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ORIGINAL ARTICLE

STUDY OF FERTILITY INDEX OF SOIL FROM PARANDA TAHSHIL IN OSMANABAD DISTRICT (M.S.) INDIA

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ABSTRACT

In the present study, chemical parameters of soil samples were studied from Paranda Tahsil in Osmanabad District to know the fertility index. The average pH values were found to be 7.35, which indicates that the soil is slightly alkaline. The electrical conductivity of analyzed soil samples was found to be less than 1 (0.1-0.9), hence the soil salinity is good and not interfere the availability of nutrients. The analyzed data reveal that the fertility level of percentage organic carbon of all soil samples was found to be low (<1%) The soil analysis data indicates that the fertility level of Available Nitrogen is low (0.96) and that of Available Phosphorus is also low (0.90). The fertility level of Available Potash is high (2.69). This data is useful to recommend the fertilizers on the basis of crop requirement.

Key words: Physicochemical parameters, available nitrogen, potash

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INTRODUCTION

The main objectives of the study were testing chemical parameters of soil, area under Paranda Tahshil to know the fertility status of soil. It was also aimed to serve the farmers by suggesting more economic use of fertilizers and soil management practices to increase the crop production. The high crop yield cannot be obtained without applying proper and sufficient fertilizers to overcome nutrient deficiencies. Now a day farmers use high quality chemical fertilizers to increase the crop yield, however amount and kind of fertilizer required for the same crop may vary from soil to soil, even field to field on same soil. Therefore the use of fertilizers without testing soil is like taking medicine without consulting a doctor to find out what is needed. The present study deals with the analysis of soil samples to know the fertility index for proper fertigation and to increase the yield.

MATERIALS ND METHODS

In the present work, the area under Paranda Tahsil was divided into four regions as east, west, south and north, to analyze the representative samples from these regions. The seventy-five (75) samples from each region as per standard method [1] were collected and analyzed to know

pH, EC, organic carbon, available nitrogen, available phosphorus, available potassium and micronutrients such as iron, copper, manganese and zinc. During analysis, pH was measured using digital pH meter (Equiptronics EQ-615), the conductivity was measured by using digital conductivity meter (Equiptronics EQ-665), the available phosphorus was determined by using spectrophotometer (Systronics-117) and micronutrients were determined by using Atomic Absorption Spectrophotometer (Chemito-203).

RESULTS AND DISSCUSSION

pH: - The analyzed data reveal that minimum pH value of east region soil was found to be 6.65 and maximum pH value was observed 8.86. The average pH values were found to be 7.35 which indicate that the soil is slightly alkaline. The high pH values shown by some soil samples may due to area near a Chandni river. The pH values of west region soil varied from 7.04-8.86. The higher pH values may responsible for low availability of macro & micronutrients. The medium alkalinity of soil may be due to cloddy soil nearby area of Chandni river.

Electrical conductivity: - The EC is generally depends on dissolved salts, as soil salinity. The salts in water reduce its potential, making it less available to plants which cause water tress in the plants. The soil salinity was determined by measuring the electric conductivity and data reveal that the average EC of all region soil was found to be less than 1mS/cm, which was optimum, not interferes the availability of macro & micro nutrients.

Organic carbon: - The organic matter improves the soil structure by acting as a bonding agent to hold soil particles together in aggregates'. Without organic matter aggregates are less stable & can be broken easily. The organic matter promotes water movement and root penetration while it reduces soil crusting, clod formation and erosion. The analyzed data suggest that the percentage organic carbon [2] was found to be varied from 0.14 – 0.88. The fertility index of percentage organic carbon of all region soil was found to be low (1.05). Due to low percentage of organic carbon the crusting and clod formation observed. The low fertility index of organic carbon may be due to insufficient rain fall and sloping land.

