Trends in Life Sciences
An International Peer-Reviewed Journal
www.sciencejournal.in

CORRELATION OF CHEMICAL PROPERTIES, SECONDARY NUTRIENTS AND MICRONUTRIENT ANIONS FROM THE SOILS OF CHAKUR TAHISIL OF LATUR DISTRICT, MAHARASHTRA.

Medhe S. R.*, Takankhar V. G. and Salve A. N.*****
*21/, Gharonda Hsg. Soc. Near Vinayak Nagar, Nagar Pune Road, Ahmednagar – 414 001, (M.S.) India
**Department of soil science and Agricultural chemistry, College of Agriculture, M.A.U. Latur. (M.S.), India
*** Department of Botany, Government Institute of Science, Aurangabad-431004 (M.S.), India
(E-mail: soniya_m06@rediffmail.com; abhaysalve@hotmail.com)

ABSTRACT
Hundred soil samples from Chakur tahsil of Latur district (M.S.) were collected and analyzed for its chemical properties, secondary nutrients and micronutrient anions. These soils were found neutral to alkaline, (pH 6.21 to 9.13) in reaction, medium to high in organic carbon (0.2 to 1.3%) and non-calcareous to calcareous in nature. The exchangeable Ca++ and Mg++ varied from 18.4 to 54.4 and 8.7 to 29.7 cmolkg-1, Available (S) Sulphur was 2.28 to 41.33 mgkg-1. The available (B) Boron and (Mo) Molybdenum content of these soils ranged from 0.01 to 4.24 and 0.10 to 1.69 mgkg-1 with the mean value of 0.84 and 0.27 mg kg-1 respectively. Exchangeable Ca++ and available Mo showed positive and significant correlation with soil pH and CaCo3 content in soil. While exchangeable Mg++ and Boron showed negative correlation with pH and organic carbon content in soil. Boron also showed negative correlation with pH and CaCo3 in soil. Available Sulpher in soil was significant and shows positive correlation with pH of soil while it was negatively correlated with organic carbon. According to Soil Nutrient Index, soils of Chakur tahsil were categorized under 'High' category for calcium, magnesium, sulphur, boron and molybdenum.

KEY WORDS: pH, CaCo3, Ca++, Mg++, S, B and Mo.

INTRODUCTION

Fertility of soil is one of the most important factors which regulate growth and yield of the crops. Due to imbalance and inadequate uses of fertilizers, improper irrigation and various cultural practices the soil quality is depleting rapidly. Micronutrient plays a vital role in maintaining soil health and also productivity of crops. 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 chemical properties and available nutrient status of soils from Chakur tahsil of Latur District.

MATERIALS AND METHODS

Twenty villages representing all the characteristics of the soil were selected from Chakur tahsil and five representative soil samples were collected from each village. In all hundred surface soil samples at the depth 0-15 cm were collected from Chakur tahsil of Latur district. These soil samples were analyzed for secondary nutrients *viz.* Ca, Mg and S, and micronutrient anions *viz.* B and Mo along with chemical characteristics. Analysis was carried out by following standard methods, soil pH was determined by using glass electrode pH meter (Jackson, 1973), free $CaCO_3$ was determined by rapid titration method (Piper, 1966), organic carbon was estimated by modified method of Walkly and Black (Piper, 1966).

Exchangeable calcium and magnesium was determined by versenate method (Jackson, 1973), sulphur was determined with 0.15% $Cacl_2$ using tubidimetric method. In case of micronutrient anions boron and molybdenum were determined by hot water soluble method (Berger and Trough, 1939) and Acid ammonium oxalate method of pH 3.3 (Grig, 1953), respectively. The obtained results were statistically analyzed by using Microsoft Excel® software, the obtained data was used for the further correlation analysis.

