most frequently observed on very sandy soils with low organic matter content during seasons of excessive rainfall (M. Ray Tucker 1999).

In the present study Sulphur content values ranges from 7.6 kg/ha to 19.2 kg/ha. Soil sample S_1, S_2, S_5 & S_6 has high Sulphur content as compared to S_3, S_4 & S_7.

Calcium:

Calcium is constituent of cell walls and is involved in production of new growing points and root tips. It provides elasticity and expansion of cell walls which keeps growing points from becoming rigid and brittle. It is immobile within plants and remains in the older tissue throughout the growing season. It acts as a base for neutralizing organic acids generated during the growing process and aids in Carbohydrate translocation and Nitrogen absorption.

Calcium deficiency symptoms appear in the new growth of leaves, stems, buds and roots. Younger leaves are affected first and are usually deformed. In extreme cases, the growing tips die. The leaves of some plants hook downward and exhibit marginal necrosis. Roots on Calcium deficiency plants are short and stubby.

In the present study Calcium content ranges from 11 ml/100 gm to 25 ml/100 gm. Sample S_1, S_3, S_4, S_5 & S_7 having high Calcium content while sample S_2 & S_6 has low Calcium content. All samples were within the permissible limit.

Magnesium:

Magnesium is required to stabilize ribosome particles and also helps to stabilize the structure of nucleic acid. It is available to plants as the ions Mg^{+2}**.** Deficiency symptoms may occurs in many plants when the leaf level is less than 0.10 to 0.15 %. Small grains may exhibit deficiency when the Mg level is less than 0.10 %. When the soil pH is less than 5.4 , Mg availability and uptake by plant is greatly reduced . Supplemental applications of fertilizer Mg may be needed in some cases to supply some of the Mg crop requirement (AESL Plant analysis Handbook).

In present investigation Mg content in the soil sample ranged from 2 to 35 ml/100 gm. Sample S_1& S_4 having very low Mg content (below standard value), while sample S_3 having very high Mg content (above standard value). Remaining samples lies within the normal range.

Chloride:

Chloride is essential in photosynthesis it increases cell osmotic pressure and water content of plant tissue (Shobha Jadhav 2012). Chloride deficiency mainly found in cereal crops (Mengel K et.al 2001).

In the present study Chloride content in the soil sample ranges from 25 to 50. All soil samples were in the normal range. Soil samples S_1, S_3, S_4, S_6 and S_7 have same Chloride content (25 ml /100gm) and soil samples S_2 & S_5 having 50 ml/100gm Chloride content.

Conclusion:

In the present investigation, the seven soil samples along the bank of Hiranykeshi River from sugar cane field were collected. All Macronutrients and Micronutrients are within the normal range except Mg. Mg content in soil sample S4 and S6 below the normal range, so supplemental application of Mg containing fertilizer should be given. In case of pH of all soil samples are slightly alkaline in nature. All soil samples having Electrical conductivity values below one.

Table 1: Macronutrient and Micronutrients analysis of soil from Sugar cane field

Soil Content	Hiralage S_1	Mahagaon S_2	Bhadgaon S_3	Mugali S_4	Nilagi S_5	Khandal S_6	Kadalage S_7
pH	6.7	7.2	8.5	7.5	7.5	8	7.9
TDS	0.47	0.42	0.32	0.39	0.61	0.66	0.38
EC	0.58	0.87	0.47	0.64	0.46	0.86	0.32
WHC	0.58	0.57	0.52	0.47	0.37	0.42	0.61

Nitrate Nitrogen (kg/ha)	228.91	217.6	241.92	219.7	221.76	257.6	217.6
Ammonium Nitrogen (kg/ha)	272	339	409.9	272	303.07	272	406.5
Potassium (kg/ha)	281	236	213.5	237	236.08	303.5	236
Sulphur (kg/ha)	19.2	11.2	7.6	9.4	10.75	15.68	5.8
Calcium (ml/100kg)	25	15	25	30	20	11	19
Magnesium (ml/100kg)	10	6	35	4	5	2	10
Chloride (ml/100kg)	25	50	25	25	50	25	25
Phosphorus (kg/ha)	22.5	22.5	56	43.4	50.16	25.08	22.5

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