EVALUATION OF PHYSICO-CHEMICAL PROPERTIESAND MICRONUTRIENT STATUS IN HOT SEMI-ARID ECO-REGION OF BEED DISTRICT, MAHARASTRA (INDIA)

[1]Rajshri Shinde, [2]G. S.Sidhu, [3]V. D. Patil,[4]Monika Naphade.

[1]Ph.D Scholar ,Guru Kashi University Talwandi Sabo,Bathinda Panjab .,[2] Dean,College of Agriculture, Guru Kashi University, Talwandi Sabo ,Bathinda, Punjab, India.[3]Ex.Director of Instruction and Dean VNMKV Parbhani.(MH)[4]Associate Professor, DUPCA, Jalgaon. MPKV, Rahuri (MH)

University College of Agriculture,

Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India.

Abstract:To meet the requirement of ever population the judicious use of available natural resources with respect to its potential supply of nutrients and elements from soil as vital natural resource is very important. In the current scenario 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 fertilizers. Less use of 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, studies on evaluation of Soil Fertility Status in Hot Semi-Arid Eco-Region of Beed District, Maharastra (India was undertaken to know the need for assessment of fertility status of Beed area.

An investigation was carried out for 440 representative soil samples selected from 11 tehsils of Beed district of Maharashtra state in 2019 -2020 by using standard methodology for collection of soil sample. Soil samples were tested for physico chemical properties i.e.pH, EC.O.C, ,$CaCO_3$, ,macro nutrients N,P,K,, S,and micro nutrients Zn,Fe,Cu,Mn and B. The analysed values showed pH range up to 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 up to 5.25 having average of 1.0- 12.4, calcium carbonate ranges 118.87 while average values 83.2-163.6 indicate existence of calcarious to non calcareous soils. The soils from Beed district were found very low to moderate in zinc and iron with 0.12 -2.88 mg kg^{-1} and 0.05-17.54 mg kg^{-1} range , respectively. However available DTPA-Extractable copper , manganese and available boron content observed moderate to sufficient in range of 0.26 -13.82,0.92-17.25 and 0.08-26.73 mg kg^{-1}, respectively. Hence it is observed that zinc availability is very low which depend on parent material, organic matter, and the availability of zinc decreased with increase in pH, organic carbon and $CaCO_3$ content From this investigation it is deduced that low medium to high nutrient status was found in different sitess of the Beed district., To maintain fertility of soil, farmers have to tested their soils to obtain good crop yield.

Index Terms: pH, Electrical conductivity, Calcareousness, Macro and Micro Nutrients , Soil fertility, Latitude , Longitude DTPA –extractable .

I Introduction

In our country 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. Fertility status of soil decreasing day by day due to ever increasing 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 geocoded 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).

II Experimental Area

In total 440 soil samples from 11 talukas of Beed district of Maharashtra state was collecetd systematically based on available soil survey data base.. Sample selection was random. From each taluka 40 farmers were selected from 88 villages (Table 1). Representative soil samples up to depth of 20 cm were collected by adopting procedure outlined by Yadav and Khanna (1956).The collected soil samples were processed and analyzed by adopting the recommended procedure for soil pH, ,Electrical conductivity, organic carbon, calcium carbonate. Micro nutrient zinc, iron, copper, manganese and available boron. etc.

