International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Correlation Study of Available Macro and Micro Nutrients and Their Effect on Soil Fertility in Koregaon Tehsil, Satara, Maharashtra

Anita S. Deshpande[1], Nikhil J. Salunkhe[2]

Nowrosjee Wadia College, Department of Chemistry, Pune-1, Maharashtra, India

Abstract: ***Over the years food production has increased in Koregaon tehsil but due to continuous cultivation of various varieties of high yielding and hybrid crops, there has been a depletion of the inherent soil nutrients and hence fertility of the soil is affected. In the present study 15 samples of soil were collected from Koregaon tehsil region. These samples were analyzed for various soil parameters like pH, EC, OC, N, K, Cu and Zn. The correlation study was carried out for N, K, Cu and Zn with respect to physicochemical properties. The purpose of this study was to estimate nutrient quantity and availability of nutrients to plants. Results show that Koregaon tehsil has low N content, medium and high levels of K while adequate amount of Cu and Zn. The fertility index for OC, N, K, Cu, and Zn is 0.39, 0.17, 0.38, 0.45, 0.38 respectively. This information will be helpful to farmers to decide the problems related to soil nutrients and amount of fertilizers to be added to soil to make the production more economic.***

Keywords: Correlation study, Fertility index, Koregaon, Nutrients

1. Introduction

Chemical analysis of soil is a standard and scientific means for quick characterization of the fertility status of soils and for predicting the nutrient requirement of crops. Soil testing provides a window to proper use of fertilizer so as to enhance crop productivity. Deficiency of primary, secondary and micronutrients has been observed in intensively cultivated areas.[4] The concept of balanced nutrition of crops also guides the use of plant nutrients in a definite proportion as required by the crops which is possible only if one knows the available nutrient status of his soil. Soil testing helps in understanding the inherent fertility status of the soils. Growth of plant is determined through soil fertility which is determined by the availability of macro and micro nutrients.[3] Many high yielding varieties are being cultivated in India and to support such varieties farmers have to use higher dosage of N, P, K along with micronutrients in the soil and the productivity of crops cannot be sustained. The deficiencies of micronutrients have become major restriction to productivity, stability and sustainability of soils.[1]. In present study there were 15 samples which are representative of Koregaon tehsil were collected and analyzed for the basic soil parameters pH, EC and OC. The available micronutrients Cu and Zn were investigated by neutral normal ammonium acetate and alkaline permanganate method respectively. The available micronutrients Cu and Zn were investigated by using atomic absorption spectrophotometer using DTPA-TEA as extracting reagent. [5]

The results were analyzed by Pearson's correlation analysis and soil fertility index.[8]

2. Materials and Methods

Study Area Characteristics: The study area Koregaon is situated in Satara, Maharashtra; India. It's geographical coordinates are 17''43'0'' North, 74''10'0'' East, and 555 meters elevation above the sea level. It's average temperature is 24.3^0C while in summer the climate is hot . The annual rainfall of Koregaon tehsil is 783 mm.

15 samples of soil were collected which represent the Koregaon tehsil region. The soil samples were collected by traditional means up to a depth of 10-30 cm in the month of November 2014. Post sampling treatments were applied to samples. The samples were dried under UV-lamps and crushed by mortar and pestle, sieved and stored into air tight bottles.[5]

Table 1: Soil properties and nutrient status of soil

S.No.	pH	EC mmhos/cm	O.C %	N kg/ha	K kg/ha	Cu mg/kg	Zn mg/kg
1.	7.38	2.02	0.55	238.32	219.52		
2.	7.26	1.62	0.26	206.96	156.8		
3.	7.36	2.11	0.56	250.88	560.0	3.55	0.79
4.	7.14	1.45	0.51	213.24	340.48	3.28	0.71
5.	7.21	1.83	0.81	238.32	555.52	4.02	0.83
6.	7.28	1.84	0.93	294.76	795.2	3.74	0.88
7.	7.11	1.92	0.54	213.24	291.2	3.20	0.68
8.	7.31	2.03	0.48	238.32	309.12	3.10	0.61
9.	7.30	1.96	0.69	181.88	408.8	7.95	0.70
10.	7.42	1.73	0.52	288.48	80.64	3.69	0.51
11.	7.53	1.88	0.58	275.96	120.96	3.77	0.79
12.	7.52	1.57	0.61	219.52	255.36	3.13	0.55
13.	7.31	1.26	0.37	188.16	170.24	3.46	0.59
14.	7.48	1.93	0.62	250.88	291.2	3.25	0.92
15.	7.79	2.47	0.55	244.60	309.12	2.81	0.70

Table 2: Range and mean values of nutrients in analyzed soil.