RESULTS AND DISCUSSION

The data regarding pH of Chakur tahsil soils is presented in Table - 1. The data revealed that these soils were neutral to alkaline (pH 6.21 to 9.13) in reaction, with average pH value of 7.56. Higher pH (9.13) was observed in soils of Ajansonda village while lower pH (6.21) was observed in soils of Khurdali village. Out of twenty villages from Chakur tahsil 1, 6 and 13 villages were found slightly acidic, neutral and alkaline in soil reaction respectively (Graph – A)

The organic carbon content in soils of Chakur tahsi (Table 1) ranged from 0.20 to 1.33 percent with mean value of 0.72 percent. The higher organic carbon content (1.35) was observed in Bavalgaon village and lower (0.20) in Murambi village. Among twenty villages 5, 50 and 45 percent soil samples were observed low, medium and high in organic carbon content (Graph –B).

Table -1 Shows the Sample no. with their Ph, Org. Carbon, and $CaCO_3$ content in the soil samples.

Sr. No.	Sample No.	pH	Org. carbon (%)	$CaCo_3$ (%)
1	**2**	**3**	**4**	**5**
1	C-1	6.96	0.2	5.06
2	C-2	7.02	0.25	2.53
3	C-3	7.94	0.25	1.84
4	C-4	7.81	0.31	1.38
5	C-5	8.2	0.55	1.84
6	C-6	7.69	0.45	2.53
7	C-7	8.11	0.62	2.53
8	C-8	8.41	0.41	1.38
9	C-9	7.33	0.74	0.69
10	C-10	8.47	0.7	2.07
11	C-11	8.15	0.51	6.21
12	C-12	6.73	0.68	1.15
13	C-13	6.64	0.47	4.14
14	C-14	6.92	0.59	1.38
15	C-15	6.79	0.55	0.92
16	C-16	8.04	0.62	1.15
17	C-17	8.42	1.33	7.82
18	C-18	7.98	0.6	2.07
19	C-19	7.6	0.55	2.76
20	C-20	7.94	1.17	1.61
21	C-21	8.26	0.84	1.61
22	C-22	8.46	0.62	2.99
23	C-23	8.38	0.86	5.06
24	C-24	7.94	0.7	1.84
25	C-25	8.48	0.64	4.6
26	C-26	6.57	1.27	2.3
27	C-27	6.32	1.17	0.69
28	C-28	6.64	0.8	1.38
29	C-29	6.44	0.82	0.69
30	C-30	6.39	1.03	1.15
31	C-31	7.69	0.68	9.2
32	C-32	8.87	0.6	7.36
33	C-33	8.67	0.94	7.82
34	C-34	8.8	1.07	5.52
35	C-35	8.62	0.99	8.05
36	C-36	6.9	0.82	3.45
37	C-37	8.05	1.09	3.91
38	C-38	7.35	0.8	0.92
39	C-39	8.14	0.94	2.07
40	C-40	8.74	0.78	2.3
41	C-41	6.96	0.98	0.69
42	C-42	9.13	0.7	6.9
43	C-43	7.81	0.84	3.91
44	C-44	7.62	0.45	2.53
45	C-45	6.97	0.41	0.92
46	C-46	8.82	0.74	4.37
47	C-47	8.56	0.98	6.44
48	C-48	8.41	1.27	5.75
49	C-49	8.78	0.55	8.51
50	C-50	8.89	1.09	14.26
51	C-51	8.42	0.49	7.26

Table -1 Continued..

