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Original Research Article

Comparative Study on Changes in Soil Quality Status of Farm, College of Agriculture, Latur

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Keywords

Soil pH, Organic Carbon, Available N, P, K, and DTPA micronutrients

A B S T R A C T

The present investigation was laid out with forty five surface soil samples (0-30cm) collected for laboratory analysis. The comparative study also carried out with the earlier results of Yadav (2005). The study area is College of Agriculture, Latur located at 18^0 25' 90” N latitude and 76^0 36' 99” E longitudes. Geographical area of college 65 ha, 73 R. The climate of the study area is hot, dry and sub-humid. The soils of study area are formed from weathered basalt. The College of Agriculture Latur farm was served to investigate changes in selected soil chemical properties and nutrient depletion from 2005 to 2017. The soils are slightly to moderately alkaline in reaction (7.38-8.03). The electrical conductivity of the soil is < 1.0 dSm^{-1}. The organic carbon content in soils is low to moderately high and varied from 0.31-0.78per cent. The calcium carbonate content varied from 5.0-17.8 per cent. Available N, P, K, are ranges from 72.8-187.2 kg ha^{-1}, 5.21-15.23 kg ha^{-1}, 219.90-652.48 kg ha^{-1} respectively. Whereas Status of DTPA extractable Fe, Mn, Zn, Cu, are ranges from 0.23-3.82 mg $kg^{-1,}$ 8.77-16.94 mg $kg^{-1,}$ 0.23-1.63 mg kg^{-1} 0.22-0.89, mg kg^{-1} respectively. The soils of the study area classified as Typic Ustorthents, Calcic Haplustepts, Vertic Haplustepts and Calcic Haplusterts, respectively. Soil fertility status was found low to high.

Introduction

The comparative study with the result reported by Yadav (2005) indicated that NPK and DTPA extractable micronutrients Fe, Mn, Zn and Cu was found decreased with time due to continuous cropping and very little changes were observed among the other soil quality parameter.

Materials and Methods

Site description

Geographically College of Agriculture, Latur situated at 18^0 25' 90” N latitude and 76^0 36' 99” E longitudes. The climate of the area is hot, dry and sub-humid with annual rainfall of 794 mm at which nearly 85 per cent is received during June to September, April and May have high temperature (38.8^0C and 39.4^0C mean temperature), The length of growing period 149 days and humid period 104 days. The soils have Ustic moisture regime and Hyperthermic temperature regime. Total geographical area of College of Agriculture, Latur is 65 ha, 73 R. R which is divided into five blocks viz., Block A, B, C, D, E. These blocks were surveyed and finalized the forty five surface soil samples (0-30cm) collected for comparative study also carried out with the earlier results of Yadav (2005). Details chemical characteristic of Farm, College of Agriculture are presented in table 1.

Collection of soil samples

The area of College of Agriculture, Latur farm was surveyed and representative soil profiles was finalized. Forty five (45) surface soil (0-30 cm) samples were collected for soil fertility evaluation and to understand the changes in soil quality.

Physico-chemical properties of farm College College of Agriculture, Latur during 2004 (Yadav 2005)

The soil of Farm, College of Agriculture, Latur are very shallow to very deep, black dark brown /very dark brown to black in colour. The soils are slightly (7.59) to moderately (pH 8.36) alkaline, safe in soluble salt and calcareous in nature. Details physical, chemical characteristic of Farm, College of Agriculture are presented in table 1.

Soil analysis

The soil samples was collected from farm during summer were initially air dried in laboratory at room temperature, grind using wooden mortar and pestle, screened through 2 mm sieve, properly labeled and stored in polythene bags for laboratory analysis.

For certain soil characteristics like organic carbon, samples were further grind and screened through 80 mesh sieve.

The following determinations were made on processed samples by adopting the standard procedures (Jackson 1967, Black *et al.*, 1965).