Available micronutrient	Range	Mean	Limiting value	Deficient %	Marginal %	Sufficient %
O.C.	0.26-0.93%	0.57%	0.50-0.75	20	66	14
M	180-294 kg/ha	236.23	280-560	87	13	Nil
K	80-795 kg/ha	324.27	108-280	7	33	60
Cu	2.81-7.95 mg/kg	3.73	0.2	Nil	Nil	100
Zn	0.55-0.92 mg/kg	0.69	0.6	13	20	67

The pH was measured by 1:2 soil:$CaCl_2$ extract while the E.C. was measured by 1:2 soil: water extract. For the estimation of total organic carbon from soil, wet digestion tritrimetric method [Walkey and Black, 1934] was adopted.[5] Available N in the samples was estimated by alkaline permanganate method.[5] Available K includes both exchangeable and water soluble forms of the potassium present in the soil. The available K was determined in neutral normal ammonium acetate [1 N CH_3CooNa] extract of soil using flame photometer.[5] The available Cu and Zn in soil samples were extracted with DTPA [0.005 M DTPA+0.01 M $CaCl_2$+0.1 M triethanolamine, pH 7.3] as per method described by Lindsay and Norvell (1978) concentration of Cu and Zn in the DTPA extracts was determined using atomic absorption spectrophotometer. The correlation analysis of data was computed in relation to available major and micronutrients contents with different physico-chemical properties of the soils as suggested by Pearson's correlation coefficient(r) using following formula. (table-3)

Table 3: Relationship between soil parameters and nutrient content in the soils determined using correlation coefficient.

Property	Nitrogen	Potassium	Copper	Zinc
pH	-0.030	0.023	-0.100	0.028
EC	-0.540	0.252	-0.016	0.196
O.C.	0.478	0.828	0.256	0.520

$$r = \frac{n\sum X1Y1 - \sum X1\sum Y1}{\{[n\sum X1^2 - (\sum X1)^2][n\sum Y1^2 - (\sum Y1)^2]\}^{1/2}}$$

The soil fertility index and classification of available nutrients as low, medium and high was evaluated as follows: **(Table 4)**

Table 4: General Interpretation of soil properties

Parameter	*Interpretation*
pH	< 4.6 - extremely acidic 4.6-5.5-strongly acidic 5.6-6.5-moderate acidic 6.6-6.9-slightly acidic 7 –neutral 7.1-8.5-moderate alkaline > 8.5 –strongly alkaline
EC mmhos/cm	0-2- salt-free 4-8- slightly saline 8-15-moderately saline >15-highly saline
OC%	<0.5 –low 0.5-0.75-medium >0.75-high
Nitrogen Kg/ha	<280 – low 280-560-medium >560-high
Potassium Kg/ha	<108 –low 108-280-medium >280- high
Coppermg/kg Zinc mg/kg	0.2ppm-limiting value 0.6 ppm-limiting value

Fertility index = (NL X 1 + NM X 2 + NH X 3)/100

Where, NL, NM, and NH are number of samples in low, medium, and high classes of nutrient.(**Table-5**)

Table 5: Soil fertility index of nutrient content

Nutrient	Fertility Index
Organic carbon	0.39
Nitrogen	0.17
Potassium	0.38
Copper	0.45
Zinc	0.38

The fertility index is used for the recommendation of fertilizers and suitable crop selection.

3. Results and Discussion

Soil properties and available macro and micro nutrients are given in table-1 while the range and mean values of analyzed soil are given in the table-2. pH ranges from 7-8.Most of the samples were moderately neutral to alkaline in nature. Several nutrients are affected by soil pH. E.C. varies from 1.26 to 2.47 mmho/cm. Most of the soil samples under investigation fall in the category of normal soils.

Organic Carbon content varies from 0.26 to 0.93 in percentage. It shows great variation in O.C. levels. This is due to high temperature and oxidative nature of soils. Low level of organic carbon also decreases the availability of Nitrogen in the soils.

The Potassium content varies from 80.64 to 795.76 kg/ha. 60% samples have medium 108-280 kg/ha. While one sample was found to be deficient in the Potassium content.

Available Nitrogen content in the soil samples ranges from 181 to 294 kg/ha. About 86 % samples were found to be deficient. The lack of Nitrogen in the soils is due to low percentage of organic matter and cultivation of high yielding crops repeatedly.

