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RESEARCH ARTICLE

Soil fertility status of Agricultural College and Research Institute, Thanjavur, Tamil Nadu, India

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ABSTRACT

The study was carried out at Agricultural College and Research Institute, Echangkottai, Thanjavur, a new TNAU research farm having an area of around 123 acres, wherein the cultivable land is divided into 6 main blocks and with further subdivisions. Field wise soil samples were collected and analyzed to assess fertility status. In total, 74 surface (0-15 cm) and sub-surface (15-30 cm) soil samples were collected and analyzed for the parameters viz., Soil reaction, Electrical conductivity OC, CEC, macronutrients, micronutrients. The soil reaction of farm soils ranged from strongly acid i.e (5.5) to very strongly acidic (4.7). The organic carbon content recorded a decreasing trend from the surface to sub-surface. The farm soil is low in available nitrogen, medium to low in available phosphorus and low in available potassium. All the farm soils are sufficient in available zinc, copper, manganese, iron status.

Keywords: *Soil productivity, Soil fertility status, Available nutrients, Available micronutrients.*

INTRODUCTION

Understanding the kind of soil with their distribution, potential and constraints are very important for proper management and for better crop productivity. The soil health is governed by physical, chemical and physicochemical attributes of soil. The physical, chemical and physicochemical properties are measured, quantified, delineated and characterized in order to identify the constraint(s) that limit(s) the crop production. It is essential to understand the soil properties and to characterize them for proper classification for the purpose of delineation and to develop better soil management options. Prevalence of unfavorable soil conditions for more or a longer period leads to un-sustainability in the agricultural system. In order to overcome the nutrient deficiency, it is appropriate to delineate the nutrient status and establishment of a strong database in soil resource inventory provides an insight into the potentialities and limitation of soil for its effective exploitation for agriculture. Soil fertility map of a farm is an important permanent and basic record to be maintained at any farm. Agricultural College and Research Institute, Echangkottai are recently established and field wise soil fertility assessment has been not yet attempted. Hence, it is necessary to assess the fertility status and other physical-chemical characteristics of this farm soil to serve as a base for formulating any soil based research and formulating crop management practices of the farm.

Location of the study area

The study area is at Echangkottai, Thanjavur district is entirely covered with red soil which is due to ferric oxide coating on soil particles. The temperature of the study area is too hot in summer with a temperature of 42 °C, with a mean annual temperature of 33.45 °C and mean annual rainfall of 938 mm.

Location details of farm blocks in Agriculture College and Research Institute, Echangkottai farm

Blocks	Locations
A	10.66678N, 79.16058E
B	110.66675N, 79.16146E
C	10.66746N, 79.16239E
D	10.66732N, 79.16314E
E	10.66626N, 79.16383E
F	10.66487N, 79.16443E

Collection and processing of soil samples

A representative soil sample of about 1kg was drawn from each field after thorough mixing. The soil samples were air-dried in shade, processed and screened through 2 mm sieve. After sieving, the samples were packed in the polythene bags for determination of, physicochemical and chemical properties.

Methods of Analysis

The soil samples were analyzed for

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physicochemical properties and chemical properties using standard procedures. Soil pH and EC was determined in 1:2.5 soil-water suspensions(Jackson, 1973), Cation exchange capacity (Chapman, 1965) and organic carbon (Walkley and Black, 1934) were determined. The available nitrogen was determined by the Kjeldahl method (Subbiah and Asija, 1956), available phosphorus by using(Olsen, 1954) and potassium by flame emission method (Jackson, 1973), Exchangeable calcium and magnesium was estimated by versenate method (Jackson, 1973)and available micronutrients are estimated using Atomic Absorption Spectrophotometer (AAS), (Lindsay and Norvell, 1978).

RESULTS AND DISCUSSION

Physico-Chemical Properties

The pH ranged from 4.9 to 5.5 in the surface and 4.9 to 5.2 (Table 1)in the subsurface indicating strongly acid to very strongly acidic soil reaction.

Table 1. Soil pH of Agriculture College and Research Institute, Thanjavur farm.