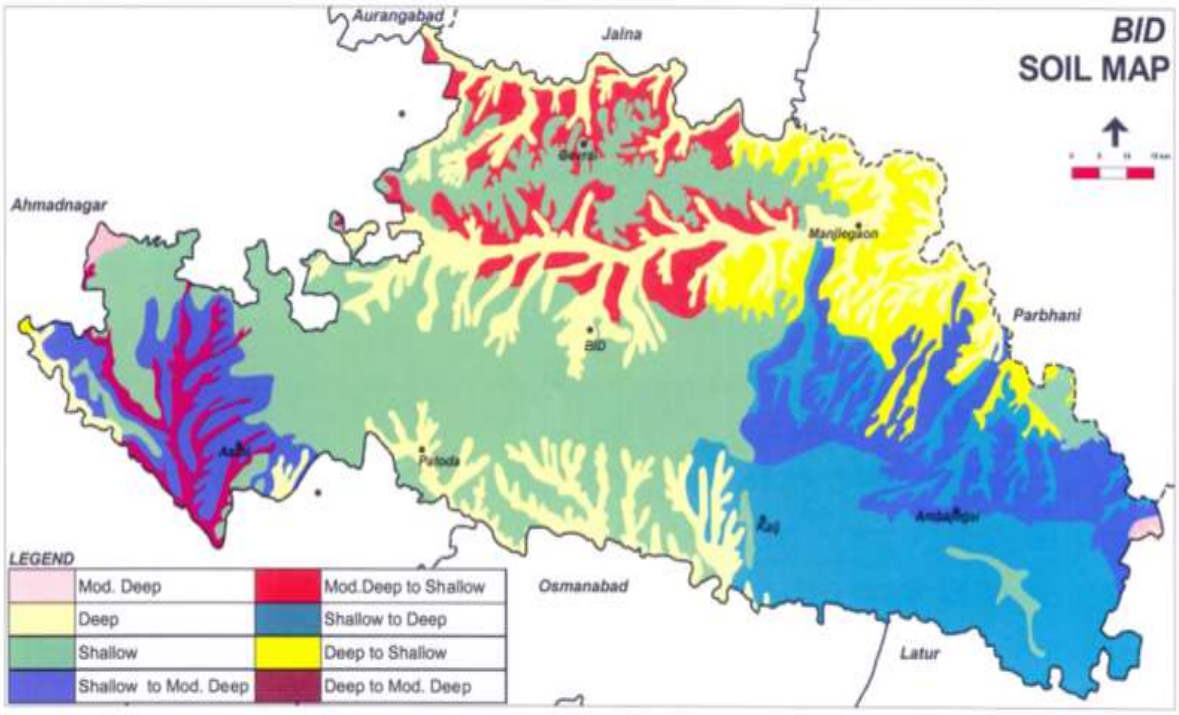

Fig 1 Soil map of Beed district Source: ICAR-NBSS &LUP , Nagpur

Table No. 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	Majalgoan	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		

III MATERIAL AND METHOD

The present studies were undertaken in order to know various physicochemical properties, available micro nutrient status in the soil of Beed District Of Maharashtra. The materials and method adopted are discussed here as following.

Table No 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		
9.	Available Micronutrient- Fe, Mn, Zn and Cu (mg Kg^{-1})	Extracted with DTPA using Atomic Absorption Spectrophotometer	Lindsay and Norvell (1978)

IV RESULT 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 Micro nutrient zinc ,iron, copper ,manganese and avaiable. boron. The results are presented in Table 3& 4 are interpreted and discussed .

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

Soil pH:

The data presented in Table 3 indicated that the soil pH of Beed district varied between 6.95 to 8.78 with an average of 7.66. Data shows that 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 these salts in soil profile which tends to reach upper soil layer by capillary movement. Similar findings were also reported by 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}. These values are in accordance with study conducted by Dhamak *et al* (2014).They also observed that soils EC values were varied between 0.1-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 soils are derived from basaltic alluvium the salt concentration could not reach to the level of crop injury.

Organic Carbon: Organic carbon is the back bone of crop production or soil quality .Its content in Beed district was observed between 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 parameter hasten the oxidation of organic carbon present in organic matter in these soils .These results are in accordance with Dhamak *et al* (2014).

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 Mean and range values of available soil micro nutrients of different tahsils of Beed district.

Sr, No.	**Name of Taluka**	**No. Of samples**	**Available micronutrients mg kg^{-1}**				
			Zn	**Fe**	**Cu**	**Mn**	**B**
1	Ambajogai	40	0.14-0.74 (0.63)*	0.56-2.65 (1.70)	0.81-2.71 (1.36)	9.44-12.61 (11.07)	0.86-3.06 (1.67)
2	Ashti	40	0.27-1.80 (1.00)	1.42-17.54 (8.98)	0.26-0.98 (0.68)	2.84-14.33 (8.17)	2.49-5.32 (3.07)
3	Beed	40	0.14-0.46 (0.247)	0.05-1.4 (0.639)	1.34-4.49 (2.60)	2.66-8.32 (6.05)	3.68-26.73 (7.96)
4	Dharur	40	0.26-0.98 (0.53)	0.44-2.44 (1.48)	0.67-3.11 (1.90)	2.41-13.20 (10.50)	2.31-3.37 (2.55)
5	Georai	40	0.12-1.57 (0.68)	0.15-4.53 (1.65)	1.11-4.6 (1.84)	2.11-11.44 (4.67)	0.63-2.54 (1.20)
6	Kaij	40	0.12-0.38 (0.24)	0.14-4.41 (2.92)	3.46-13.82 (7.16)	0.92-4.3 (3.18)	0.08-1.04 (0.31)
7	Majalgoan	40	0.2-0.46 (0.33)	1.28-4.02 (2.15)	1.2-3.82 (2.41)	2.56-17 (11.53)	0.09-0.42 (0.25)
8	Parali	40	0.24-0.74	0.56-	0.81-	9.45-	1.95-

