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Assessment of nutrient status of cotton growing soils in Amravati district

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Abstract
The present investigation in relation to "Assessment of nutrient status of cotton growing soil in Amravati district." was undertaken during 2020-21. Total 60 i.e. 30 Surface and 30 subsurface soil samples were collected and analysed for their chemical properties and micronutrient status in soil. The results revealed that, neutral to slightly alkaline in reaction with no salinity hazard, low to high in organic carbon, calcium carbonate were moderately high to high in category. The DTPA-extractable iron in Dhamangaon and Chandur block were low to medium (4.10-7.00 mg kg^{-1}, 4.01-6.22 mg kg^{-1}, respectively), medium to very high for copper (0.24-1.33 mg kg^{-1}) in Dhamangaon block and medium to high (0.22-0.92 mg kg^{-1}) in Chandur block. Whereas, soils of Dhamangaon and Chandur block were moderately high to high in manganese (4.50-8.70 mg kg^{-1} and 4.45-8.12 mg kg^{-1}, respectively) and very low to moderately high in zinc (0.50-1.56 mg kg^{-1} and 0.25-1.36 mg kg^{-1}) respectivel0079.

Keywords: Chemical properties and micro nutrients

Introduction
Soil is source of infinite life, it is the most precious and natural resources and not renewable in short time. Soil fertility is the dynamic natural property which can change under the influence of natural and human induced factors. (Denis *et al*., 2017) [1]. There are various techniques for soil fertility evaluation, among them soil testing is the most widely used in the world (Havlin *et al*., 2010) [2]. The chemical properties of soil are important for the availability of nutrients in soil and there by crop production.
Chemical indicators include measurements of soil pH, salinity, organic matter, phosphorus concentrations, cation exchange capacity, nutrient recycling and concentration of elements that may be potential contaminants or those that are needed for plant growth and development. The deficiency of micronutrients has become major constraint in sustainable crop productivity of soils and hence there is need to know the status of nutrients of the soil (Katkar *et al*., 2019) [4]. Micronutrients in soils are very important for plant growth, soil fertility, animal nutrition and productivity (Renwick & Walkar, 2008) [11]. The deficiency of nutrients directly effects on the growth of crops and crop response become poor (Jagtap *et al*., 2018) [8].

Materials and Methods
The research work entitled "Assessment of nutrient status of cotton growing soil in Amravati district" conducted during the year 2020-21. Survey of selected villages of Dhamangaon and Chandur block i.e. Naygaon, Mangrul and Dighi villages from Dhamangaon block and Dhanodi, Supalwada and Nimgavan villages from Chandur block of Amravati district was conducted. Total 60 soil samples (0-15 and 0-30 cm) were collected after harvesting of cotton (10 soil samples from each village i.e. 5 Surface and 5 Subsurface).
The soil pH was determined by digital pH meter using glass electrodes and 1:2.5 soil: water ratio as described by Jackson (1973) [3]. Electrical conductivity (EC) was determined with conductivity meter using 1:2.5 soil: water suspension as described by Jackson (1973) [3]. Organic carbon was determined by Walkley and Black (1934) [7] method as described by Jackson (1973) [3]. Calcium carbonate was estimated by rapid titration method using phenolphthalein indicator as described by Piper (1966) [6]. DTPA (0.005 M) extractable Fe, Mn, Zn and Cu was determined as the procedure outlined by Lindsay and Norvell (1978) [10] using atomic adsorption spectrophotometer.

Results and Discussion

Soil pH and Electrical Conductivity

The study revealed that, pH of surface and subsurface soil of Dhamangaon block varies from 7.45-8.25 and 7.48-8.37 with a mean of 7.80 and 7.95, respectively. Similarly, the pH of Chandur block soil ranges from 7.10-8.10 and 7.17-8.37 with a mean of 7.64 and 7.95, respectively (Table 1). Maximum soil samples of Amravati district were found neutral to moderately alkaline in nature by the study of Katkar *et al*., (2019) [4]. The electrical conductivity of surface and subsurface soil of Dhamangaon block varies from 0.120-0.213 and 0.127-0.232 ds m^{-1} with the mean of 0.169 and 0.190 dS m^{-1}, respectively and Chandur block varies from 0.115-0.207 and 0.143-0.227 dS m^{-1} with the mean of 0.159 and 0.188 dS m^{-1}, respectively (Table 1). The result shows that, the salinity hazard does not exist in selected study area. Katkar *et al*., (2019) [4] were recorded that, the soils of Amravati district were non-saline (0.101 to 0.510 dS m^{-1}) in nature and suitable for plant growth with a mean value of 0.170 dS m^{-1} which was in normal in range (< 1 dS m^{-1}).

Organic Carbon and Calcium carbonate

The organic carbon in the surface and subsurface soil of Dhamangaon block ranges from 0.30-0.91 and 0.26-0.88 per cent, respectively, and in Chandur block it varies from 0.25-0.79 and 0.23-0.73, respectively (Table 1). The higher organic carbon content was obtained at surface and declined progressively with depth. Similar result were also recorded by Khandagale *et al.,* (2019) [5] for organic carbon in Jabalpur. The results revealed that, the calcium carbonate in surface and subsurface soil of Dhamangaon block ranges from 3.75-8.10 and 3.98-9.50 per cent with the mean of 5.37 and 6.23 per cent, respectively. Whereas in surface and subsurface soil of Chandur block ranges from 2.44-7.70 and 3.30-8.20 with a mean value of 4.08 and 4.68 per cent, respectively (Table 1).

