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Correlation between chemical properties and nutrient in soils of Basmat tehsil

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Abstract
A survey was carried out to evaluate the nutrient status and to correlate the chemical properties with the nutrients like macro and micro nutrients of Basmat tahsil of Hingoli District. For this experiment 100 no. of samples were collected from 20 villages of Basmat tahsil. Five number of samples were collected each village which may possible represents the village identity. All the Soil Samples were analysed for Macro and micronutrients. On an average the available nitrogen content and available phosphorous content was observed low in category. Available potassium was found to be high. All Secondary nutrients were found to be sufficient in amount. In case of DTPA extractable micronutrient Fe and Cu were observed in sufficient quantity which was more than its critical limit. Major samples of Ma were observed in sufficient quantity and Zinc was observed in deficient range. Organic carbon showed positive significant correlation with available N and DTPA extractable Fe, $CaCO_3$ showed positive significant association with av. K & DTPA Cu & Mn.

Keywords: Nutrient index, macronutrient, micronutrient, correlation etc.

Introduction

Soil fertility affects considerably the land use of agro-ecosystem. The inherent fertility of soil is controlled by the set of pedogenic factors that vary from soil to soil and declining soil fertility is the main cause for low land productivity. Present day exploitive agriculture, with involved efforts to increase crop yield has not only depleted our soils of their nutrients reserve, but also resulted in the emergence of a number of new nutrient deficiencies. Soils are a vital natural resource whose proper use greatly determines the capabilities of life support system and socio-economic development of a peoples. Being important component of geo-sphere, biosphere system, Soil provides food, fiber, fodder, and fuel wood for varieties of basic human needs. Soil is a natural dynamic body containing mineral matter, organic matter and living forms considered to be store house of nutrients even though their continuous removal by intensive cropping. Among the several factors that influence crop production potential, soil fertilities fundamental factors. It is the integral part of soil and generally defined as capacity of soil to supply nutrient needed by crop in proper form and which having both direct and indirect effect on plant growth. Because of the wide gap between supply and removal of nutrients by crops, in addition to nutrient losses, various nutrient deficiencies of exhibited by the crops in the field. Thus, the soil fertility is of prime important in saving soil from nutrients sickness and over all important in crop production. Due to continuous cropping system for periods without adequate supply of additional amount of nutrients, there is every possibility of deficiencies of essential nutrients in due to course of time. The productivity of soil depends equally on its physical properties and nutrients status.

After the green revolution, changed the scenario of Indian Agricultural, introduction to fertilizer responsive high yielding varieties, Use of high analyses of fertilizers, mainly N.P.K. to achieve targeted yields. The fertility aspect of soil was ignored which led to many problems related to depletion of soil health with deficiencies of several nutrients. Available data suggest annual nutrient gap of (N.P.K.) about 8-10 million ton in Indian Agriculture and 3.39 million ton (N.P.K.S.) in Maharashtra Agriculture. Intensive cropping and increased use of fertilizers, though there is increasing production tremendously resulted in heavy turnover of nutrients from soil. There is a continuous decline in soil fertility and productivity due to exploitation of soil resource base. Imbalanced and indiscriminate use of fertilizers and emergence of micronutrients deficiencies have been identified as most important factors for declining crop growth productivity. Soil nutrients play a vital role in the growth development and yield of plant and information an the nutritional status of an areas can go a long way in planning judicious fertilizers and soil management practices to develop economically viable alternatives for farming community.

Therefore, it is critical that we increase our understanding regarding chemical, biological and physical properties and relationship in the soil-plant atmosphere continue that control nutrient availability.

Methodology

Total hundred soil samples were collected scientifically from twenty villages of Basmat tahsil. The pH was determined in 1:2.5 soil water suspension with glass electrode on pH meter (Jackson 1967) [2], electrical conductivity was determined in 1:2.5 soil water suspension ratio with conductivity bridge model (Jackson 1967) [2], Modified Wet oxidation method suggested by Walkley and Black (1934) [9] was used for the estimation of organic carbon from soil and Free calcium carbonate was determined by Rapid titration method using phenolphthalein indicator (Jackson 1967) [2]. Available nitrogen was determined by alkaline permanganate method by (Subhia and Assija, 1956). Available phosphorus was determined from soil with Olsen's method (0.5 M $NaHCO_3$) Olsen *et.al* (1954). Available K was determined with neutral normal ammonium acetate and the K in the extract was determined by using flame photometer (Jackson, 1973) [3]. Exchangeable Ca and Mg were determined by using ammonium acetate extractant of soil by EDTA versenate method (Jackson, 1973) [3]. Available sulphur was determined by Turbidi-metric method by using 1:5 soil and extractant 0.15 per cent $CaCl_2$ Solution (William and Seinberges, 1959) [10].