Soil pH and EC of 1:2.5 Soils: water suspension was determined electrometrically using pH meter and EC meter as per method described by Jackson (1979). Organic carbon was estimated by Modified Walkley and Black's rapid titration procedure (Jackson, 1958). Available phosphorus was determined by Olsen's method, reading was recorded using spectrophotometer (Jackson, 1967). Available potassium was determined by flame photometer using 1N Neutral ammonium acetate (pH 7.0) solution as an extractant as described by (Jackson, 1967). DTPA (0.005 M) extractable Fe, Mn, Zn and Cu was determined as the procedure outlined by Lindsay and Norvell (1978) using atomic absorption spectrophotometer.

Collection of yield data

Yield data were collected from Farm, College of Agriculture, Latur.

Statistical analysis

The correlation between physico-chemical characteristics and available nutrients as well as correlation study was undertaken to find out the relation between physical chemical properties of soil with yield as per procedure described by Panse and Sukhatme (1985).

Results and Discussion

Soil pH

The pH value at various plot compare with the data reported by Yadav (2005) in table 1 indicated that little difference in soil reaction. In plot A3 and B2 the pH value was increased (Table 1 and 2) after thirteen year. This may be due to application of fertilizer or application of irrigation water. Increase in soil pH over years could be ascribed to an increase in sodium rich groundwater table has been also evidenced from common occurrence of such events in the irrigated farms of the area. The same result was reported by different authors (FAO, 1988; Ghafoor *et al.*, 2004), whereas all remaining plots pH value was decreased over time. The decrease in pH might be due to the continuous cropping (Zhong *et al.*, 2014), and increased use of chemical fertilizer, primarily with large nitrogenous fertilizer (Zhong *et al.*, 2014; Yusuf *et al.*, 2009).

Electrical conductivity

Electrical conductivity of soils was safe and varied from 0.21 to 0.41 dSm^{-1} with the average value 0.28 dSm^{-1}. All the samples were in safe (<1 dSm^{-1}) category. Highest value of EC was recorded in plot no. C1a (0.41 dSm^{-1}) and lower value of recorded in D11 (0.21 dSm^{-1}). The comparative study indicated that very little difference was found among the electrical conductivity of soil.

Organic carbon

Organic carbon is single important factor of soil which influences physical, physico-chemical, chemical and biological properties of soil. Organic carbon of soils varies from low to moderately high value varied from 0.31 to 0.78 per cent with the mean value 0.60 per cent. The highest value of organic carbon recorded in plot A6 (0.78 %), whereas lower value recorded in plot A1, A2, A3, A5, B2, D6, E1, E2, and E5 (0.31 %). The comparative study indicated that the organic carbon was decreased with time in most of plots of Farm College of Agriculture, Latur (Table 1 and 2) this may be due to continuous cropping tended to decrease the content of total organic carbon and also oxidation of organic matter due to hot weather Zhang *et al.*, (2014).

Available nitrogen

Deficiency of Nitrogen was almost universal in Indian soil. The plants absorb nitrogen either as ammonium or as nitrate ion. The transformation of the nitrogen compound in the soils involves different processes and conversion of nitrogen containing compounds into humic acid, ammonification, nitrification, denitrification, and then leaching loss of nitrogen compound by intra-soil and surface flow. The data on status of available N, P and K (Table 2) revealed that the available N content of these soils ranged from 72.8 to 187.2 kg ha^{-1} with a mean value of 145.6 Kg ha^{-1}. The lowest N content (72.8 kg ha^{-1}) was recorded in plot no. A1, whereas the highest N content (187.2 kg ha^{-1}) was recorded in plot no. B6. Study indicated that decreased in N content in soil with time. This may be due to continuous cropping similar result reported by Kaur and Singh, (2014). Availability of nitrogen in soil controlled by the bio-chemical processes of decomposition and addition of fresh organic material to the soil.

Available phosphorous

The available phosphorus content in these soils ranged from 5.21 to 15.23 kg ha^{-1} with a mean value 13.20 kg ha^{-1}. The highest (15.23 kg ha^{-1} available phosphorus content was recorded in plot B6. The lowest (5.21 kg ha^{-1}) available phosphorus content recorded in plot A1.