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	5.50	5.40	5.00	5.50	5.50	-	-	**5.38**
	(15-30)cm	5.20	5.10	4.90	5.00	4.90	-	-	**5.02**
		B1	**B2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	5.00	5.50	5.00	5.50	5.50	5.00	-	**5.25**
	(15-30)cm	4.90	5.00	4.90	5.00	4.90	4.90	-	**4.93**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	5.50	5.50	5.00	5.00	5.50	5.10	-	**5.26**
	(15-30)cm	5.00	4.70	4.90	4.90	5.00	4.90	-	**4.99**
		D1	**D2**	D3	D4	D5	D6	D7	
D	(0-15)cm	5.00	5.50	5.50	5.00	5.50	5.10	5.00	**5.21**
	(15-30)cm	4.90	4.90	5.00	4.90	5.00	4.90	4.90	**4.92**
		E1	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	
E	(0-15)cm	5.50	5.00	5.00	5.50	5.30	5.00	5.00	**5.18**
	(15-30)cm	5.00	4.80	4.90	5.00	4.80	4.90	4.90	**4.90**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	5.50	4.90	4.90	5.00	5.50	5.30	-	**5.18**
	(15-30)cm	5.00	5.00	5.50	4.90	5.00	5.10	-	**5.08**

The decreasing trend with depth might be due to continuous removal of basic cations by crop plants and leaching (Negasa and Gebrekidan, 2003) movement of cations to deeper layers (Singh and Agrawal, 2003) or due to precipitation as calcium carbonate (Balpande*et al*., 2007). The EC ranged

Table 2.Soil EC (dSm^{-1})of Agriculture College and Research Institute, Thanjavur farm

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	0.30	0.29	0.28	0.30	0.29	-	-	**0.29**
	(15-30)cm	0.29	0.28	0.25	0.27	0.27	-	-	**0.27**
		B1	B2	B3	B4	**B5**	**B6**		
B	(0-15)cm	0.30	0.31	0.30	0.33	0.29	0.31	-	**0.30**
	(15-30)cm	0.29	0.27	0.29	0.30	0.27	0.29	-	**0.28**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	0.30	0.29	0.33	0.30	0.29	0.30	-	**0.30**
	(15-30)cm	0.28	0.28	0.31	0.29	0.28	0.28	-	**0.28**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	0.31	0.30	0.29	0.36	0.34	0.29	0.29	**0.31**
	(15-30)cm	0.29	0.28	0.28	0.27	0.24	0.27	0.27	**0.27**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	0.36	0.29	0.29	0.36	0.34	0.29	0.37	0.32
	(15-30)cm	0.30	0.24	0.24	0.29	0.24	0.27	0.33	**0.27**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	0.33	0.29	0.37	0.33	0.37	0.35	-	**0.34**
	(15-30)cm	0.30	0.27	0.29	0.30	0.33	0.30	-	**0.29**

from 0.28 to 0.37 dS m^{-1} in the surface and 0.25 to 0.33 dS m^{-1}(Table 2)in the subsurface soils indicating the non-salinity. This could be due to low clay content in soils resulting in less accumulation

Table 3. Organic carbon status (g Kg^{-1}) of Agriculture College and Research Institute,Thanjavur farm

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	6.90	3.80	6.30	6.70	5.20	-	-	**5.50**
	(15-30)cm	5.60	2.00	3.80	5.40	4.70	-	-	**4.30**
		B1	**B2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	5.60	5.20	3.80	6.40	6.70	6.90	-	**5.70**
	(15-30)cm	4.10	3.90	3.50	5.30	4.70	4.60	-	**4.30**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	3.80	6.30	6.70	4.90	5.60	6.90	-	**5.70**
	(15-30)cm	2.00	3.80	5.40	4.00	4.10	4.50	-	**3.90**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	5.80	6.40	6.70	6.90	3.80	6.30	6.70	**6.00**
	(15-30)cm	3.80	5.30	4.70	5.60	2.00	3.80	5.40	**4.30**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	4.90	5.60	5.20	5.80	5.40	6.70	6.90	**5.70**
	(15-30)cm	4.00	4.10	3.90	3.80	4.30	4.70	4.60	**4.20**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	3.80	6.30	6.70	5.60	6.40	5.80	-	**5.70**
	(15-30)cm	2.00	3.80	5.40	4.70	3.50	3.80	-	**3.80**

of soluble salts. The organic carbon content ranged from 3.8 to 6.9 g Kg^{-1}in the surface and 2.0 to 5.4 g Kg^{-1}(Table 3) in the subsurface, which makes the soil to categorize under low to medium in organic carbon status. The low to medium content of OC could be attributed to the oxidation and decomposition of

Table 4. Soil Cation Exchange Capacity(cmol (p+) kg^{-1})of Agriculture College and Research Institute, Thanjavur farm