Sr. No.	Sample No.	pH	Org. carbon (%)	$CaCo_3$ (%)
52	C-52	7.31	0.7	2.86
53	C-53	7.94	0.82	5.5
54	C-54	6.99	0.74	2.86
55	C-55	7.22	0.45	3.96
56	C-56	6.78	0.64	2.42
57	C-57	8.16	0.92	3.96
58	C-58	6.82	0.62	1.54
59	C-59	6.65	0.21	3.96
60	C-60	7.54	0.45	2.64
61	C-61	7.22	0.55	3.3
62	C-62	7.63	0.84	7.26
63	C-63	7.86	1.01	5.06
64	C-64	7.9	0.74	3.96
65	C-65	7.87	0.82	8.8
66	C-66	6.81	0.62	1.98
67	C-67	7.57	0.88	2.86
68	C-68	6.96	0.62	1.76
69	C-69	6.46	0.55	3.08
70	C-70	6.73	0.74	1.98
71	C-71	7.03	0.55	2.42
72	C-72	6.51	0.94	3.3
73	C-73	6.37	0.64	4.4
74	C-74	7.74	0.66	4.62
75	C-75	6.21	0.98	3.3
76	C-76	7.96	1.19	4.84
77	C-77	7.97	0.94	10.12
78	C-78	8	0.98	5.06
79	C-79	7.77	0.92	4.4
80	C-80	7.52	0.98	3.3
81	C-81	6.68	0.84	2.2
82	C-82	7.99	1.15	17.38
83	C-83	8.04	0.74	11.44
84	C-84	7.93	0.62	6.38
85	C-85	7.46	0.9	0.66
86	C-86	7.74	0.84	2.2
87	C-87	7.98	0.76	2.86
88	C-88	7.84	0.72	5.94
89	C-89	7.82	1.05	2.64
90	C-90	7.56	0.82	0.66
91	C-91	6.94	0.57	2.2
92	C-92	7.01	0.7	1.76
93	C-93	6.95	0.31	1.76
94	C-94	6.63	0.68	2.2
95	C-95	6.67	0.35	1.98
96	C-96	6.73	0.72	1.1
97	C-97	6.48	0.57	2.2
98	C-98	6.65	0.35	6.6
99	C-99	6.88	0.74	3.3
100	C-100	7.3	0.33	1.32
Range		**6.21 - 9.13**	**0.20 - 1.33**	**0.66 - 17.38**
Mean		**7.56**	**0.73**	**3.78**
S.E.		**0.07**	**0.02**	**0.29**
C.V. (%)		**9.77**	**34.13**	**77.69**

Further, data in Table -1 indicate that $CaCO_3$ content in these soils ranged from 0.66 to 17.38 percent with average value of 3.77 percent. The lower $CaCO_3$ (0.66) was observed in soils of Shivankhed and Gharni villages. Similarly the higher $CaCO_3$ (17.38) was observed in soils of Shivankhed village. Majority soil samples (74 percent) were observed non-calcareous while few samples (26 percent) were calcareous in nature. This might be due to leaching of $CaCO_3$ from surface layer to subsurface layer. Patil and Shingte, 1982 also reported lower $CaCO_3$ in surface layer as compared to subsurface layer (Graph – C).

Table - 2. Range and average value of exchangeable cations (Na^+ and K^+) and CEC in the soils of Chakur tahsil.

