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Original Research Article

Assessment of Soil Fertility in Baramkela Block under Raigarh District of Chhattisgarh, India

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A B S T R A C T

For evaluation of the soil fertility status of Baramkela Block Under Raigarh District of Chhattisgarh, a systematic survey was carried out. Surface (0-15 cm depth) soil samples were collected in the year 2014. These soil samples were analyzed for N, P and K and categorized as low medium and high as per criteria followed in the soil testing laboratory. Based upon the coefficient of correlation between macronutrients and soil properties, A positive significant correlation was found between pH and available N. Available N showed positive and significant correlation with available K. Positive and non-significant correlation was found between available P and organic carbon. Significant and positive correlation was found between available potassium content and pH whereas, with available phosphorus had positive and non-significant correlation with pH. The positive significant correlation found between pH and available K. Correlation studies amongst available major nutrients revealed that only available N and K had positively significant correlation was observed amongst them.

Keywords

Fertility status, major nutrients, Chattisgarh

Introduction

Soil fertility is an important factor, which determines the growth of plant, productivity and profitability of crops in agriculture. Chhattisgarh State has four major soils type i.e. *Entisols*, *Inceptisols*, *Alfisols*, *Vertisols* in whole area and only *Mollisols* at Mainpat area of Ambikapur and forest area of Baster plateau. Almost all soils are deficient in nitrogen and phosphorus and medium to high in potassium. Fertilizing soils to bring all the deficient elements at high levels as to provide sufficient ionic activity in soil solution for crop uptake is one of the most important considerations for maximization of the crop yield. The use of plant nutrients in a balanced manner is the prime factor for efficient fertilizer program. Soil fertility is an important factor, which determines the growth of plant, productivity and profitability of crops in agriculture. In order to achieve higher productivity and profitability, every farmer should realize that fertility levels must be measured as these measurements can then be used to manage soil fertility. The diagnostic techniques for fertility evaluation include fertilizer trials, soil test and plant analysis. Out of these, soil test provides the most accurate information on the availability of various plant nutrients. In this context, Baramkela block which comes under Raigarh District in the state of Chhattisgarh was selected for evaluation of

the soil fertility status and a systematic survey work was be carried out.

Materials and Methods

Collection of Sample Collection

Baramkela block comes under Raigarh District in the state of Chhattisgarh. The area was selected for evaluation of the soil fertility status and a systematic survey work was be carried out. Triplicate soil samples from all plots from 0-15 cm depths were collected in 2014 from three locations under each land use systems using a core sampler. The entire volume of soil from each land use systems were mixed thoroughly and representative samples were used for the analysis. Soil samples were air-dried for 7 days, sieved through 2 mm sieve, mixed and stored in sealed plastic jars for further analysis. Representative sub samples were drawn to determine various physico-chemical properties using standard procedures (Piper, 1950).

The soil samples were analyzed for different physico-chemical properties such as pH, E.C. Organic carbon, Available N, Available P, Available K and micronutrients viz ; Fe, Mn, Cu, Zn. Soil pH was measured by glass electrode pH meter by Black, and Evans,, (1965). The EC of supernatant liquid was determined by Solubridge as described by Black, and Evans, (1965). OC was estimated by Walkley and Black's rapid titration method as described by Jackson (1967). Available nitrogen was determined by alkaline potassium permanganate method as described by Subbiah and Asija (1956). Available phosphorus of the soil was estimated by Olsen's method as described by Olsen (1954). Soil potassium was extracted by shaking with neutral normal ammonium acetate as described by Jackson (*1967*). Correlation coefficients were worked out using the procedure suggested by the Steel and Torrie (1960).

Results and Discussion

Physico-chemical characteristics

Soil reaction (pH)

The pooled soil pH value ranged from 6.5 – 7.7 with an average of 7.1, with a mean value of 7.1. The soil pH averaged as neutral and can be said to be very favourable for good crop growth.

Electrical conductivity (EC)

The total salt content of these soils expressed as EC ranged as 0.05 – 0.90 dSm^{-1} with a mean value of 0.12 dSm^{-1}. The EC values ranged were found to be all under safe limits for crop production.

Organic carbon (OC)

The overall organic carbon ranged from 0.35 – 0.58% with mean of 0.46 % out of all the soil samples of the block 4.Mostly the soils were found to be deficient in organic carbon.