Available Nitrogen: - The Nitrogen is responsible for healthy green foliage of plants as well as protein and chlorophyll development. The most of nitrogen is tied up in organic matter and it is taken up by plants in the form of nitrate (NO_3^-) and ammonium (NH_4^+) ion. The available nitrogen was determined by Kjeldhal method [3] The analyzed data reveal that, the Fertility index of available nitrogen was found to be 1.01, 0.94, 0.97 & 0.93 for East, West, and South & North region respectively. Thus the average fertility index of available nitrogen was observed to be 0.965 i. e. low. The data indicates that the most of soil samples were deficient in nitrogen. The deficiency of nitrogen may be due to lower percentage of organic carbon and easy leaching of nitrogen from sloping land.

Available Phosphorus:-The plant needs phosphorus for strong root growth, stem and seed development, disease resistant and plant strength. The plant uses phosphorus to form nucleic acid, DNA, RNA and to store & transfer energy. It is also essential for flowering, fruiting and to transfer of hereditary traits. The phosphorus is absorbed by plants as $H_2PO_4^-$, HPO_4^{--} $PO4^{---}$, depending upon the soil pH. The available phosphorus was determined by Olsen method [4-11] and it was found to be varied from 11-52 kg/ha. The observed fertility index of east, west, south & north region soil was found to be 0.84, 0.91, 0.96& 0.92 respectively. The average fertility index of analyzed soil samples was 0.91, indicates lower availability of phosphorus. The less availability of phosphorus was ascribed to alkaline pH values.

Potassium: - The Potassium is necessary for plants for translocation of sugar and for starch formation. Potassium is important for efficient use of water through its role in opening and closing to stomata on the surface of leaves. The plants take potassium in the form of K^+ ion. The potassium was determined by Ammonium acetate method [12-13] & the result indicates that the available potassium ranged 113-946 Kg/ha. The fertility index of potassium for east, west and south region was found to be 2.67 , 2.58 & 2.71 respectively (high), and that of north region was found to be 2.79 respectively (very high), that the available potassium ranged 113-946 Kg/ha. The fertility index of potassium for east, west and south region was found to be 2.67 , 2.58 & 2.71 respectively (high), and that of north region was found to be 2.79 respectively (very high).

Micronutrients: - The elements such as iron, copper, manganese, zinc, boron, molybdenum is required by plants in trace amount are called micronutrients. Diethyene triamine pent acetic acid is a chelating agent; it combines with metal ions in solution and forms soluble complexes. During analysis the available micronutrients (Fe, Cu, Mn, and Zn.) were extracted from soil samples (1:2 Soil-water suspensions) by DTPA [14]. The readings were taken on Atomic Absorption Spectrophotometer

Iron (Fe):- Iron is necessary for chlorophyll formation and transfer of oxygen. The iron deficiency causes intervinel chlorosis of young leaves, leaf yellowing etc. The analyzed data reveal that the 100% soil samples under study were found to be deficient in iron. The observed values varied from 0.16-1.20 ppm, which was below the critical value.

Zinc (Zn):- Zinc is essential component of several enzymes in plant. It is useful in production of chlorophyll and proteins. Zinc deficiency causes delayed maturity in plants. The data reveal that the 66% soil samples were found to be deficient in zinc.

Copper (Cu): - Copper is necessary for production of proteins and it is also important for reproduction. Copper deficiency causes bluish green leaves. The data indicates that the values ranged from 0.1-2.98. The 90 % soil samples contain copper above the critical value.

Manganese (Mn):- Manganese is catalyst for many enzymes and important for chlorophyll formation. Mn deficiency causes yellowing of leaves. Excess manganese causes iron deficiency. The analyzed data reveal that the Mn values ranged from 0.08-8.05 ppm. The 80 % analyzed soil samples contain Mn above critical value.

The deficiency of iron and zinc may be due to higher pH range and lower percentage of organic carbon.