The comparative study indicated that (Table 1 and 2) the phosphorous content was decreased with time. This may be due to continuous cropping and continuous removal of crop residue and absence of phosphate containing mineral in soil. The similar result reported by Menaleshoa, (2016) in long term continuous monocropping (cotton) under Vertisols.

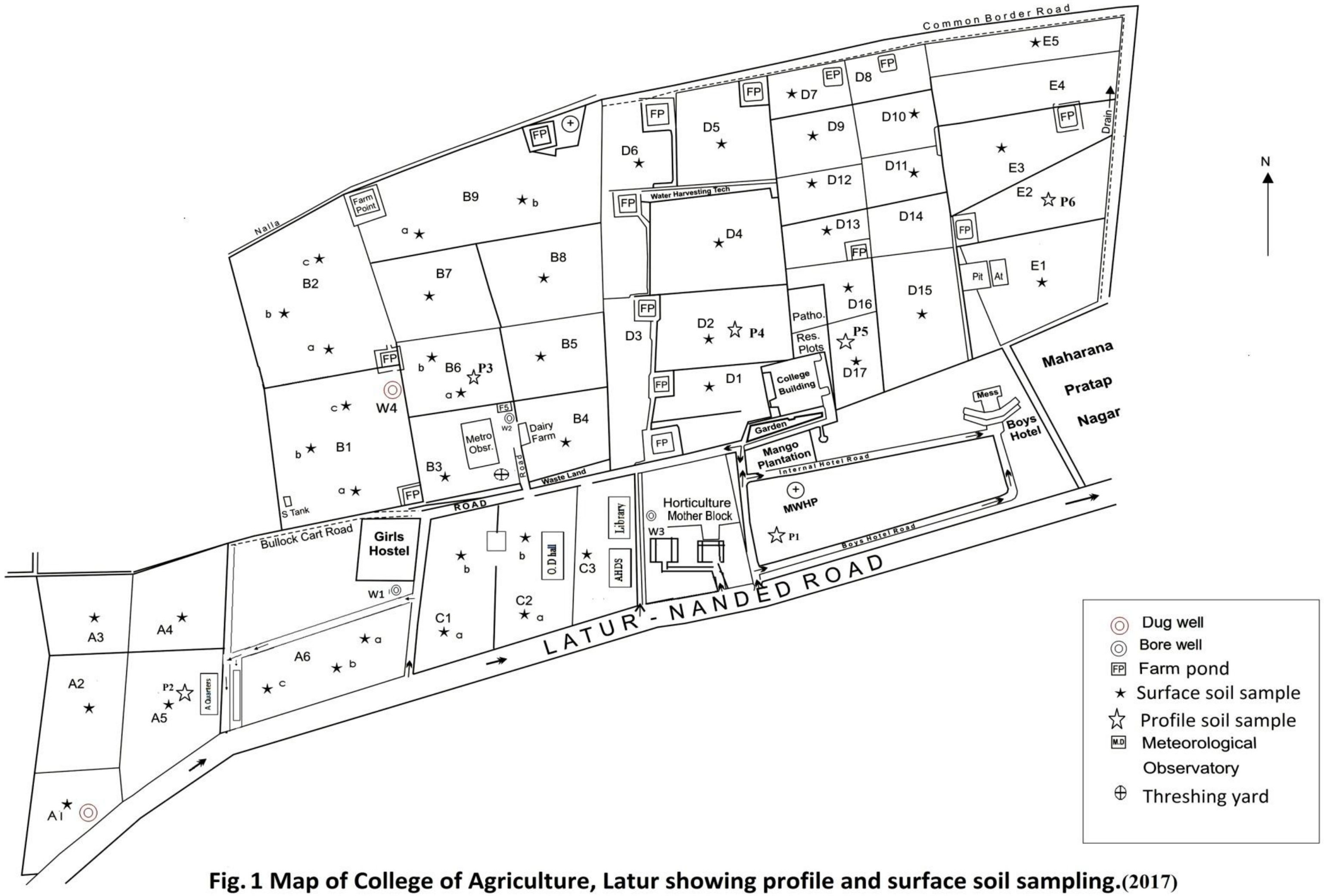

Fig. 1 Map of College of Agriculture, Latur showing profile and surface soil sampling.(2017)