Available N status

The available N content of all the soil samples ranged from 100 to 326 kg ha^{-1} with an average value of 175.9 kg ha^{-1} (Table 1).

The N status of the block was low. In general, out of all the samples, 99.23% under low and 0.76% samples were categorized under medium N status (Table 1).

Available P status

The overall mean was of available P content noted from 10.52 to 25.45 kg ha-1 with a

mean value of 17.95 kg ha^{-1} in the study area (Table 1). Considering the soil test rating for available phosphorus (<12.5 kg ha^{-1} as low, 12.5-25 kg ha^{-1} as medium and >25 kg ha-1as high) 81.81% low status in available phosphorous. The 17.93 samples of study area were categorized under medium available P content.

Available K status

The results showed that the available potassium content ranged from 97 to 371 kg ha^{-1}with an average value 234 kg ha^{-1} of the block (Table 1). Considering the soils having <135 kg ha^{-1} as low, 135-335 kg ha^{-1} as medium and >335 kg ha^{-1} as high in available potassium content. Distribution of the samples with respect to available potassium indicates that about 55.08%, 39.11 % and 5.80% were medium, high and low in available K content respectively.

Available Fe status

The available Fe content of all the soil samples ranged from 3.2 – 5.8ppm with an average value of 4.5 ppm (Table 1).

Table.1 Pooled Salient soil properties values of the study area

Soil characteristics	Range	Mean	S.D
pH (1:2.5, Soil: water)	6.5 – 7.7	7.1	± 0.60
E.C. (dS m-1)	0.05 – 0.90	0.12	± 0.07
O.C. (%)	0.35 – 0.58	0.46	± 0.16
Available N (kg ha-1)	100 – 326	175.94	± 36.3
Available P (kg ha-1)	10.52 – 25.45	17.95	± 5.12
Available K (kg ha-1)	97 – 371	234	± 98.32
Available Fe (mg kg-1)	3.2 – 5.8	4.5	±.94
Available Mn (mg kg-1)	4.2 – 6.8	5.5	±.67
Available Cu (mg kg-1)	0.4 – 4.6	2.5	±.45
Available Zn (mg kg-1)	0.2 – 2.7	1.45	± 0.39

Table.2 Correlation coefficient (r) between physico-chemical properties and available N, P and K

	pH	**EC**(dSm^{-1})	**OC** (%)	**N** (kg ha^{-1})	**P** (kg ha^{-1})	**K** (kg ha^{-1})
pH						
EC(dSm^{-1})	0.109**					
OC (%)	0.027	0.006				
N (kg ha^{-1})	0.101**	0.016	0.036			
P (kg ha^{-1})	0.051	0.060	0.032	-0.056		
K (kg ha^{-1})	0.144**	0.025	0.001	0.067*	0.068*	

**Significant at 1% level *Significant at 5% level

Available Mn status

The available Mn content of all the soil samples ranged from 4.2 – 6.8ppmwith an average value of 5.5 ppm (Table 1).

Available Cu status

The available Mn content of all the soil samples ranged from 40.4 – 4.6 ppm with an average value of 2.5 ppm (Table 1).

Available Zn status

The available Mn content of all the soil samples ranged from 0.2 – 2.7ppm with an average value of 1.45 ppm (Table 1).

Relationship between soil characteristics and available N, P and K

Available N showed positive and significant correlation with available K (r=0.067*) in (Table 2). The positive relation among the major nutrients is the result of synergistic effects.

The soil reaction (pH) showed significant and positive correlation (r = 0.109**) with electrical conductivity (Table 2). These results are in agreement with Kumar *et al.*, (2009).

Available N resulted significant and positive correlation with pH (r = 0.101**) as presented in table 2. The results indicated that available N increased with increase in pH Kumar *et al.*, (1995) also reported the identical results. Positive and non-significant correlation (r = 0.032) was found between available P and organic carbon (Table 2). This relationship was also observed by Kumar *et al.*, (2009).

A significant and positive correlation was found between available potassium content and pH (r = 0.144**) Similar result were also reported by Singh *et al.*, (2009) in soils of Gajipur district of Uttar Pradesh. Positive and non-significant correlation (r =0.060) was found between available phosphorus and electrical conductivity. Sharma *et al.*, (2008) also reported the identical results in soils of Amritsar district of Punjab.

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