			(0.58)	2.61 (1.27)	2.71 (1.70)	17.25 (11.37)	9.35 (2.76)
9	Patoda	40	0.94-2.88 (1.93)	1.51-2.44 (2.20)	1.60-2.74 (2.13)	9.56-12.61 (11.34)	2.31-2.88 (2.54)

Figures in the parenthesis indicates mean values

DTPA-Extractable Zinc :

The **DTPA-Extractable** Zinc in soils of Beed District ranged from 0.12-2.88 mg kg^{-1} with average value (0.65 mg kg^{-1}). Very low content of DTPA-extractable zinc found in Georai And Kaij (0.12 mg kg^{-1}) tahsil respectively, while highest values in Patoda Tahsil (2.88 mg kg^{-1}).The availability of micronutrient cations is generally low in alkaline soils and crops grown on these soils suffer from hidden hunger (Malewar 2005).

DTPA- Extractable Iron

The variation also noticed in DTPA-Extractable Iron which is ranged from (0.05-17.54 mg kg^{-1} in Beed district with mean value 2.44 mg kg^{-1}. .Maximum samples are in low to moderate category indicating that the soils are becoming deficient in DTPA-extractable Iron followed by Zinc. Patil.2004 reported 40.0 and 34.7 % soils are deficient in Zinc and Iron, respectively in Vidarbha region of Maharashtra state. The deficiency of nutrient create imbalance in soils which results into nutritional stress in plants (Malewar ,2005).

DTPA-Extractable Manganese

Status of DTPA-extractable Mn varied from 0.92-17.25 mg kg^{-1} having average value 8.89 mg kg^{-1}.The soil sample shows sufficiency in available DTPA-extractable Mn because all the values of soil samples are in moderately high to high category. It has been reported that soils with good organic matter content have high chelating action of organic compounds released during decomposition which prevent cations from fixation , precipitation, oxidation and leaching (Babu et al 2007). Gajbhe et al (1976) also revealed that available Mn content in surface soil of Marathwada ranged from 13.3-65.20 mg kg^{-1}.

DTPA-Extractable –Copper

The soil samples from Beed district shows range values of DTPA-extractable Cu from 0.26-13.82 mg kg^{-1} with mean value (2.37 mg kg^{-1}).where similar results by Patil and Sonar (1994) stated that in swell shrink soils of Maharashtra ,available copper was in range of 0.58 to 1.7 mg kg^{-1}. Like wise soils of Beed district shows sufficiency in available copper in soil samples. . The maximum amount of DTPA-Cu in surface layer might be due to higher biological activities and chelating effect (Kadao et al. 2002; Jibhakate et al. 2009).

Available Boron

The $CaCL_2$ –B in soils of all the tahsil ranged from moderate to very high which is ranged from 0.08-26.73 mg kg^{-1}.with mean value 2.19 mg kg^{-1} .The range of avail Boron content varios at different pH values i.e It shows Boron content increases with increasing pH values similar findings were also reported by Mathur (1964).

V Conclusion

The data summarises from above tables that the soils of Beed District were neutral to alkaline in reaction with safe limits for germination, low to moderate in organic carbon and calcareous to non calcareous in nature. Also the data on DTPA-extractable micronutrient content averagely lowest for Zinc and iron higher values were found for Mn, Cu and Boron in most of soils which might be due to higher clay and organic matter content in these soils . While micronutrient content increases with textural fineness and organic carbon content of project area.

