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ORIGINAL ARTICLE

Soil Fertility Status of Tribal Areas District Dindori

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ABSTRACT

Soil is our greatest natural resource. Knowledge about the fertility status of soils is of prime importance for its appropriate use and sustainable management for increasing crop production. Dindori is situated at 20.5 ^{0}N latitude and 81.51 ^{0}E longitudes at an altitude of 710 meters above mean sea level. Soil samples (0-15 cm) were collected from different blocks of Dindori district, Madhya Pradesh and were analyzed for available macro nutrients namely nitrogen, phosphorous and potassium. It is very clear from the analytical results that all the soil samples did not vary too much among different analysed chemical properties. The majority of Dindori soils are red and skeletal in nature with very shallow soil depth. The pH of the soil samples was slightly acidic, neutral with low soil organic carbon content. For the whole Dindori district 35 percent and 55 percent samples were tested as a low in available nitrogen and available phosphorous, respectively, while, none of the soil samples were found low available potassium.
Key wards : Soil fertility, Tribal area, Macro nutrients.

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INTRODUCTION

Madhya Pradesh is the largest state of the country with a geographical area of 44.34 million hectares. Widespread NPKS and some micronutrients (Zn & B) deficiency ware reported earlier in the soils of Madhya Pradesh. Amongst the soil types highest zinc deficiency was observed in Alluvial soils (86%) followed by mixed red and black soils (68%), red and yellow soils (62%), medium black soils (61%), deep black soils (35%) and skeletal soils (31%) respectively. The 44 percent soil samples were found deficiency with sulphur, while 61 percent soil samples were recorded for Zn deficiency in soil of Madhya Pradesh [1].

Dindori and Mandla districts are the predominant tribal district of Madhya Pradesh and the Gond and Baiga are very primitive tribes of these district [2&3]. Majority of the soils of the region are shallow, skeletal and stony comprised of gravel (50% of the area), loamy and sloppy (35%) and only 15% is flat and black soil. Rainfall is scattered, untimely and uneven. Generally no fertilizers are applied to lack of awareness among the farmers and their very poor playing capacity and also having low market value. The average fertilizer consumption of Dindori district is negligible, 3.1 kg ha^{-1} in *kharif* and 0.9 kg ha^{-1} in *rabi* with the annual average of 2.4 kg ha^{-1}. Kodo, kutki and Niger are major crops of the tribal and rural areas. These crops are responsive to the adverse climatic and poor soil conditions [4&5].

Soil is our greatest natural resource. It is the chief wealth of an agricultural country in as much as it produces the crops that support the people and the nation. Soil testing is a tool for rapid soil chemical analysis to assess the available nutrient status of a soil, interpretation of the test results and making fertilizer recommendations based on crop responses and economic considerations. The awareness of the farmers about the benefits of soil testing is helpful in determining the status of nutrients in the soil, while fertilizer recommendation is useful in determining appropriate amount of fertilizers. Knowledge about the fertility status of soils is of prime importance for its appropriate use and management for increased crop production. Usual researches have been carried out on various aspects for enhancing crop production in the area but no serious attempt has really been made to give impetus on soil characteristics and fertility status [6].

MATERIAL AND METHODS

Dindori is situated at 20.5 ^{0}N latitude and 81.51 ^{0}E longitudes. It is located 144 km from Jabalpur (M.P.) railway station at an altitude of 710 meters above mean sea level. The area comes under the North-Eastern hills zone. The climate of the area is subtropical. Due to high rainfall and frequent winter

showers, the climate remains sub-humid for about six months from June to December. The district is received 1393 mm average rains annually. Most of the precipitation is received through South-West monsoon during June to September. The winters are very cool and temperature goes down as low as 03 ^{0}C. Hailstorms often damage the *rabi* crops in winter. In *kharif* occasional failures of rains either in early or late cause severe loss to the crops. The soils of the experimental area were gravelly and referred as skeletal soils. They vary in colour from pale brown to dark brown and red with thickness varying from 07 to 15 cm, which are easily disturbed through erosion, therefore, the development of any horizenation action is hardly noticeable. The slope of experimental area was 1.5-3.0 per cent. One hundred thirty four soil samples (0-15 cm) were collected from different blocks of Dindori district (Table 1), Madhya Pradesh and were analyzed for available macro nutrients by the standard laboratory procedures. The soil samples were air- dried, pulverized and passed through a 2 mm nylon sieve before analysis.