CALCULATION OF FERTILITY INDEX

Fertility Index = 0.5× No. of samples having very low nutrient availability + 1× No. of samples having low nutrient availability+1.5× No. of samples having medium nutrient availability + 2×No. of samples having medium high nutrient availability + 2.5× No. of samples having high nutrient availability + 3× No. of samples having very high nutrient availability

1. Fertility Index of Percentage Organic carbon = 0.5× 21 + 1× 228 +1.5× 46 + 2×5 / 300
   =317.5/300 = **1.05**
2. Fertility Index Av. Nitrogen = 0.5× 47+ 1× 228 +1.5× 24+ 2×1 / 300
   =289.5/300 = **0.97**
1. Fertility Index of Av. Phosphorus = 0.5× 112+ 1× 144+1.5× 35 + 2×6 + 2.5×3 / 300
   = 272/300 = **0.90**

1. Fertility Index of Av. Potassium = 0.5× 4+ 1× 14+1.5× 17 + 2×16 + 2.5×3 1 + 3×218/ 300
= 805/300 = **2.68**

Fertility index of analyzed samples

Sr. No.	Nutrient	Fertility index	Fertility Level
1	Available Nitrgen	0.97	low
2	Available Phosphorus	0.90	Low
3	Available Potassium	2.68	High

SUGGESTIONS:

-The farmers are advised to use

a) Humic acid (5kg /acre) along with chemical fertilizers to maintain optimum pH, for availability of macro & micronutrients.

b) Compost manures that increase the percentage organic carbon, availability of nutrients & maintain soil health.

c) The 50 % excess dose of nitrogenous and phosphorus containing fertilizers.

d) To reduce the leaching of nitrogen, farmers are advised to apply nitrogenous fertilizers in mixture with azadirecta indica powder (*Nimboli powder*). The total quantity of N-fertilizers should not be given in one dose, it should be applied frequently.

e) The Phosphorus and Potassium do not move in the soil as easily as nitrogen, therefore they should be used before plantation.

f) The farmers are advised to use 25 % less dose of Potassium fertilizers.

g) The farmers are also advised to use 10Kg ferrous Sulphate & 5 Kg Zinc Sulphate along with bio fertilizers to overcome the deficiency of iron and zinc.

Fertilizers dose as per fertility index (Kg/ha)

The farmers are advised to use Fertilizer dosse as per table for specific crop

Sr.No.	Crop	Dose Time	As per Agriculture university			As Per Fertility Index		
			N	P	K	N	P	K
1	Tur *(Cajanuscajan)*	At the time of sowing	25.0	50.0	0.00	31.25	62.50	0.00
2 i	Sunflower (*Kharip)*	At the time of sowing	30.0	30.0	30.0	37.50	37.50	22.50
ii	Sunflower (*Kharip)*	After 30 days of sowing	30.0	0.00	0.00	37.50	0.00	0.00
3	Jawar Non -irri. (*Rabbi)*	At the time of sowing	25.0	0.00	0.00	31.25	0.00	0.00
4	Jawar Irri. (*Rabbi)*	At the time of sowing	50.0	25.0	0.00	62.50	31.25	0.00
5 i	Wheat Irri. *(Triticumvalgare)*	At the time of sowing	60.0	60.0	40.0	75.0	75.0	30.0
ii	Wheat Irri.	After 30 days	60.0	0.00	0.00	75.0	0.00	0.00

		of sowing						
6	Harbara	At the time of sowing	25.0	50.0	0.00	31.25	62.5-	0.00
7 i	Sugarcane *(Suru)*	At the time of sowing	25.0	60.0	60.0	31.25	75.0	45.0
ii	Sugarcane *(Suru)*	After 6-8 weeks	100.0	0.00	0.00	125.0	0.00	0.00
iii	Sugarcane *(Suru)*	After12-16 weeks	25.0	0.00	0.00	31.25	0.00	0.00
iv	Sugarcane *(Suru)*	At the time of *Bandhani*	100.0	55.0	50.0	125.0	68.75	37.50

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