Sr. No.	Location	Exch. Na+ (cmol kg^{-1})	Exch. K+ (cmol kg^{-1})	CEC (cmol kg^{-1})
1.	Murambi	0.047 – 0.075 (0.0612)	0.005 – 0.018 (0.011)	54.17 – 39.15 (49.77)
2.	Nalegaon	0.037 – 0.067 (0.053)	0.009 – 0.024 (0.014)	27.15 – 56.44 (48.74)
3.	Ajansonda	0.044 – 0.069 (0.052)	0.008 – 0.016 (0.013)	38.38 – 55.06 (46.18)
4.	Bavalgaon	0.059 – 0.069 (0.060)	0.009 – 0.025 (0.015)	42.26 – 55.27 (49.39)
5.	Rohana	0.045 – 0.073 (0.063)	0.003 – 0.024 (0.012)	48.37 – 53.17 (50.86)
6.	Bothi	0.044 – 0.077 (0.058)	0.002 – 0.011 (0.005)	29.77 – 38.14 (33.82)
7.	Shelgaon	0.059 – 0.067 (0.061)	0.004 – 0.024 (0.017)	47.08 – 59.18 (54.53)
8.	Wadgaon	0.042 – 0.067 (0.055)	0.005 – 0.027 (0.016)	44.27 – 60.14 (52.56)
9.	Ajansonda (B)	0.043 – 0.066 (0.054)	0.004 – 0.020 (0.011)	31.37 – 54.77 (42.74)
10.	Chapoli	0.061 – 0.073 (0.069)	0.008 – 0.020 (0.014)	50.08 – 56.48 (53.15)
11.	Anandwadi	0.048 – 0.074 (0.060)	0.002 – 0.018 (0.008)	47.95 – 61.17 (56.52)
12.	Naigaon	0.053 – 0.058 (0.055)	0.005 – 0.023 (0.010)	42.46 – 55.58 (48.56)
13.	Wagholi	0.044 – 0.057 (0.053)	0.014 – 0.020 (0.017)	37.15 – 59.07 (50.84)
14.	Zari	0.043 – 0.055 (0.049)	0.013 – 0.015 (0.014)	43.45 – 59.36 (52.13)
15.	Khurdali	0.042 – 0.086 (0.060)	0.013 – 0.018 (0.015)	43.15 – 50.20 (47.21)
16.	Wadval	0.036 – 0.054 (0.043)	0.005 – 0.020 (0.018)	50.05 – 58.05 (52.51)
17.	Shivankhed	0.037 – 0.044 (0.041)	0.012 – 0.022 (0.017)	55.15 – 61.16 (59.09)
18.	Gharani	0.040 – 0.048 (0.045)	0.006 – 0.024 (0.018)	52.37 – 57.36 (55.68)
19.	Chakur	0.052 – 0.077 (0.059)	0.012 – 0.019 (0.014)	42.56 – 60.04 (48.28)
20.	Ganjurwadi	0.041 – 0.056 (0.048)	0.017 – 0.022 (0.019)	42.06 – 58.07 (50.16)

- Figures in parenthesis indicate average value.

Table 3. Correlation between chemical properties and available nutrients in soils from Chakur tahsil.

Soil chemical properties	Secondary nutrients		Micronutrients		
	Exch. Ca^{++}	Exch. Mg^{++}	S	B	Mo
pH	0.365**	-0.084	0.232*	-0.119	0.665**
Org. carbon	0.074	-0.058	-0.007	0.106	-0.074
$CaCO_3$	0.257**	0.001	0.046	-0.011	0.488*

* Significant at 5 % level
** Significant at 1 % level

The data regarding status of secondary nutrients in soils of Chakur tahsil are presented in Table - 2. The data revealed that the exchangeable Ca^{++} and Mg^{++} content in soil were ranged from 18.4 to 54.4 and 8.7 to 29.7 cmol/kg^{-1} with the mean value of 33.51 and 16.63 cmolkg^{-1}. The results are in similar range with that of Bacchewar, G.K and Gajbhiye, (2011)**.** The higher exchangeable Ca^{++} and Mg^{++} were observed in Chakur and Shivankhed village respectively. While both were lower in Nalegaon village.

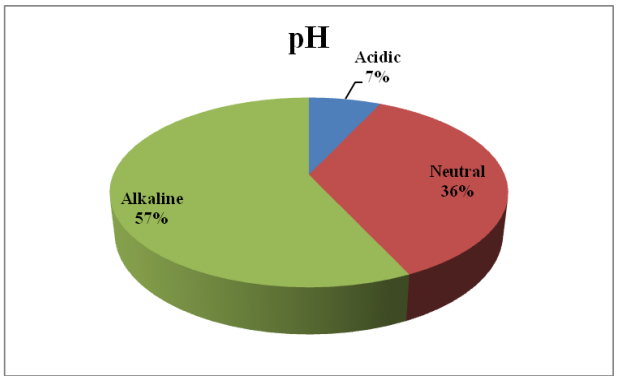
The data regarding available is presented in Table -2. The available S ranged from 2.28 to 41.33 mg kg^{-1} with the average value of 15.2 mgkg^{-1}. The higher and lower available S was recorded in soils of Chapoli and Wadgaon village, Respectively. Out of hundred soils samples, 9, 11 and 80 soil samples were low, medium and high in available S respectively soils of Chakur tahsil were found moderate to high in available S because of accumulation of So_4^- in surface layer. These findings are in accordance with the results of Tisdale *et al.* (1993).

