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Assessment of soil fertility status of cotton growing soils in Dhamangaon and Chandur block in Amravati district

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Abstract

The present investigation in relation to “Assessment of soil fertility status of cotton growing soil in Dhamangaon and Chandur block 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 physico-chemical properties, macro nutrient status in soil. The results revealed that, the soils under study were clayey in texture, neutral to slightly alkaline in reaction with no salinity hazard, low to high in organic carbon in surface and subsurface soil (0.25-0.91 and 0.23-0.88 per cent) respectively, calcium carbonate were moderately high to high in category. The soil of Dhamangaon and Chandur block were very low to low in category (113.00-235.00 kg ha⁻¹) and (106.52-223.25 kg ha⁻¹) respectively, for available nitrogen, low to moderately high for phosphorus (13.47-25.10) for Dhamangaon block and medium to moderately high for Chandur block (17.55-22.22). Whereas, soil of Dhamangaon block were high to very high (205.00-400.00) for available potassium and Chandur block were moderately high to very high (280.00-406.00), respectively. The soils of Dhamangaon block were medium to high in available sulphur (11.77-20.10 mg kg⁻¹) and Chandur block were low to moderately high (9.89-18.32 mg kg⁻¹).

Keywords: Physico-chemical properties, macro nutrient

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]. Soil testing is important to recommend the fertilizer doses based on fertility status of soil to get good production. It provides information about nutrient availability of soil upon which fertilizer recommended for maximizing crop yield. The crop production is mainly depending on the fertility status of soil. The physico-chemical properties of soil are important for the availability of nutrients in soil and thereby 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. Macronutrients (N, P and K) are important soil elements that control its fertility. For the sustainable agricultural production the information on soil characterization in relation to fertility status of the soils of the region will be useful. Therefore, the present investigation was undertaken to study the physico-chemical properties and available nutrient status of cotton growing soil in Amravati district of Maharashtra.

Materials and Methods

The research work entitled “Assessment of soil fertility status of cotton growing soil in Dhamangaon and Chandur block 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).

Soil texture was determined by Bouyoucos hydrometer method described by Bouyoucos (1936). The soil pH was determined by digital pH meter using glass electrodes and 1:2.5 soil: water ratio as described by Jackson (1973) [4]. Electrical conductivity (EC) was determined with conductivity meter using 1:2.5 soil: water suspension as described by Jackson (1973) [4].

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Organic carbon was determined by Walkley and Black (1934) [15] method as described by Jackson (1973) [4]. Calcium carbonate was estimated by rapid titration method using phenolphthalein indicator as described by Piper (1966) [9]. Available nitrogen was determined by alkaline permanganate method as described by Subbiah and Asija (1956) [12]. The available phosphorus was determined by using Olsen's reagent 0.5 M NaHCO₃ (pH 8.5) as extractant by using spectrophotometer (Jackson, 1973) [4]. Available potassium extracted from the soil by using neutral normal ammonium acetate solution and estimated with using flame photometrically as per Jackson (1973) [4]. The available sulphur estimated turbidimetrically using spectrophotometer described by Piper (1966) [9].

Results and Discussion

Soil Physical Properties

The particle size distribution showed that, the soils had fairly high amount of clay (Table 1), it varies from village to village. Basalt, being the parent material of these soils is known to produce higher amount of clay. The soils of selected areas are developed on basaltic parent material and the soil developed on basalt produces the high amount of clay on weathering (Eswaran *et al.*, 1988) [2].

Table 1: Soil texture and textural class of selected villages of Amravati district

Name of villages	Sample No.	Sand (%)		Silt (%)		Clay (%)		Textural Class
		S	SS	S	SS	S	SS	
Dhamangaon								
Naygaon	1	15.8	14.8	30.1	24.6	54.4	66.8	Clay
Mangrul	2	12.5	11.8	25.8	24.9	61.7	63.9	Clay
Dighi	3	16.2	15.9	26.2	27.2	57.6	56.9	Clay
Chandur								
Dhanodi	4	18.7	18.2	26.8	25.4	54.5	56.4	Clay
Supalwada	5	17.2	16.2	24.3	26.2	59.5	57.6	Clay
Nimgavan	6	20.5	18.7	24.8	26.8	54.7	54.5	Clay

Where, S= Surface and SS= Subsurface

Soil chemical properties

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. Maximum soil samples of Amravati district were found neutral to moderately alkaline in nature by the study of Katkar *et al.*, (2019) [5]. 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. The result shows that, the salinity hazard does not exist in selected study area. Katkar *et al.*, (2019) [5] 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. The higher organic carbon content was obtained at surface and declined progressively with depth. Similar result were also recorded by Khandagale *et al.*, (2019) [6] 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.

Macronutrient status

Nitrogen

The available nitrogen in the surface and subsurface soil of Dhamangaon ranges from 113.00 to 235.00 and 106.52 to 223.25 kg ha⁻¹ with the mean value 165.00 and 152.48 kg ha⁻¹, respectively. The available nitrogen in surface and subsurface soil of Chandur block varies from 113.00 to 223.00 and 106.52 to 182.22 kg ha⁻¹ with the mean of 164.00 and 142.51 kg ha⁻¹, respectively. The available N was found to be relatively higher in surface horizons over sub surface horizons, which might possibly be due to decreasing trend of organic carbon with depth (Rajeshwar and Mani 2013) [10].