Micro-nutrient status

Iron

The study of selected area revealed that, in the surface soil of Dhamangaon and Chandur block Fe ranges from 4.10 to 7.00 and 3.80 to 8.80 mg kg^{-1} with a mean value 5.84 and 6.04 mg kg^{-1} respectively. The subsurface soil of Dhamangaon and Chandur block Fe ranges from 4.00 to 6.22 and 3.00 to 8.34 with mean value of 5.27 and 5.48 mg kg^{-1} respectively (Table 2). The DTPA-Fe showed wide variation in the soils of Amravati district (Katkar *et al*., 2019) [4]. In black soils, low Fe content may be due to precipitation of Fe^{2+} by $CaCO_3$ and decrease the availability (Mamaledesai *et al*., 2012) [12]. Similar results were also observed by Ravikumar *et al.,* (2007) [13].

Copper

Copper is also an important micronutrient for plants, and required for lignin synthesis, it acts as a constituent of ascorbic acid, oxidase, phenolase and plastocyanin (Havlin *et al*., 2010) [2]. The DTPA extractable copper in surface soil of Dhamangaon and Chandur block ranges from 0.24 to 1.33 and 0.22 to 0.92 mg kg^{-1} with the mean value 0.66 and 0.60mg kg^{-1} (Table 2) respectively. In sub-surface soil copper ranges from 0.28 to 1.17 and 0.19 to 0.71 mg kg^{-1} with the mean value of 0.57 and 0.47 mg kg^{-1} (Table 2) respectively.

Manganese

Manganese plays an important role in oxidation and reduction processes in plants (Mousavi *et al*., 2011) [9]. The DTPA extractable manganese in the surface soils of Dhamangaon and Chandur block ranges from 4.50 to 8.70 and 4.45 to 8.12 kg ha^{-1} with the average value of 6.55 and 6.37 kg ha^{-1} and in subsurface soil ranges from 4.34 to 7.78 and 4.31 to 7.96 with the mean value 6.08 and 6.02, respectively (Table 2). Soils of Amravati district were sufficient in Mn (Katkar *et al.* 2019) [4].

Zinc

Zinc is essential for several biochemical processes in plants, such as cytochrome and nucleotide synthesis, auxin metabolism, chlorophyll production, enzyme activation and the maintenance of membrane integrity (Havlin *et al*., 2010) [2]. The surface soil of Dhamangaon and Chandur block DTPA-extractable zinc ranged from 0.50 to 1.55 and 0.25 to 1.36 mg $kg^{-1}$with a mean value of 0.74 and 0.63 mg kg^{-1} and in sub-surface soil it ranges from 0.41 to 1.07 and 0.24 to 1.14 mg kg^{-1} with the average value of 0.59 and 0.50mg kg^{-1} respectively (Table 2). The DTPA-Zn of Amravati district as a whole, varied from 0.11 to 5.31 mg kg^{-1} indicating 43.3 per cent deficiency, whereas 44.7 per cent samples of available Zn were noticed in medium category showing widespread deficiency of zinc (Katkar *et al*., 2019) [4].

Table 1: Distribution of surface and sub-surface soil pH, EC, OC and $CaCO_3$ of Dhamangaon and Chandur block in Amravati District

Sample No.	pH		EC		OC		$CaCO_3$	
	S	SS	S	SS	S	SS	S	SS
Dhamangaon								
Naygaon								
1.	8.05	8.15	0.17	0.19	0.30	0.26	5.70	6.12
2.	7.62	7.80	0.14	0.15	0.76	0.74	4.62	5.88
3.	7.74	7.91	0.16	0.23	0.51	0.48	4.55	5.40
4.	7.45	7.55	0.15	0.18	0.39	0.34	4.20	4.54
5.	7.60	7.90	0.16	0.16	0.91	0.88	4.40	3.98
Mangrul								
6.	8.07	8.25	0.19	0.20	0.84	0.82	6.22	7.50
7.	7.60	7.70	0.15	0.17	0.38	0.33	3.78	4.85
8.	7.93	8.04	0.18	0.20	0.69	0.67	5.42	6.67
9.	8.20	8.33	0.21	0.22	0.25	0.22	8.00	9.01
10.	7.35	7.48	0.12	0.12	0.57	0.52	3.75	5.40
Dighi								
11.	8.10	8.08	0.17	0.21	0.87	0.85	7.40	8.80
12.	7.55	7.80	0.14	0.16	0.55	0.52	4.80	4.20
13.	7.81	7.99	0.17	0.18	0.40	0.37	5.00	5.92