Soil pH was determined with the help of glass electrode pH meter in a 1:2.5 (soil : water) suspension kept for half an hour after starring [7]. EC was determined by the same soil suspension, used for pH determination. It was determined using "Solubridge" method [7]. Organic carbon was determined by Walkely and Black [8] rapid titration method. The available nitrogen was determined by distilling soil with potassium permagnate and sodium hydroxide solution [9]. Available phosphorus was extracted by Olsen's method [10] using 0.5 m sodium bicarbonate (pH 8.5) and was determined by ascorbic acid method suggested by [11]. The available potassium was extracted by neutral normal ammonium acetate and it was estimated by using flame photometer [12].

RESULT AND DISCUSSION

Basic properties of soils

The physico-chemical properties of the soils are presented in table 2. It is indicated that the soil pH which varied from 6.0 to 6.9 with a mean value of 6.5. On an average the soils of Dindori district were slightly acidic in reaction. While, the electrical conductivity ranges from 0.11 to 0.23 dS m^{-1} with a mean value 0.17 dS m^{-1} hence the soils were found normal in soluble salts. However, soil organic carbon content varied from 2.9 to 4.5 g kg^{-1} with a mean value of 3.7 g kg^{-1}, therefore, the soils of Dindori district were found in low category for organic carbon content. It is due to continuous organic matter oxidation subjected to anthropogenic activities [13] and also to sparse vegetation and no application of organic residues in the soil [14].

Fertility Status of soils

Available nitrogen in soils

The data presented in table 3 indicate that the available nitrogen content in soil was found to varied from 200 to 270 kg ha^{-1} with a mean value of 240 kg ha^{-1} at Karanjiya block, 210 to 290 kg ha^{-1} with a mean value of 230 kg ha^{-1} at Samnapur block, 205 to 285 kg ha^{-1} with a mean value of 235 kg ha^{-1} at Bajag block, 220 to 295 kg ha^{-1} with a mean value of 248 kg ha^{-1} at Amarpur block, 222 to 280 kg ha^{-1} with a mean value of 244 kg ha^{-1} at Mehandawani block, 231 to 293 kg ha^{-1} with a mean value of 250 kg ha^{-1} at Shahpura block and 221 to 300 kg ha^{-1} with a mean value of 254 kg ha^{-1} of Dindori block. The available nitrogen content in soils of entire Dindori district was found to varied from 200 to 300 kg ha^{-1} with a mean value of 245 kg ha^{-1}. Considering 250 kg ha^{-1} nitrogen as the critical limit, below which response of crop to application of nitrogenous fertilizer may be expected. There were 30, 35,31, 36, 34, 38 and 37 percent samples found deficient in Karanjiya, Samnapur, Bajag, Amarpur, Mehandawani, Shahpura and Dindori block respectively. For the Dindori district as a whole 35 percent samples were tested as a low in available nitrogen. The presence of low amount of nitrogen in all soils might be due to removal by the crops, transformation to elemental nitrogen etc. The similar findings were also recorded by [15, 16 & 17].

Available phosphorus in soils

The data presented in table 3 indicate that the available phosphorus content in soil was found to varied from 7.0 to 12.0 kg ha^{-1} with a mean value of 9.8 kg ha^{-1} in Karanjiya block, 7.2 to 15.0 kg ha^{-1} with a mean value of 11.0 kg ha^{-1} in Samnapur block, 7.0 to 22 kg ha^{-1} with a mean value of 12 kg ha^{-1} in Bajag block, 8.0 to 21.0 kg ha^{-1} with a mean value of 15.0 kg ha^{-1} in Amarpur block, 8.1 to 28.0 kg ha^{-1} with a mean value of 16 kg ha^{-1} in Mehandawani block, 8.5 to 25 kg ha^{-1} with a mean value of 13.0 kg ha^{-1} in Shahpura block and 9.0 to 19.0 kg ha^{-1} with a mean value of 18.0 kg ha^{-1} of Dindori block. For the entire Dindori, district, available phosphorus content in soil was found to varied from 7.0 to 28.0 kg ha^{-1} with a mean value of 14.0 kg ha^{-1}. Considering 10.0 kg ha^{-1} phosphorus as the critical limit, below which response of crop to application of phosphatic fertilizer may be expected. It was observed that 20, 30, 33, 21, 17, 22 and 20 percent samples were found deficient in Karanjiya ,Samnapur, Bajag, Amarpur, Mehandawani, Shahpura and Dindori block respectively. For the Dindori District as a whole 25 percent samples were tested as a low in available phosphorus. The low content of available phosphorus could be ascribed to the