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	1.90	1.70	1.90	1.90	1.80	-	-	**1.50**
	(15-30)cm	1.50	1.40	1.50	1.30	1.40	-	-	**1.40**
		B1	**B2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	1.70	1.90	1.70	1.90	1.80	1.90	-	**1.80**
	(15-30)cm	1.50	1.40	1.50	1.30	1.40	1.30	-	**1.40**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	1.80	1.90	1.70	1.80	1.70	1.90	-	**1.80**
	(15-30)cm	1.60	1.50	1.40	1.50	1.60	1.70	-	1.50
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	1.80	1.90	1.70	1.80	1.80	1.90	1.70	**1.80**
	(15-30)cm	1.60	1.50	1.60	1.40	1.50	1.40	1.50	**1.50**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	1.80	1.90	1.80	1.70	1.80	1.90	1.70	**1.80**
	(15-30)cm	1.30	1.50	1.50	1.40	1.60	1.70	1.60	**1.50**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	1.90	1.80	1.70	1.90	1.70	1.80	-	**1.80**
	(15-30)cm	1.40	1.50	1.40	1.50	1.50	1.40	-	**1.40**

added organic matter under the tropical condition and lesser addition of organic manures in the block (Saha *et al*., 1996).

The exchangeable bases in both surface and surface were in the order of Mg^{2+}> Ca^{2+}> K^{+}> Na^{+}. The exchange complex was dominated by divalent

Table 5. Available nitrogen status of Agriculture College and Research Institute, Thanjavur farm soil (kg ha^{-1})

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	87.80	75.20	100.30	100.30	87.80	-	-	**90.30**
	(15-30)cm	62.70	62.70	62.70	50.10	75.20	-	-	**62.70**
		B1	B2	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	112.80	112.80	100.30	112.80	100.30	100.30	-	**106.60**
	(15-30)cm	75.20	87.80	75.20	75.20	75.20	62.70	-	**75.20**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	137.90	112.80	100.30	100.30	100.30	100.30	-	**108.70**
	(15-30)cm	75.20	62.70	75.20	75.20	87.60	75.20	-	**75.20**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	75.20	87.00	62.70	87.80	87.80	100.50	87.80	**84.20**
	(15-30)cm	62.70	62.70	50.10	62.70	50.10	62.70	62.70	**59.10**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	87.80	87.80	87.80	62.70	62.70	87.00	70.20	**78.00**
	(15-30)cm	75.10	75.10	62.70	75.20	87.80	62.70	62.70	**71.60**
		F1	F2	F3	F4	F5	F6		
F	(0-15)cm	87.80	87.80	100.30	75.20	87.80	75.20	-	**85.70**
	(15-30)cm	75.20	62.70	87.80	62.70	75.20	62.80	-	71.00

cations like Mg and Ca ranging 2.4 to 7.2 meq 100g^{-1} and 1.2 to 2.2 meq 100g^{-1} (Table 8 and 9). These results are in conformity with findings of (Thangasamy*et al*., 2015).CEC values varied from 1.5 to 6.1 cmol (p+) kg^{-1} soil (Table 4). As CEC represents the behavioral change of soils, where clay acts as the fundamental factor contributing towards cation exchange, the to low clay content in the soil resulted in low CEC.

Table 6. Available phosphorous status of Agriculture College and Research, Institute, Thanjavur farm

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	87.8	75.2	100.3	100.3	87.8	-	-	90.3
	(15-30)cm	62.7	62.7	62.7	50.1	75.2	-	-	**62.7**
		B1	**hB2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	112.8	112.8	100.3	112.8	100.3	100.3	-	**106.6**
	(15-30)cm	75.2	87.8	75.2	75.2	75.2	62.7	-	**75.2**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	137.9	112.8	100.3	100.3	100.3	100.3	-	**108.7**
	(15-30)cm	75.2	62.7	75.2	75.2	87.6	75.2	-	**75.2**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	75.2	87	62.7	87.8	87.8	100.5	87.8	**84.2**
	(15-30)cm	62.7	62.7	50.1	62.7	50.1	62.7	62.7	**59.1**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	87.8	87.8	87.8	62.7	62.7	87	70.2	**78**
	(15-30)cm	75.1	75.1	62.7	75.2	87.8	62.7	62.7	**71.6**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	87.8	87.8	100.3	75.2	87.8	75.2	-	**85.7**
	(15-30)cm	75.2	62.7	87.8	62.7	75.2	62.8	-	**71**

Available major nutrient status

The available nitrogen content of farm soil was in low status and ranged from 63 to 112 kg ha^{-1} in the surface and 50 to 88 kg ha^{-1} in the sub-surface (Table 5), which is due to the low organic carbon content in the soil (Malavath, 2013).