Phosphorus

Study of available P in selected study area revealed that, in the surface and subsurface soil of Dhamangaon block the available P ranges from 13.47 to 25.10 and 11.18 to 22.22 kg ha⁻¹ with the mean of 19.74 and 16.92 kg ha⁻¹, respectively. While in Chandur block it ranges from 17.55 to 22.22 and 14.47-19.94 kg ha⁻¹ with mean of 19.91 and 17.35 kg ha⁻¹ respectively. Which is under low to medium category. Similarly, the soils of Nagpur district are also low to medium in available phosphorus. (Thombe *et al.*, 2020) [13].

Potassium

The available K in surface soil of Dhamangaon and Chandur block were ranges from 205.00 to 400.00 and 280.00 to 406.00 kg ha⁻¹ with mean of 357.19 and 350.26 kg ha⁻¹ respectively, while in subsurface soil it varies from 220.57 to 376.60 and 331.01 to 406.67 with a mean of 330.61 and 331 kg ha⁻¹, respectively. The value of available potassium ranged in moderately high to very high in study area of Amravati district. Waikar *et al.*, (2014) [14] recorded Central farm, MKV, Parbhani were found sufficiently supplied with available K. This may be due to occurrence of potash rich minerals like mica and feldspar the available K was high Malewar, (1995) [7] and More *et al.*, (2013) [18].

Sulphur

Sulphur is required for synthesis of S-containing amino acids cystine, methionine and cysteine, and these are essential components of protein that comprise about 90 per cent of the total S in plants (Havlin *et al.*, 2010) [3]. The sulphur in surface soil ranges from 11.77 to 20.10 and 9.89 to 18.32 mg kg⁻¹ with the mean of 15.94 and 15.05 mg kg⁻¹, respectively in Dhamangaon and Chandur block, while in subsurface soil it varies from 10 to 18.22 and 8.67 to 17.06 mg kg⁻¹ with the mean of 14.40 and 13.80 mg kg⁻¹, respectively.

Table 2: Distribution of surface and sub-surface soil pH, EC, OC and CaCO₃ 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 3: Distribution of surface and sub-surface soil N, P, K and S of Dhamangaon and Chandur block in Amravati District.

Sample No.	N		P		K		S	
	S	SS	S	SS	S	SS	S	SS
Dhamangaon								
Naygaon								
1.	113.00	106.52	15.21	12.42	332.09	328.95	11.99	12.00
2.	166.12	159.94	19.50	17.94	379.00	358.00	18.16	17.61
3.	130.09	122.30	17.00	15.78	352.87	338.76	16.06	15.51
4.	170.00	153.49	19.00	13.20	331.98	304.67	13.97	12.11
5.	231.34	223.25	25.10	22.22	400.00	376.60	20.01	18.22
Mangrul								
6.	225.81	209.44	23.70	20.35	380.21	340.81	19.00	17.49
7.	145.32	133.49	16.03	13.47	335.90	220.57	13.60	11.54
8.	115.22	108.52	21.64	19.94	365.76	342.28	16.54	15.50
9.	117.45	113.52	13.47	11.18	305.22	284.97	12.11	10.23
10.	177.00	155.44	20.70	17.80	355.45	350.00	17.50	16.06
Dighi								
11.	235.05	207.76	25.02	18.67	388.00	369.60	18.89	15.45
12.	170.00	156.69	17.67	15.80	335.34	319.95	11.77	10.00
13.	132.32	122.89	21.52	18.48	358.86	334.76	14.52	13.64

14.	186.00	163.43	19.22	16.77	382.00	347.70	18.11	16.71
15.	159.94	150.53	21.40	19.82	355.21	341.57	16.95	15.39
Range 113-235 106.53- 13.47- 11.18- 205- 220.57- 11.77- 10-18.22 223.25 25.10 22.22 400 376.60 20.10								
Mean 164.97 152.48 19.74 16.92 357.19 330.61 15.94 14.49								
CHANDUR								
Dhanodi								
16.	210.00	180.11	21.52	18.82	340.00	312.38	17.72	14.61
17.	138.00	131.71	20.24	17.30	348.80	331.67	14.88	16.06
18.	155.22	137.89	19.00	17.32	328.32	309.55	17.00	14.41
19.	162.22	146.03	19.77	17.33	360.99	338.59	15.62	13.91
20.	177.00	125.44	19.88	17.54	360.34	345.76	15.95	13.73
Supalwada								
21.	178.75	159.94	21.64	19.94	378.08	358.81	17.8	15.72
22.	159.94	146.8	21.40	19.82	365.12	331.58	18.16	16.50
23.	134.85	128.58	19.88	17.53	355.67	406.67	16.06	15.62
24.	189.00	155.32	21.40	18.11	348.65	291.99	18.32	17.06
25.	223.00	182.22	22.22	18.12	387.44	366.8	18.00	16.94
Nimgavan								
26.	120.00	108.52	17.55	14.82	296.02	278.33	9.89	8.72
27.	155.90	133.62	19.07	16.04	358.86	334.95	13.31	12.42
28.	178.22	151.52	18.55	14.47	406.67	382.76	10.00	8.89
29.	160.00	143.49	19.07	17.32	338.05	313.44	13.20	12.53
30.	113.01	106.52	17.55	15.80	280.98	262.00	9.89	8.67
Range	113-223	106.52-182.22	17.55-22.22	14.47-19.94	280-406	331-406.67	9.89-18.32	8.67-17.06
Mean	163.67	142.51	19.91	17.35	350.26	331	15.05	13.81

Where, S= Surface and SS= Sub-Surface

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