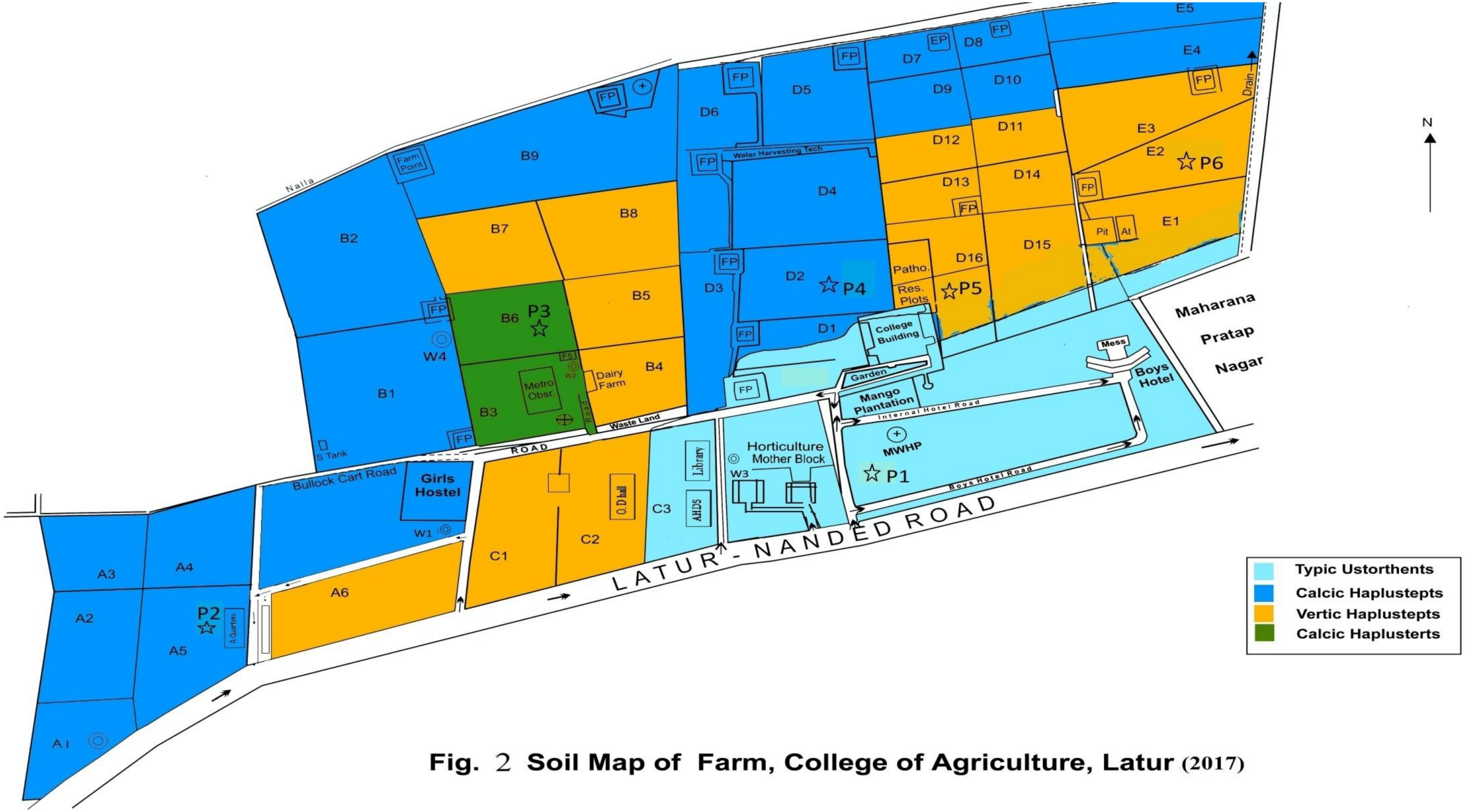

Fig. 2 Soil Map of Farm, College of Agriculture, Latur (2017)