Available Cu content in the soil varied from 2.81 to 7.95 mg/kg with mean value of 3.73 mg/kg. Available Zn content in the soil varied from 0.55 to 0.92 mg/kg with mean value of 0.62 mg/kg. From results the amount of Cu and Zn present in samples are in adequate amount.

Correlation study among pH, E.C., O.C. and nutrients:

Correlation analysis is given in table-3. The available Nitrogen shows positive correlation with organic carbon (r= 0.478) and negative correlation with pH (r= -0.030) and EC (r= -0.54).It shows that available N increased significantly with increase in organic carbon.

The available potassium shows positive correlation with pH (r= 0.023), EC (0.252) and O.C. (r= 0.828). The available K increases with increase in pH, EC, and OC of soil.

Copper content in soil sample shows negative correlation with pH (r=-0.100) while it shows positive correlation with EC (0.016) and OC (r= 0.256). The availability of Cu increases with increase in organic carbon and decreases with increase of pH level. Available Zn in the soil samples shows positive correlation with EC (r= 0.196), pH (r= 0.0.028), and OC (r= 0.520).

Soil Fertility Index

Soil fertility index were studied for evaluating soil fertility status for making judicious use of fertilizers. The soils were classified into different types of soil groups as deficient, medium and soils having sufficient amount of nutrient content. The fertility index is given in Table-5.The fertility index of Nitrogen is found to be poor (0.17),it is due to deficiency of Nitrogen in samples. The fertility index for Potassium IS 0.38, Copper is 0.45 and for Zinc it is 0.38.

4. Conclusion

The conclusions obtained from this study are:-

a) Correlation studies are well adopted for the the macro and micro-nutrients in soil samples and the conclusions drawn are:-
   1) Significant correlation of pH with Potassium and Zinc.
   2) Electrical conductivity shows good correlation with Potassium, Nitrogen and Zinc.

   Organic carbon shows significant correlation with Nitrogen, Potassium, Copper and Zinc.

b) Soil fertility studies were carried out and we can find out fertility status of soils for different plants and crops.

Present study concludes that statistical methods like correlation analysis can provide a scientific basis for controlling and monitoring agriculture soil fertility management.

5. Acknowledgement

Special thanks to Department of Chemistry, Nowrosjee Wadia College, Pune-1 for providing assistance in different stages and for permission to carry out the study.

References

[1] Jyoti P. Mahashabde and Sureshbhai Patel “DTPA Extractable micronutrients and fertility status of soil in Shirpur tehsil region”, International journal of ChemTech research 2012 col.4, no.4,pp 1681 – 1685
[2] Y.P.Singh*, B.P.S. Raghubanshi, Rajbeer S Tomar, S.K.Verma and S.K.Dubey, “Soil Fertility Status and Correlation of available macro and micronutrients in Chambal region of Madhya Pradesh”, Journal of the Indian Society of soil sciences, vol. 62,no.4,pp 369-375 (2014)
[3] Bhanuben K. Patel, Shantiben A. Jain, Manoj S. Jagtap,Kanubai P. Patel and Dilipbhai H. Patel, “Study of presence of available potassium in soil of Lunawada taluka territory, Scholars Research library, 2014,6(i): 79-84
[4] Methods Manual Soil Testing in India, Department of Agriculture and cooperation, Ministry of Agriculture, Government of India, Jan.2011.
[5] Soil, plant, water and fertilizer analysis by P. K. Gupta, College of Agriculture, Rajasthan Agriculture University, Bikaner, Agrobios (India) Publication 1999.
[6] S,R. Narkhede,S,R,Bhirud,N.S.Patil and R>r> chaudhari,”Physicochemical analysis of soil collected from Charwad Tehsil, Bhusawal, Dist-Jalgaon (M.S.)” Int. Journal of Chemical Sciences :9(4),2011,1973-1978.
[7] Anil B. Nawale, Rajeshwari Saraswat “Analysis of Soil characteristics for crop development in Sanganer Tehsil in Ahmednagar District of Maharashtra”, PDFARDU (online) 2013,9(6);(p) 29-42.
[8] Prakash l. Patel, Nirmal P.Patel, Prakash H.Patel ,Anita Gharekhan “ Correlation study of Soil parameters of Kutch district Agriculture land”,International Journal of scientific research and publication,Volume 4.Issue 5,May 2014.

Author Profile

Anita S. Deshpande, M.Sc. M.Phil., Nowrosjee Wadia College, Department of Chemistry, Pune, Maharashtra India

Nikhil J. Salunkhe, M.Sc. ,Nowrosjee Wadia College, Department of Chemistry ,Pune ,Maharashtra, India