



Original Research Article

<https://doi.org/10.20546/ijcmas.2021.1003.008>

Evaluation of Physico-chemical Properties in Hot Semi-arid Eco-region of Beed District, Maharashtra (India)

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ABSTRACT

To meet the increasing requirement of ever increasing population the judicious use of available natural resources with respect to its potential of supply of nutrient and elements is soil which vital natural resource. In the current scenerio the study of soil fertility status with physico chemical properties has increased markedly because deficiency of major and micronutrient occurs frequently which might be happened due to continuous and intensive multiple cropping with the use of high yielding cultivars which may have higher demand for nutrient also use of fertilizer that have high analysis fertilizer with small amount of macro and micronutrient contamination fertilizer e.g. animal manures ,crop residues ,compost also use of soils that are inherently low in nutrient reserves and induced natural and anthropogenic factors which are limited to supply the adequate plant nutrient and turns nutrient imbalance. Hence, Evaluation of Soil Fertility Status. In Hot Semi-Arid Eco-Region of Beed District, Maharashtra (India) research was undertaken to know the need of judging fertility status of Beed area. An investigation was carried out for 440 representative soil samples selected from 11 tahsils of Beed district of Maharashtra state in 2019 -2020 by using method of Yadav and Khanna for collection of soil sample. Soil samples were tested for physico chemical properties i.e. pH, Ec (electrical conductivity). O.C, (Organic carbon), CaCO₃ (calcium carbonate), macro nutrients N, P, K, and S and micro nutrient Zn, Fe, Cu, Mn and B. Where the analysed values show pH range upto 7.66 with average values 6.95 -8.78 i.e. slightly neutral to slightly alkaline, conductivity with range 0.35 in average of 0.09-0.99 in suitable ranges of germination, organic carbon ranges 5.25 having average of 1.0- 12.4, calcium carbonate ranges 118.87 while average values 83.2-163.6 some calcareous to non calcareous soils. Macro nutrient as ranges from 142.35, 21.17, 537.72 and 34.27 for Avail. N, P, K and S respectively nitrogen lies in low to medium, phosphorous medium range while potassium in high ranges with sufficient sulphur. From this investigation its seen that at low nutrient status different places of the Beed district also having medium to high mineral contents and at some places, to maintain fertility of soil farmers have to open eye for good land and crop yield.

Keywords

pH, Electrical conductivity, Calcareousness, Macro and Micro Nutrients ,Soil fertility, Latitude , Longitude

Article Info

Accepted:

04 February 2021

Available Online:

10 March 2021

Introduction

In India more than 58 per cent of population depends on agriculture. Soil is the most vital

natural resource of the nation and it is the exclusive source of infinite living organisms which supports the life of crop plants by acting as a medium for growth along with

providing nutrients, air and water. Soil fertility plays a key role in increasing crop production in the soil. It comprises not only supply of nutrients but also their efficient management. Now a days fertility status of soil decreases day by day due to ever increase in human population, intensive cultivation, land degradation and desertification. Every inch of arable land has already been utilized to the maximum extent. The optimal management of these resources with minimum adverse effect on environment is essential.

Hence, assessment of available nutrient status of soils that are intensively cultivated needs to be carried out. Soil testing is usually followed by collecting the soil samples in the fields. Soil available nutrients status of an area using latitude and longitude will help in formulating site specific balanced fertilizer recommendation to understand the status of soil fertility and also helpful for adopting a rational approach compared to farmers - practices or blanket use of recommended fertilization, but also reduce the necessity for elaborate plot-by-plot soil testing activities (Gurumurthy *et al.*, 2019).

Experimental area

A broad soil survey comprising 440 soil samples from 11 taluk as of Beed district of Maharashtra state was carried out. Sample selection was random. From Each taluka 40 farmer were selected from 88 villages (Table 1). Representative soil sample up to depth of 20 cm was collected by adopting procedure outlined by Yadav and Khanna (1956). The collected soil sample were processed and analyzed by adopting the recommended procedure for soil pH,, Electrical conductivity, organic carbon Avail. Nitrogen, Avail. Phosphorous, Avail. Pottasium, Avail. sulphur. They were tabulated as presented in Table No 2.

Materials and Methods

This topic was undertaken in order to know various physicochemical properties, available nutrient status in the soil of Beed District of Maharashtra. The materials used and method adopted are discussed in this chapter as following.

Results and Discussion

The evaluation of soil fertility status was carried out determining the soil properties viz., Soil pH, Ec, organic carbon, calcium carbonate content and avail. nutreint status viz, Nitrogen, Phosphorous, Potassium and Sulphur. The results are presented in Table 3 are interpreted and discussed below.

Soil pH: The data presented in Table 3 indicated that the soil pH of Beed district varied between 6.95 and 8.78 with an average of 7.66 these shows the soils are tender to have alkaline soil reaction. The alkaline soil pH range in the present survey is because of alkaline basic parent material i.e Basaltic alluvium. Basaltic alluvium parent material rich in ferromagnesium mineral which on decomposition release basic cations which forms salts, further sub tropical climate with high evaporation rate with low rainfall leach there salts in soil profile which tends to reach upper soil layer in by capillary movement Similar findings with Jibhakate *et al.*, (2009).