Table.1 Physico-chemical properties of farm, College of Agriculture, Latur (Yadav. 2005)

Plot No.	pH	EC (dSm^{-1})	$CaCO_3$ ($g\ kg^{-1}$)	O.C ($g\ kg^{-1}$)	Available (Kg/ha)			Micronutrients status ($mg\ kg^{-1}$)			
					N	P	K	Fe	Mn	Zn	Cu
Typic Haplusterts											
B1	7.8	0.26	32.0	13.3	852.99	24.51	318.30	1.28	13.89	1.08	3.94
B2	8.0	0.34	34.0	12.8	740.09	25.87	337.79	0.94	14.25	2.27	2.07
B3	7.8	0.28	39.0	13.0	852.99	28.60	347.83	1.21	14.26	0.99	1.86
B4	7.8	0.29	33.0	12.8	903.16	26.96	393.08	1.30	13.38	1.60	2.64
D1	8.0	0.32	36.0	11.0	765.28	29.96	382.26	1.53	12.96	2.00	3.62
D2	8.2	0.28	46.0	9.7	752.64	30.64	318.30	1.38	12.63	2.53	2.05
D11	7.9	0.33	32.0	13.2	740.09	26.55	392.67	2.47	12.42	1.00	1.78
D23	7.7	0.32	43.0	9.9	852.99	31.32	392.67	2.51	17.56	1.56	3.32
D25	7.6	0.38	36.0	9.9	878.61	29.96	347.53	1.38	14.68	2.56	4.03
D26	7.5	0.27	29.0	13.2	765.18	29.28	318.30	1.19	15.36	0.98	3.48
E1	7.6	0.34	28.0	13.0	928.25	29.96	347.53	1.04	12.39	2.40	5.54
E5	7.9	0.38	38.0	13.8	577.04	32.00	334.54	1.53	15.56	2.30	8.56
E6	7.6	0.32	29.0	12.8	840.84	27.29	347.53	1.31	16.64	1.64	4.76
Ave	7.8	0.31	35.00	12.18	803.81	28.68	352.17	1.28	14.29	1.76	3.66
Vertic Ustochrepts											
D3	8.3	0.27	37.0	12.3	777.72	25.87	321.55	1.32	12.63	1.22	2.05
D4	7.9	0.28	39.0	13.4	790.27	25.19	380.01	2.20	14.36	1.04	3.08
D8	7.7	0.32	29.0	9.6	928.25	2751	354.03	2.30	16.32	1.29	5.34
D14	7.8	0.28	43.0	13.9	677.37	27.91	392.67	2.04	14.56	1.20	7.33
D15	7.9	0.29	39.0	13.0	752.64	29.96	363.77	2.46	13.96	1.56	4.00
D16	7.8	0.32	42.0	12.9	852.99	29.96	354.03	1.24	9.98	0.96	3.39
D17	7.2	0.33	38.0	12.0	689.92	27.23	392.67	2.54	13.65	1.07	4.22
D20	7.8	0.29	62.0	12.5	715.00	29.96	315.05	1.34	13.26	1.36	4.03
D21	7.8	0.33	39.0	13.8	827.90	26.55	367.77	1.56	13.36	0.98	3.48
D24	7.7	0.29	32.0	12.8	790.27	30.64	350.78	1.96	15.56	2.25	4.02
E2	7.6	0.33	32.0	12.9	840.44	30.64	383.26	1.04	12.39	2.40	5.54
E3	7.5	0.32	39.0	13.2	940.08	31.32	334.03	1.05	13.44	3.40	6.32
E4	7.6	0.29	32.0	14.0	802.81	32.64	321.55	1.54	14.28	3.55	2.82
E7	7.8	0.29	34.0	9.2	890.62	26.55	335.47	1.06	16.34	0.96	6.65
E8	7.8	0.31	39.0	13.4	903.16	27.91	363.77	1.20	13.68	1.98	4.09
Ave	**7.8**	**0.30**	**38.4**	**12.59**	**811.96**	**28.78**	**355.36**	**1.65**	**13.86**	**1.68**	**4.42**
Typic Ustorthents											
A3	7.9	0.28	79.0	12.8	702.43	28.60	337.79	1.45	13.80	2.42	2.92
A4	7.8	0.26	32.0	13.8	928.25	29.96	341.04	1.39	13.36	1.39	2.40
A5	7.7	0.30	73.0	9.9	827.90	27.91	333.08	1.36	12.96	1.42	1.74
A7	7.7	0.33	67.0	12.0	602.46	30.30	383.34	1.49	12.48	1.42	9.03
A8	7.7	0.32	39.0	13.5	865.53	26.89	347.53	1.02	15.36	2.43	1.54
C1	7.6	0.33	28.0	13.0	702.46	27.91	399.50	0.79	14.26	1.21	7.24
D6	7.7	0.33	33.0	9.9	903.16	28.70	315.05	1.39	13.68	1.40	1.69
D7	7.7	0.34	28.0	9.3	953.34	29.96	380.01	1.15	14.68	1.72	3.05
D12	7.7	0.29	36.0	13.0	677.37	26.86	663.77	1.62	13.84	0.96	13.6
D13	7.8	0.27	45.0	12.2	640.09	29.55	354.03	1.13	13.26	2.18	4.69
D19	7.7	0.33	64.0	13.0	702.46	31.32	380.01	1.75	12.78	1.64	4.02
D22	7.8	0.29	42.0	12.0	702.46	29.28	380.01	1.43	14.28	3.30	3.72
Ave	**7.7**	**0.30**	**47.16**	**12.03**	**775.66**	**28.68**	**359.59**	**1.33**	**13.72**	**1.79**	**4.30**
Lithic Ustorthents											
A1	7.7	0.29	45.0	13.0	639.74	26.89	311.80	2.42	11.36	1.79	8.87
A2	7.6	0.23	31.0	13.5	602.11	29.28	427.84	1.35	12.38	1.46	6.86
A6	7.6	0.29	64.0	9.7	652.28	26.55	350.78	1.56	11.36	1.79	2.98
C2	8.2	0.38	29.0	9.8	727.95	26.55	367.02	1.35	13.68	1.58	2.02
D5	7.7	0.32	38.0	13.2	702.46	27.23	350.78	1.24	13.68	1.92	3.84
D8	7.9	0.34	33.0	13.9	762.18	30.66	350.78	1.42	12.68	2.30	3.32
Ave	**7.8**	**0.30**	**40.0**	**12.18**	**681.12**	**27.85**	**359.83**	**1.55**	**12.55**	**1.80**	**4.61**
G.M	**7.8**	**0.30**	**39.9**	**12.2**	**780.96**	**27.83**	**362.67**	**1.50**	**14.27**	**1.74**	**4.29**