The data regarding available B and Mo content in soils of Chakur tahsil are presented in Table- 3. The results revealed that the available B and Mo content in these soils ranged from 0.01 to 4.24 and 0.10 to 1.69 mgkg^{-1}, respectively. The lower B and Mo content in soil were recorded in Shelgaon and Bori village while it was higher in Wagholi and Ajansonda village respectively. Out of hundred soil samples 15, 26 and 59 percent Samples were deficient, marginal and sufficient in B content, respectively, with respective to available Mo majority (74 percent) soil samples were sufficient.

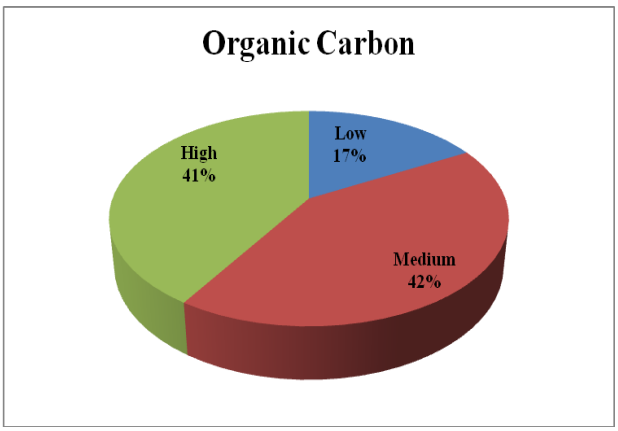
The results on correlation between chemical properties and available nutrients in soils of Chakur tahsil are presented in Table - 4. The results regarding correlation revealed that the soil pH (0.365**) and $CaCo_3$ (0.257**) were significantly and positively correlated with exchangeable Ca^{++}. Similarly, organic carbon was also positively correlated with exchangeable Ca^{++}. In case of exchangeable Mg^{++}, it was negatively correlated with pH (-0.084) and organic carbon (-0.058) and positively correlated with $CaCO_3$ (0.001). Similar correlation was reported by Mahapatra and Sahu (1996) in soils of Orissa.

Available sulphur in soils of Chakur tahsil was positively correlated with pH (0.232*) and $CaCO_3$ (0.046) but it was significant in case of pH only. Further the available sulphur has found negative relationship with organic carbon (-0.007). The observations are supported by the finding of Dwarkanath *et. al.* (1996), Pandey *et al.* (2000), Mali and Raut (2001). While it has positive correlation with organic carbon (0.106). This might be due to increase in pH and calcareousness of soil which decreases the availability of boron, while organic carbon helps in increasing the availability of boron. The results are confirmatory with the results obtained by Siddequi *et. al.* (1994).

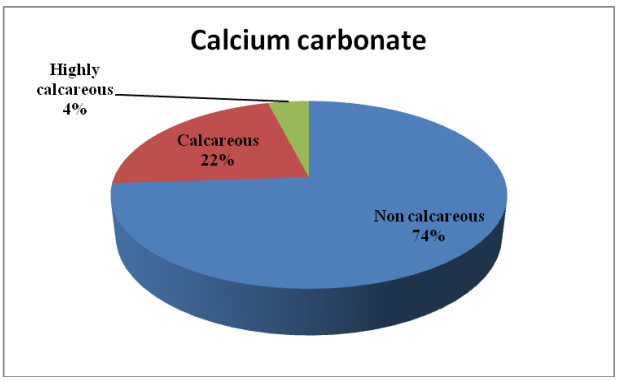
Availability Mo in soils of Chakur tahsil had significant and positive correlationship with soil pH (0.665**) and $CaCO_3$ (0.488*). But it was negative with organic carbon (-0.074). This is because of the increase in Mo availability with increase in pH due to the replacement of MoO_4^{2-} by OH^- ions. These findings are in confirmatory with results reported by Sharma and Bhaskar (2003).