On the basis of pool of nutrients in soil i.e, NPK fertility index was suggested by Parkar *et al.* (1951)

$$NI = \frac{(NL \times 1) + (NM \times 2) + (NH \times 3)}{NT}$$

Where,

NI = Nutrient index
NT = Total number of samples
NM = Number of sample under medium
NL = Number of samples under low
NH = Number of samples under high

Categorization,

NI <1.5 fertility status is low, NI 1.5-2.5 fertility status is medium and NI >2.5 fertility status is high.

On the reference of above formula of Parkar *et al.* (1951) fertility map of Basmat taluka was generated.

Results and Discussion

The present investigation was carried out by analyzing one hundred surface soil samples from Basmat tahsil of Hingoli district. The pH of soil ranged from 7.03 to 8.34 with an average 8.04 and electrical conductivity in between 0.07 to 0.94dSm^{-1}with an average of 0.167 dSm^{-1}. Free Calcium carbonate content of soil was ranged from 0.8 to 7.1 per cent with an average value of 4.67 g kg^{-1}. From hundred samples, eighty nine (89 %) soil samples were low in calcium carbonate whereas, 11 soil samples (11%) were vertisol in nature. There was slight variation in the content of organic carbon which was varied from 1.5 to 8.0 g kg^{-1}. The average organic carbon content in the soil was 6.09g kg^{-1}. Little variation was seen in the organic carbon content of soils of Basmst tahsil. Out of 100 soil samples 67 were observed in low, 29 (29%) were medium, 4 (4%) were high in organic carbon. Hence soils of Basmat tahsil were low to medium in organic carbon and organic matter content.

The available nitrogen content of soils of Basmat tahsil was ranged from 105.02 to 290.51 kg ha^{-1} with an average value of 221.16 kg ha^{-1}. Out of 100 soil samples 96 (96%) were low in available nitrogen, 04 (04%) was medium. The available phosphorus content of soils of Basmat tahsil was varied from 5.37 to 18.18 kg ha^{-1} with a mean value of 10.58 kg ha^{-1}. Overall status of Basmat tahsil soils showed that 53 soil samples were low in available phosphorus, 47 soil samples were medium in availability. The available potassium content in soils of Basmat tahsil were ranged from 182.10 to 1078.20 kg ha^{-1} with an average value of 513.78 kg ha^{-1}.Out of 100 soil samples of Basmat tahsil 25 soil samples were placed medium in available potassium and rest of the samples were placed high.

The exchangeable calcium content of soils of Basmat tahsil was ranged from 1.36 to 6.16 Cmol(P^+)/kg of soil with mean value of 3.90 Cmol(P^+)/kg. Out of 100 soils samples of Basmat tahsil 16 samples were observed in medium and 82 in high status.

Table 1: Overall range and mean of various parameters of Basmat tehsil

Parameters	Range	Mean
pH	7.03-8.34	8.04
EC (dSm$^{-1)}$	0.070-0.94	0.167
O.C (g/kg)	1.5-8.0	6.09
Free $CaCO_3$ (%)	0.80-7.10	4.67
Available N (kg/ha)	105.02-290.51	221.61
Available P (kg/ha)	5.37-18.18	10.58
Available K (kg/ha)	182.1-1078-.02	513.78
AvailableCa Cmol(P+)/kg	1.36-6.16	3.90
AvailableMgCmol(P+)/kg	0.52-3.20	1.73
Available S (mg/kg)	3.73-20.03	10.02
Available Fe (mg/kg)	2.65-13.64	5.55
Available Mn (mg/kg)	4.75-32.40	13.70
Available Zn (mg/kg)	0.42-2.30	1.09
Available Cu (mg/kg)	0.87-4.05	2.41
Available B (mg/kg)	0.13-0.58	0.30
Available Mo (mg/kg)	0.14-0.43	0.30

The exchangeable Mg content of Basmat tahsil soils were ranged from 0.52 to 3.20 Cmol(P^+)/kg with an average 1.73 Cmol(P^+)/kg. All 100 soil samples were observed low in magnesium status. The available sulphur content of soils of Basmat tahsil was ranged from 3.73 to 20.03 mg/ kg with a mean value of 10.02 mg/kg. Out of 100 soil samples 30 soils samples were observed sufficient in available sulphur content, 70 samples were deficient in available sulphur content of Basmat tahsil soils.