Table.2 Chemical properties of Farm, College of Agriculture, Latur

Sr. No	plot No.	pH	EC (dSm^{-1})	O.C (%)	$CaCO_3$ (%)	Available (Kg/ha)			Micronutrients (mg kg^{-1})			
						N	P	K	Fe	Mn	Zn	Cu
						Typic Ustorthents						
1	D1	7.80	0.23	0.66	6.06	109.0	7.50	261.9	1.88	9.62	**1.63**	0.25
2	C3	7.83	0.37	0.75	11.3	100.8	6.32	**219.9**	1.59	9.58	1.42	0.48
	Mean	**7.81**	**0.30**	**0.70**	**8.68**	**105.**	**6.91**	**302.6**	**1.73**	**9.6**	**1.52**	**0.36**
						Calcic Haplustepts						
3	A1	7.78	0.27	0.38	13.1	**72.8**	**5.21**	234.9	0.64	9.16	0.25	0.25
4	A2	7.82	0.28	0.42	6.3	77.2	6.31	**219.9**	0.62	9.18	0.26	**0.22**
5	A3	7.85	0.26	0.44	7.9	100.0	7.50	290.9	0.82	10.2	**0.23**	0.23
6	A4	7.89	0.31	0.51	6.3	145.6	5.91	285.3	0.84	10.3	0.43	0.25
7	A5	7.93	0.54	0.47	11.4	112.0	6.00	354.1	1.40	10.9	0.78	0.58
8	B1a	7.84	0.30	0.71	7.8	151.2	6.72	264.9	0.62	10.8	1.02	0.28
9	B1b	7.88	0.32	0.72	8.9	112.0	8.81	261.9	**0.23**	12.6	0.83	0.50
10	B1c	7.94	0.34	0.75	6.3	95.2	8.50	257.7	0.57	13.5	0.86	0.38
11	B2a	7.96	0.25	0.37	10.0	100.8	7.01	349.7	0.67	13.6	0.63	0.34
12	B2b	7.97	0.26	0.40	**17.8**	117.6	8.06	354.5	1.58	13.3	0.43	0.33
13	B2c	7.96	0.25	0.39	7.9	76.4	6.55	234.8	1.57	12.4	0.63	0.62
14	B9	7.90	0.25	0.67	6.3	89.6	6.80	422.7	0.87	13.8	0.45	0.30
15	B9	7.87	0.26	0.66	9.1	112.0	7.56	358.8	0.86	14.4	0.63	0.34
16	D4	7.84	0.30	0.66	7.5	145.6	10.7	387.8	1.64	9.75	0.50	0.54
17	D2	7.85	0.50	0.56	14.0	134.4	10.5	378.1	0.44	9.76	0.35	0.80
18	D5	7.90	0.28	0.54	7.0	87.2	8.92	286.7	0.71	9.83	0.36	0.24
19	D6	7.92	0.35	0.49	8.1	95.2	7.81	285.2	0.96	9.76	0.32	0.29
20	D7	7.93	0.26	0.52	7.9	61.6	8.62	358.8	1.88	12.0	0.29	0.28
21	D9	7.94	0.26	0.54	9.1	128.8	7.09	579.3	3.25	13.6	0.27	0.60
22	D10	7.88	0.32	0.67	6.3	123.2	9.0	388.2	1.36	9.69	0.43	0.34
23	E5	7.95	0.26	0.37	7.9	78.4	6.90	244.1	1.68	9.68	0.45	0.49
	Mean	**7.89**	**0.28**	**0.55**	**8.6**	**105.5**	**7.64**	**323.5**	**1.26**	**11.1**	**0.62**	**0.38**