VI Acknowledgment:

The author is thankful to Dr G.S.Sidhu Dean , College of Agriculture GKU, Talwandi Sabo Bathinda Dr. V.D. Patil ex. Director of Instruction and Dean VNMKV, Parbhani, Maharashtra for their valuable guidance and constant encouragement. Authors acknowledge the facilities provided by Agriculture College Ashti. Dist Beed, and GKU, Talwandi (Sabo).Bathinda (Pb).

REFERENCES

1. Babu, M.V.S., Reddy, M.C., Subramanyam, A. and Balaguravaih, D. (2007). Effect of integrated use of organic and inorganic fertilizers on soil properties and yield of sugarcane. Journal of the Indian Society ofSoil Science **55**, 161-166.
2. Black, C.A. (1965). "Method of Soil Analysis. ASA. Inc. Madison,Wis., USA.
3. Dhamak A.L.*, N. A. Meshram and S. L. Waikar (2014) Identification of Major Soil Nutritional Constraints in Vertisol, Inceptisol and Entisol from Ambajogai Tahsil of Beed District Journal of Research in Agriculture and Animal Science Volume 2 ~ Issue 10 (2014) pp: 35-39 ISSN(Online) : 2321-9459.
4. Dhamak A L *, N. A. Meshram and S. L. Waikar (2014) Comparative Studies on Dynamics Soil Properties and Forms of Sulphur in Oilseed Growing Soils of Ambajogai Tahsil of Beed District. IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) Volume 7, Issue 12 Ver. II (Dec. 2014), PP 98-102
5. Gajbhe M.V.,M.G.Lande and S.B Varade (1976). Soils Of Marathwada. Journal of Maharashtra Agriculture Universities 1,55-59.
6. K.T. Gurumurthy*, D. Balaji Naik, D. Ravikumar, Ganapathi, A.N. Raghu, S. Raghavendra, G.N. Thippeshappa, H.S. Sindhu and Anantakumar Patil Evaluation of Soil Fertility Status of Macronutrients and Mapping in Beguru Micro watershed of Tarikere Taluk of Chikkmagaluru District, Karnataka, India. Int.J.Curr.Microbiol.App.Sci (2019) Special Issue-9: 223-229.

7. Jackson, M.L. (1973) "Soil Chemical Analysis, Prentice Hall of India Pvt. Ltd., New Delhi.

8. Jibhakate, S.B., Bhende, S.N., Kharche, V.K. and Sevalakshmi, V. (2009). Physico-chemical status of soils of Katol tahasil in Nagpur district. J. Soils & Crops, 19(1) : 122-128.

9. Mathur, C.M., Moghe, V.B. and Talati, R.A. (1964) Distributionof boron in soils of western Rajasthan irrigated with high boron water. Journal of the Indian Society of Soil Science **12**, 319-324.

10. Jibhakate, S.B., Raut, M.M., Bhende, S.N. and Kharche, V.K. (2009) Micronutrient status of soils of Katol tahasil in Nagpur district and their relationship with some soil properties. Journal of Soils and Crops, 19 : 143-146.

11. Kadao, S.H., Prasad J. and Gajbhiye, K. S. (2002) Micronutrients status in Banana growing soils of Wardha district of Maharashtra. Journal of Maharashtra Agricultural University, 27 : 117-119.

12. Lindsay, W.C. and Narvell, W.L.(1978)Development of DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Soc. Amer. J. 42:421-428.

13. Malewar,G.U.,(2005). Micronutrient stresses in soils and crops :Serious sickness and clinical approaches for sustainable agriculture ,Journal of the Indian Society of Soil Science 53,484-499.

14. Patil D.B.,Bharambe P,R.,Deshmukh P.W.,Rane P.V and Guldekar S.V.(2004).Micronutrient status in soils of Vidharba.Technical Bulletin Dr.P.D.K.V Akola.

15. Patil V D. 2014. Soil Map of Marathwada. Published by Head, Dept. Soil Science and Agril. Chemistry, VNMKV, Parbhani.

16. Patil Y.M. and Sonar K.R. (1994) status of major and micro nutrient in swell shrink soils of Maharashtra .Journal of Maharashtra Agriculture Universities 19,169-172.

17. Piper, C.S. (1966) Soil and Plant Analysis. Asian Reprint, Hans Publication Bombay, India.

18. Yadav D.V and Khanna ,S.S , (1979).Practical manual for introductory courses in soils. HAU. pp: 35-36.