Electrical conductivity: Total soluble salt concentration is represented by E.C. The EC values in the present study varied between 0.09 to 0.99 dSm^{-1} with an average of 0.35 dSm^{-1} .there values in accordance with study conducted by Dhamak *et al.*, (2014).They Also Observed that this soil EC values were varied between 0.1 and to 0.65 as categorized on safe for crop production. In general soils of Beed district soils taxonomically fall in Entisol or Inceptisol order with good drainage

and hence even with soils are derived from basaltic alluvium the salt concentration could not reach to the level of crop injury.

Organic carbon: Organic carbon is the backbone of crop production or soil quality. Its content in Beed district was observed 1.00 to 12.40 g kg⁻¹ with average value of 5.25 g kg⁻¹. The soils found to be very low to

medium in organic carbon content. This might be because of shallow or eroded soil observed in this area. Further organic carbon content was low because of high temperature and low moisture content. These two climatic parameters hasten the oxidation of organic carbon present in organic matter in these soils. These results are in accordance with Dhamak *et al.*, (2014).

Table.1 Details of soil sample collected from Beed district

Sr .No	Name of Taluka	No of Villages	No Of Farmer /soil sample	Location	
				Latitude	Longitude
1	Ambajogai	8	40	18° 42' 55.9584"	76°23 28' . 626"
2	Ashti	8	40	18°48' 37.6416"	75°1009' .6888"
3	Beed	8	40	18°59' 24.3168"	75°45 11' .2752"
4	Dharur	8	40	18°48' 57.2508"	76°0627' . 4572"
5	Georai	8	40	19°15' 26.8344"	75°4537' . 4544"
6	Kaij	8	40	18°42' 51.2496"	76°0351' . 7608"
7	Majalgaon	8	40	19°09' 52.794"	76° 12 16' . 038"
8	Parali	8	40	18°50' 43.1412"	76°3111' . 4456"
9	Patoda	8	40	18° 03' 56.664"	76°1349' .9116 "
10	Shirur kasar	8	40	19°03' 45.1836"	75°2540' . 0152"
11	Wadawani	8	40	18°59' 24.4392"	76°0228' . 9212"
Total	11		440		

Table.2 Methods of soil analysis

Sr. No.	Particulars	Method	References
Physico-chemical properties			
1.	pH (1:2.5)	Digital pH meter	Jackson (1973)
2.	EC (dSm ⁻¹)	Conductivity meter	Jackson (1973)
4.	Organic carbon (g kg ⁻¹)	Walkley and Black's Wet oxidation method	Piper (1966)
5.	CaCO ₃ (%)	Rapid titration method	Jackson (1973)
Soil fertility status			
6.	Available N(Kg ha ⁻¹)	Alkaline permanganate method	Subbiah and Asija (1956)
7.	Available P ₂ O ₅ (Kg ha ⁻¹)	NaHCO ₃ (0.5M) pH 8.5 Calorimetrically	Olsen <i>et al.</i> (1954)
8.	Available K ₂ O (Kg ha ⁻¹)	1N NH ₄ OACFlame photometry	Hanway and Heidel (1952)
9.	Available Sulphur	0.15% CaCl₂ solution	Williams and Steinberg (1969)

Table.3 Mean and range values of soil properties of different tahsils of Beed district

Sr, No.	Name of Taluka	No. Of samples	Soil properties			
			pH	EC dSm ⁻¹	OC g kg ⁻¹	CaCO ₃ g kg ⁻¹
1	Ambajogai	40	7.1-8.0 (7.58)*	0.1-0.51 (0.23)*	3.2-9.1 (4.47)*	90-142.3 (121.0)*
2	Ashti	40	7.14-7.96 (7.51)	0.25-0.99 (0.70)	1.0-6.5 (2.12)	93-163.5 (126.96)
3	Beed	40	8.28-8.51 (8.45)	0.13-0.86 (0.27)	3-8.9 (5.15)	101.3-142.3 (116.75)
4	Dharur	40	7-7.65 (7.14)	0.10-0.69 (0.23)	4-0-9.8 (6.73)	100-163.6 (123.28)
5	Georai	40	7.2-8.2 (7.59)	0.09-0.19 (0.157)	2.9-8.6 (5.46)	95.6-140 (113.81)
6	Kaij	40	8.11-8.78 (8.48)	0.25-0.52 (0.34)	2.0-7.8 (4.44)	96.6-142.6 (116.39)
7	Majalgoan	40	6.95-7.87 (7.38)	0.17-0.54 (0.21)	3.2-8.9 (5.3)	102.2-142.6 (122.09)
8	Parali	40	7-7.9 (7.57)	0.21-0.96 (0.41)	1.1-12.4 (6.0)	92.3-132.6 (111.94)
9	Patoda	40	7.5-7.7 (7.54)	0.20-0.32 (0.24)	3-8.2 (5.42)	95.6-142.6 (116.45)
10	Shirur kasar	40	7.2-7.8 (7.5)	0.1-0.31 (0.90)	4.2-9.9 (7.4)	83.2-142 (117)
11	Wadawani	40	7.38-7.84 (7.61)	0.14-0.53 (0.24)	3.6-8.9 (5.29)	102.3-143.2 (122.0)
Range			6.95-8.78	0.09-0.99	1.0-12.4	83.2-163.6
Mean			7.66	0.35	5.25	118.87