						Calcic Haplusterts						
24	B3	7.85	0.35	0.75	5.9	123.2	10.2	254.9	2.11	12.1	0.84	0.69
25	B6a	7.82	0.27	0.70	7.4	**187.2**	**15.2**	364.4	0.69	13.4	0.63	0.38
26	B6b	7.96	0.39	0.78	6.7	**187.2**	14.3	286.6	0.82	15.0	0.63	0.30
	Mean	**7.87**	**0.33**	**0.74**	**6.66**	**165.8**	**13.2**	**302.0**	**1.20**	**13.5**	**0.70**	**0.45**
						Vertic Haplusteps						
27	A6a	7.84	0.32	**0.78**	5.2	140.0	6.28	343.4	0.79	12.2	1.22	0.58
28	A6b	7.81	0.28	0.61	8.1	100.8	9.92	286.3	1.58	13.3	1.42	0.29
29	A6c	7.82	**0.21**	**0.78**	5.8	151.2	14.8	358.6	0.42	13.7	0.85	**0.22**
30	B4	7.86	0.29	0.66	8.1	145.6	13.2	430.0	0.83	**16.9**	1.15	0.62
31	B5	7.93	0.25	0.60	7.4	81.6	10.7	286.3	0.70	12.1	0.43	0.28
32	B7	7.91	0.28	0.67	8.9	134.4	9.45	237.8	0.90	14.2	0.68	0.32
33	B8	7.79	0.36	0.67	7.9	145.6	8.21	354.5	1.29	16.9	0.83	0.47
34	C1a	7.86	**0.41**	0.67	10.0	100.8	5.50	334.9	0.69	12.1	0.82	0.68
35	C1b	7.93	0.23	0.63	6.2	112.0	11.6	336.8	1.51	13.8	0.87	0.66
36	C2a	7.47	0.27	0.67	8.9	123.2	15.1	367.6	1.01	9.77	0.55	0.62
37	C2b	**7.38**	0.31	0.78	13.3	123.2	14.2	390.7	1.28	9.83	0.56	0.51
38	D11	7.96	**0.21**	0.60	8.2	78.4	10.3	392.1	1.34	9.94	0.39	0.36
39	D12	7.93	0.25	0.60	8.9	78.4	8.61	353.7	0.66	13.4	0.31	**0.89**
40	D13	7.90	0.28	0.61	**4.9**	117.6	11.6	527.3	**3.82**	9.82	0.31	0.77
41	D15	7.97	0.28	0.70	5.5	84.9	5.60	366.6	1.59	12.1	0.36	0.35
42	D16	7.91	0.31	0.63	10.0	173.6	10.0	349.1	0.85	9.80	0.32	0.74
43	D17	7.72	0.31	0.80	8.2	168.0	8.12	**652.4**	0.94	14.2	0.61	0.27
44	E1	**8.03**	0.27	0.34	13.3	99.6	7.50	285.2	1.40	**8.77**	0.41	0.25
45	E3	8.01	0.25	**0.31**	15.3	128.8	7.34	366.2	3.14	10.0	0.43	0.25
	Mean	**7.85**	**0.27**	**0.63**	**8.62**	**120.4**	**10.1**	**369.4**	**1.30**	**10.2**	**0.43**	**0.25**
Range		7.38-8.03	0.21-0.41	0.31-0.78	5.0-17.8	72.8-187.2	5.21-15.2	219.9-652.4	0.23-3.82	8.77-16.9	0.23-1.63	0.22-0.89
Mean		**7.87**	**0.28**	**0.60**	**10.65**	**145.6**	**13.2**	**430.1**	**1.25**	**11.8**	**0.62**	**0.43**