Among the DTPA extractable micronutrients, DTPA Cu varied in the range of 0.87-4.05 mg/kg with the mean of 2.41mg kg^{-1}. All 100 soil samples were observed sufficient condition. DTPA-Fe varied in the range from 2.65 to 13.65 mg/kg with an average value of 5.54 mg/kg. DTPA- Mn was in the range of 4.75 to 32.40 mg/kg with a mean value13.70 mg/kg from the soils of Basmat tahsil. DTPA-Zn noticed from 0.42 to 2.30 mg/kg with an average value of 1.09 mg/kg. Hot water soluble Boron present in the soils of Basmat tahsil was in the range of 0.13 to 0.58 mg/kg with a mean value of 0.29 mg/kg. Available Mo was in the range from 0.14 to 0.43 mg/kg with a mean value of 0.29 mg/kg. All 100 soil samples were observed in sufficient condition.

The data on correlation coefficient showed that the pH showed negative but significant correlation with available nitrogen instead of available Mo and all micronutrients had negative significant correlation, available Mo and available P

and K had positively significant correlation. $CaCO_3$ had positively significant correlation with available potassium but negatively correlate significantly with available Zn.
The data on correlation coefficient showed that the pH showed negative but significant correlation with available nitrogen and all micronutrients had negative significant correlation except available Mo, available P and K had positively significant correlation. The significant value of organic carbon with available nitrogen may be due to the close association of N with organic matter and adsorption of Ammonical N by humus complex in soil. The similar findings were also reported by Kathaliya and Saxena (1989) that the available N was positively significant correlated with organic carbon.
The organic carbon had positive significant correlation with available nitrogen and all micronutrients except available Mo. Positive significant correlation were observed between pH, EC and calcium carbonate with available K. This was attributed due to facts that interlayer collapse of clay mineral structure. The low hydration energy if cations produced interlayer dehydration and layer collapse (Kanthaliya and Saxena, 1989).

Table 2: Correlation between Chemical properties and macro and micronutrients in soils of Basmat tahsil.

Chemical properties	Available macronutrients						Available micronutrients					
	N	P	K	Ca	Mg	S	Zn	Cu	Fe	Mn	B	Mo
pH	-0.635	0.607**	0.628**	-0.596	0.584**	0.011	-0.600	-0.583	-0.645	-0.555	-0.558	0.447**
EC	-0.469	-0.441	0.488**	0.431**	0.474**	-0.217	0.373**	0.381**	0.417**	0.399**	0.388**	-0.454
O.C.	0.895**	-0.923	0.864**	0.946**	0.734**	0.312**	0.935**	0.982**	0.885**	0.937**	0.939**	0.042
$CaCO_3$	0.597**	0.582**	0.601**	0.575**	0.554**	0.06	-0.559	0.578**	0.600**	0.546**	0.560**	0.328**

* 1% level of significance.
** 5% level of significance

Positively significant correlations were observed between pH and organic carbon with available Zn. This was attributed due to organic matter plays an important role in controlling the availability of Zn particularly in alkaline and calcareous soils. The same results were reported by Meena *et al.* (2006) [4]. These results were in confirmatory with Pharande *et al.* (1996) [7].

Nutrient Index
The nutrient index was categorized as low (1.14) for available Nitrogen as per Parker *et al.* (1951) [6]. Among all soil samples ninety six samples were placed in low and four samples placed in medium status. For available Phosphorus the nutrient index was categorized as low (1.47).

Table 3: Categorization of soil samples from Basmat tehsil

Nutrients	Low	Medium	High
N	96	4	0
P	53	47	0
K	0	25	75
Exch. Ca	0	16	84
Exch. Mg	100	0	0
Nutrients	**Deficient**	**Sufficient**	
S	70	30	
Fe	51	49	
Mn	-	100	
Zn	67	33	
Cu	-	100	
B	55	45	
Mo	-	100	

Fifty three soil samples were categorized in low and forty seven samples were placed in medium category. About available Potassium, the nutrient index was categorized as high (2.75). From one hundred soil samples twenty five samples were placed in medium and seventy five soil samples were placed in high category.

Conclusion
In Basmat tahsil soil, pH of the soil was alkaline in nature. Electrical conductivity of the soil was in safe limit of the crop growth. The organic carbon status was low to medium, $CaCO_3$ were moderately calcareous in nature. Low nitrogen and low phosphorus were observed in this type. High potassium content was observed. About 51% soil samples were observed deficient in DTPA-Fe. DTPA- Cu observed as in sufficient amount which was more than critical limit. Maximum samples were sufficient in DTPA-Mn and 67 soil samples were observed deficient in DTPA-Zn. Organic carbon showed positive and significant correlation with available nitrogen and DTPA Fe $CaCO_3$ showed positive significant association with available potassium and DTPA Cu and Mn.

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