high amount of free oxides of Ca^{2+}, Mg^{2+} and Na^{+} which induce the fixation and subsequent precipitation of phosphorus as well as to the low amount of organic matter [14, 18 & 19].

Available potassium in soils

The data presented in table 3 indicate that the available potassium content in soil was found to varied from 230 to 270 kg ha^{-1} with a mean value of 250 kg ha^{-1} in Karanjiya block, 240 to 260 kg ha^{-1} with a mean value of 250 kg ha^{-1} in Samnapur block, 254 to 290 kg ha^{-1} with a mean value of 260 kg ha^{-1} in Bajag block, 245 to 267 kg ha^{-1} with a mean value of 255 kg ha^{-1} in Amarpur block, 264 to 290 kg ha^{-1} with a mean value of 270 kg ha^{-1} in Mehandawani block, 243 to 295 kg ha^{-1} with a mean value of 252 kg ha^{-1} in Shahpura block and 246 to 288 kg ha^{-1} with a mean value of 260kg ha^{-1} of Dindori block. For the entire Dindori, district the available potassium content in soil was ranged from 230 to 295 kg ha^{-1} with a mean value of 250 kg ha^{-1}. None of the samples were tested low in potassium. The content status of K on these soils may be due to feldspars minerals in parent material [20 & 21].

Table 1: Location of soil samples

S. No.	Blocks	Soil colours	Cropping system	No of soil samples
1.	Karanjiya	Red	Kutki	19
2.	Samnapur	Red and Black	Kodo	22
3.	Bajag	Red, Black and yellow	Maize, Kutki	25
4.	Amarpur	Red	Niger, Maize, Kodo	16
5.	Mehndawani	Red and yellow	Kodo, Maize, Kutki	15
6.	Shahpura	Red	Kodo, Kutki	17
7.	Dindori	Red	Kodo, Kutki	20

Table 2: Basic properties of soils

S. No.	Blocks	pH		EC (dS m^{-1})		OC (g kg^{-1})	
		Range	Mean	Range	Mean	Range	Mean
1.	Karanjiya	6.1-6.6	6.5	0.11-0.18	0.14	3.1-3.8	3.5
2.	Samnapur	6.3-6.9	6.3	0.12-0.19	0.15	3.2-3.9	3.6
3.	Bajag	6.3-6.6	6.4	0.13-0.18	0.16	3.4-4.0	3.5
4.	Amarpur	6.0-6.8	6.5	0.12-0.19	0.16	3.5-4.2	3.8
5.	Mehndawani	6.6-7.0	6.7	0.14-0.21	0.17	3.1-3.9	3.6
6.	Sahpura	6.2-6.5	6.3	0.11-0.20	0.18	2.9-3.8	3.4
7.	Dindori	6.2-6.9	6.6	0.13-0.23	0.19	3.5-4.5	4.1

Table 3: Distribution of available macronutrients status (kg ha^{-1}).

S. No.	Blocks	Available-N			Available-P			Available-K		
		Range	Mean	PSD	Range	Mean	PSD	Range	Mean	PSD
1.	Karanjiya	200-270	240	30	7.0-12	9.8	20	230-270	240	0
2.	Samnapur	210-290	230	35	7.2-15	11	30	240-260	250	0
3.	Bajag	205-285	235	31	7.0-22	12	33	254-290	260	0
4.	Amarpur	220-295	248	36	8.0-21	15	21	245-267	255	0
5.	Mehndawani	222-280	244	34	8.1-28	16	17	264-290	270	0
6.	Sahpura	231-293	250	38	8.5-25	13	22	243-295	252	0
7.	Dindori	221-300	254	37	9.0-19	18	20	246-288	260	0
Dindori district :-		**200-300**	**245**	**35**	**7.0-28**	**14**	**25**	**230-295**	**250**	**0**

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