14.	8.25	8.37	0.20	0.21	0.81	0.79	8.15	9.50
15.	7.70	7.92	0.18	0.20	0.64	0.63	4.60	5.78
Range	7.45-8.25	7.48-8.37	0.12-0.21	0.12-0.23	0.30-0.91	0.26-0.88	3.75-8.10	3.98-9.50
Mean	7.80	7.49	0.16	0.19	0.59	0.56	5.37	6.23
Chandur								
Dhanodi								
16.	7.44	8.08	0.15	0.19	0.70	0.65	3.85	4.18
17.	8.05	7.80	0.19	0.21	0.54	0.52	7.42	4.87
18.	7.61	7.99	0.14	0.15	0.43	0.36	2.90	3.30
19.	8.10	8.37	0.20	0.22	0.50	0.42	7.70	8.20
20.	7.77	7.92	0.16	0.19	0.52	0.49	4.00	4.50
Supalwada								
21.	7.25	7.56	0.12	0.14	0.76	0.73	3.35	4.78
22.	7.83	7.98	0.19	0.22	0.64	0.63	3.00	3.59
23.	7.50	7.73	0.13	0.15	0.52	0.49	3.37	5.52
24.	7.10	7.17	0.11	0.26	0.64	0.63	2.44	3.75
25.	7.80	8.15	0.18	0.19	0.79	0.71	5.00	5.82
Nimgavan								
26.	7.66	7.78	0.14	0.16	0.26	0.23	3.43	4.45
27.	7.97	8.23	0.16	0.18	0.37	0.34	4.22	4.60
28.	7.38	7.54	0.14	0.15	0.26	0.23	4.00	5.30
29.	7.50	7.65	0.14	0.17	0.36	0.33	3.75	4.10
30.	7.75	8.28	0.16	0.18	0.25	0.23	2.80	3.35
Range	7.10-8.10	7.17-8.37	0.11-0.20	0.14-0.22	0.25-0.79	0.23-0.73	2.44-7.70	3.30-8.20
Mean	7.64	7.88	0.15	0.18	0.50	0.46	4.08	4.68

Table 2: Distribution of surface and sub-surface soil Micronutrients Fe, Mn, Cu and Zn of Dhamangaon and Chandur block in Amravati District.

Sample No.	Fe(mg kg^{-1})		Mn(mg kg^{-1})		Cu(mg kg^{-1})		Zn(mg kg^{-1})	
	S	SS	S	SS	S	SS	S	SS
Dhamangaon Block								
Naygaon								
1.	5.50	5.41	5.20	4.98	0.32	0.29	0.56	0.52
2.	6.50	6.12	7.40	7.12	0.75	0.56	0.75	0.54
3.	6.10	5.72	6.50	6.25	0.60	0.51	0.82	0.65
4.	5.90	5.35	5.23	5.13	0.39	0.28	0.50	0.41
5.	7.00	6.22	8.70	8.58	1.33	1.17	1.56	1.07
Mangrul								
6.	6.80	4.30	8.40	7.78	0.91	0.82	0.77	0.62
7.	6.10	5.62	6.60	6.30	0.65	0.48	0.80	0.62
8.	5.20	4.01	6.90	6.12	0.89	0.79	0.90	0.75
9.	4.10	5.60	5.57	5.44	0.24	0.45	0.75	0.65
10.	5.50	4.30	7.30	6.12	0.73	0.62	0.63	0.50
Dighi								
11.	6.50	6.22	5.40	5.30	0.71	0.55	0.51	0.45
12.	5.90	5.01	6.50	5.46	0.76	0.65	0.65	0.59
13.	5.50	4.89	4.50	4.34	0.51	0.48	0.73	0.65
14.	5.62	5.13	6.60	6.55	0.73	0.68	0.67	0.49
15.	5.70	5.23	7.50	5.78	0.48	0.32	0.51	0.42
Chandur Block								
Dhanodi								
16.	6.20	5.56	6.82	6.67	0.55	0.46	0.63	0.43
17.	6.20	5.78	5.60	5.27	0.44	0.37	0.49	0.41
18.	4.20	3.54	7.72	6.88	0.35	0.26	0.56	0.47
19.	6.35	5.82	4.45	4.31	0.65	0.55	0.45	0.30
20.	5.20	4.75	8.03	7.89	0.60	0.43	0.67	0.55
Supalwada								
21.	8.80	8.34	5.65	5.39	0.92	0.71	1.22	1.02
22.	5.00	4.75	5.50	5.34	0.72	0.65	0.45	0.37
23.	4.15	3.97	6.30	6.18	0.55	0.39	0.32	0.29
24.	6.80	5.85	7.11	6.83	0.82	0.63	0.98	0.71
25.	7.20	6.45	6.87	6.57	0.84	0.58	1.36	1.14
Nimgavan								
26.	3.90	3.33	6.25	5.81	0.25	0.20	0.25	0.22
27.	6.50	5.25	5.20	5.03	0.55	0.38	0.80	0.68
28.	8.75	8.28	5.82	4.67	0.75	0.61	0.56	0.45
29.	7.60	7.58	8.12	7.96	0.88	0.71	0.32	0.24
30.	3.80	3.05	6.21	5.55	0.22	0.19	0.41	0.34

Where, S= Surface and SS= Sub-surface

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