Available potassium

The available potassium content in soils varied from 219.68 to 652.48 kg ha^{-1} with an average value of 430.10 kg ha^{-1}. The highest available potassium (652.48 kg ha^{-1}) was reported in plot D17 and the lowest available potassium was recorded in plot C3 and A2. The comparative study indicated that (Table 3.2 and 4.10) the available potassium content was decreased with time.

This may be due to continuous cropping which causes continuous removal of potassium through crop harvest and removal of crop residue inferring that experimental soil had inherent high level of K but must be noted that potassium bearing mineral do not provide an inexhaustible K source, and with time, the rate of release of reserve source may decline. This was also reported by Menaleshoa, (2016) in long term continuous monocropping cotton crop under Vertisols.

Micronutrients

The DTPA extractable micronutrients Fe, Mn, Zn and Cu varied from 0.23 to 3.82, 8.77 to 16.94, 0.23 to 1.63 and 0.23 to 1.63 mg kg^{-1} respectively. The comparative study (Table 1 and 4) indicated that the decrease in available micronutrients content in soil with time. This may be due to continuous uptake by the crop over the year to their non-replenishment in the form of fertilizer (Zhong, 2014).

The comparative study with the earlier result reported by Yadav (2005) indicated that NPK and DTPA extractable micronutrients Fe, Mn, Zn and Cu was found decreased with time due to continuous cropping, little or absence bio-chemical processes of decomposition and fresh organic material to the soil and due to the effect of long term continuous mono-cropping

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