Figures in the parenthesis indicates mean values

Table.4 Mean and range values of available soil macro nutrients of different tahsils of Beed district

Sr, No.	Name of Taluka	No. Of samples	Available Macro nutrients kg/ ha ⁻¹			
			N	P	K	S
1	Ambajogai	40	101.24- 199.21 (183.95)*	6.36- 22.39 (12.24)	359.09- 665.38 (589.56)	4.25-9.99 (5.76)
2	Ashti	40	37.63- 150.54 (115.90)	7.10- 17.35 (10.01)	214.2- 967.82 (403.99)	25.62-167.30 (93.86)
3	Beed	40	58.39- 131.71 (98.10)	42.67- 64.83 (55.00)	170.65- 522.81 (438.57)	14.33-86.50 (46.64)

4	Dharur	40	124.25-167.34 (142.40)	6.36-29.56 (15.57)	506.96-760.44 (623.59)	7.57-11.51 (8.67)
5	Georai	40	17.25-134.1 (61.63)	16.23-68.81 (50.71)	60.2-979.06 (594.64)	4.99-87.09 (46.59)
6	Kaij	40	104.97-194.71 (153.63)	9.9-21.29 (14.73)	176.8-828.8 (671.38)	25.87-155.16 (69.34)
7	Majalgoan	40	159.9-235.2 (202.73)	3.05-18.28 (7.98)	197.1-1023.7 (466.7845)	10.17-38.52 (23.71)
8	Parali	40	101.24-532.36 (168.27)	5.48-25.36 (15.27)	125.25-665.38 (556.86)	5.73-121.43 (23.48)
9	Patoda	40	124.31-156.41 (142.26)	3.62-17.54 (11.06)	464.71-686.5 (561.30)	8.10-8.98 (8.49)
10	Shirur kasar	40	110.33-153.44 (128.9)	16.23-31.58 (23.1)	433.03-887.26 (570.9)	3.24-5.93 (4.9)
11	Wadawani	40	128.6-194.4 (168.13)	5.82-33.78 (17.22)	287.8-676.5 (437.45)	13.66-74.81 (45.58)
Range			17.25-532.36	3.05-68.81	125.25-1023.7	3.24-155.16
Mean			142.35	21.17	537.72	34.27

Figures in the parenthesis indicates mean values

Calcium carbonate: The data on CaCO_3 are reported in Table 3 which shows that Soils are calcareous to to highly calcareous in nature. Patil *et al.*, (2014) reported that nearly 42 percent soils of Marathwada region are calcareous in nature. This Might be due to precipitation and accumulation of calcium and magnesium carbonate in the soil due to high evaporation rates observed in this area (Table 4).

Avail. nitrogen: The available nitrogen content of Beed District was found between 17.25 to 532.30 Kg ha^{-1} with an average of 142.35 kg ha^{-1} avail nitrogen. This shows that these soils are very deficient in avail Nitrogen can be attributed to low available carbon

status observed in this area. Chalwade *et al.*, (2006) also reported that low Avail. Nitrogen content in the soils of Marathwada region.

Available phosphorous: Availability of phosphorous is mainly governed by Soil pH and calcium carbonate content of soil. In the present investigation low availability of Avail. Phosphorous is mainly due to these two parameters. soil with pH more than 7.5 and CaCO_3 content more than 5.0 %. These type of results were also reported by Chaudhari *et al* (2018).

Avail. potassium: In case of Avail. K the soils of Beed district were found sufficiently supplied with avail. K with range of 25.25 to

1023.7 kg ha⁻¹ with average K value 537.72 kg ha⁻¹. This may be due to Occurrence of Potash rich mineral like Mica and Feldspar the Avail. K was high this findings were proved by Malewar *et al.*, (1995).

Avail. sulphur: The avail sulphur content was varied from 3.24 to 155.16 kgha⁻¹ with average of 34.27 kg ha⁻¹. These findings are similar with Patil *et al.*, (1994). They revealed that 64 % soils of oilseed growing tract of Marathwada region were sufficient in S as 36 % soils deficient in avail S. In Beed district as low on 3.24 kgha⁻¹ avail. S was noticed. This might be due to shallow course textured soil, low in clay content hastened the leaching of sulphate and sulphur.

Acknowledgment

Authors acknowledge the facilities provided by Agriculture college Ashti Dist Beed, and GKU, Talwandi (saboo), Bathinda (PJ).

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How to cite this article:

Shinde Rajshri, G. S. Sidhu, V. D. Patil and Monika Naphade. 2021. Evaluation of Physico-chemical Properties in Hot Semi-arid Eco-region of Beed District, Maharashtra (India). *Int.J.Curr.Microbiol.App.Sci.* 10(03): 45-51. doi: <https://doi.org/10.20546/ijcmas.2021.1003.008>