A) Graph showing % distribution of pH (acidic, neutral and alkaline)in the studied soil samples



B) Graph showing % distribution of low, medium and high organic contents in the studied soil samples



C) Graph showing percent distribution of highly calcareous, non-calcareous and calcareous soil in the studied soil samples

CONCLUSION

The soils of Chakur tahsil are neutral to alkaline in reaction, low to medium in organic carbon content and calcareous to non-calcareous in nature. These soils are high in calcium and magnesium content while medium to high in available sulphur. In case of B soils of Chakur tahsil were marginal to sufficient. Majority soils of Chakur tahsil were sufficient in available Mo. Thus, it can be concluded that the chemical properties like. pH, $CaCO_3$ and organic carbon content alone or in combination controls the availability of nutrients in the soils.

REFERENCE

Bacchewar G.K and Gajbhiye B R. (2011). Correlation Studies on Secondary Nutrients and Soil Properties in Soils of Latur District of Maharashtra. *Res. J. Agri. Sci.* **2**(1): 91-94

Berger K.C. and Troug K. (1939). Boron determined by using the quinalizarin reaction, *Ind. Eng. Chem* II : 540-545.

Dwarkanath K., Mohite A. V. and Patil M. D. (1996). Relationship of different forms of sulphur with soil properties. *J. Maharashtra Agri. Uni.* **2**(1): 123-124.

Grig J.L. (1953). Determination of the available molybdenum of soils. *N.Z.J. Sci. Tech. Sect. A*-**34**:405-414.

Jackson M.L. (1973). Soil chemical analysis, Prentice Hall of India Pvt. Ltd., New Delhi PP : 498.

Lande M.G., Varade S.B. and Badhe N.N. (1977). Sulphur status and its relationship with physico-chemical properties of Marathwada soils. *J. Maharashtra Agric. Univ.* **2** (3):195-201.

Mahapatra P.K. and Sahu S.K. (1996). Relationship between some major, secondary and micronutrient status of soils growing groundnut and their contents in ground plants. *J. Indian Soc. Sci.* 44 (1): 100-103.

Maji A.K., Reddy G.P., Thayalan S. and Walke N.J. (2005). Charasterization and classification of land form and soils over basaltic terrain in sub humid tropics of Central India. *J. Indian Soc. Soil Sci.* **53** (2): 154-162.

Pandey S. P., Singh R.S. and Mishra S.K. (2000). Availability of phosphorus and sulphur in Inceptisols of central Uttar Pradesh, *J. Indian Soc. Soil Sci.* **48** (1) :118-121.

Patil J. D. and Shingte A.K. (1982). Micronutrient status of soils from drought prone area of Pune region (Maharashtra). *J. Indian Soc. Soil Sci.* 7 (3): 216-218.

Piper C.S. (1966). Soil and plant analysis. Hons publication Bombay.

Sharma J.P. and Bhaskar B.P. (2003). Variability and similarity of soils in Rajkot district Gujrat. *J. Indian Soc. Soil Sci.* **51** (3): 279-287.

Siddiqui Muneera, Nirmale S.P., Malewar G.V. and Housare D.S. (1994). "Boron status of some soils of Parbhani district" paper presented in seminar or recent trends, in micronutrient Research in soils and plants in Maharashtra held from Nov. 12-13 at MAU, Parbhani: 5.

Tisdale S.L. Nelson W.L. Beaton J.D. and Havlin J.L. (1993). Soil Fertility and Fertilizers, 5th Edition, Macmillan Publishing Co., New Delhi. pp : 144, 180, 198, 201.