The available P content of farm soil ranged from

Table 7. Available potassium status of Agriculture College and Research, Institute, Thanjavur farm soil (kg ha^{-1})

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	14.25	12.35	15.65	16.26	17.25	-	-	**15.15**
	(15-30)cm	9.23	7.25	8.25	6.25	5.65	-	-	**7.32**
		B1	B2	B3	B4	**B5**	**B6**		
B	(0-15)cm	12.24	13.25	14.25	9.23	11.25	13.25	-	**12.24**
	(15-30)cm	5.55	6.64	6.75	6.25	6.78	6.25	-	**6.37**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	12.67	15.25	14.78	14.23	13.26	14.25	-	14.07
	(15-30)cm	5.23	4.78	6.78	5.45	4.25	5.12	-	**5.26**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	14.26	14.25	13.23	15.27	13.31	14.25	15.26	**14.26**
	(15-30)cm	4.26	6.54	4.52	8.72	6.21	7.21	9.65	**6.73**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	13.25	12.67	17.25	16.78	15.26	13.25	14.25	**14.67**
	(15-30)cm	6.25	5.23	4.78	6.78	9.65	6.25	6.64	**6.51**
		F1	F2	F3	F4	F5	F6		
F	(0-15)cm	14.25	13.23	11.25	14.25	12.35	15.65	-	**13.49**
	(15-30)cm	6.75	6.25	6.78	9.23	7.25	8.25	-	**7.41**

11 to 15 kg ha^{-1} in surface and 5 to 9 kg ha^{-1}(Table 6)in subsurface soils respectively, which falls under low to medium in surface and low in subsurface. The low P status of soil might be due to low CEC, clay content and low pH of these soils which causes P fixation with Fe or Al ions and

Table 8. Exchangeable calcium status (meq 100 g^{-1}) of Agriculture College and Research, Institute, Thanjavur farm soil

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	93.8	72.6	89.7	96.2	78.9	-	-	**86.2**
	(15-30)cm	19.8	20.3	16.8	19	21.1	-	-	**19.3**
		B1	**B2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	180	96.2	88.7	76.2	81.9	79.2	-	**100**
	(15-30)cm	20.1	19.1	20.1	19.2	21.9	19.7	-	**20.1**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	74.9	79.6	78.6	81.6	80.1	76.2	-	**78.5**
	(15-30)cm	24.6	21.7	19.6	18.7	21.2	18.7	-	20.8
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	39.3	64.2	71.2	66.7	89.6	64.2	52.1	**63.9**
	(15-30)cm	26.2	17.2	19.6	21.5	21.1	18.6	21.1	**20.7**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	37.4	51.6	61.6	47.6	71.2	67.2	81.1	**59.7**
	(15-30)cm	20.9	21.6	17.7	20.9	17.9	19.2	21.2	**19.9**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	21.6	29.2	25.6	20.2	34.2	29.2	-	**26.7**
	(15-30)cm	12.6	11.6	13.6	12.2	10.2	11.2	-	**11.9**

hydroxides resulting in the deficiency of phosphorus in the form of insoluble compound of $Al_2(H_2PO_4)_3$ and FeH_2PO_4(Iyamuremye*et al*.,1996).

The available potassium content of farm soil ranged from 22 to 110 kg ha^{-1} in the surface and 12 to 26 kg ha^{-1}(Table 7)in subsurface soils. As the

Table 9. Exchangeable magnesium status (meq 100 g^{-1}) of Agriculture College and Research, Institute, Thanjavur farm soil

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	7.5	9	7.5	9	10.5	-	-	**8.7**
	(15-30)cm	6	7.5	6	7.5	9	-	-	7.2
		B1	**B2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	9	7.5	10.5	10.5	9	10.5	-	**9.5**
	(15-30)cm	7.5	6	9	7.5	7.5	9	-	**7.7**
		C1	C2	C3	**C4**	**C5**	**C6**		
C	(0-15)cm	7.6	10.5	7.5	9	7.5	7.5	-	**8.2**
	(15-30)cm	6	9	6	7.5	6	6	-	**6.7**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	10.5	9	9	7.5	9	10.5	7.5	**9**
	(15-30)cm	7.5	7.5	7.5	6	7.5	9	6	**7.2**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	7.5	9	7.5	9	7.5	10.5	10.5	**8.7**
	(15-30)cm	6	7.5	6	7.5	6	7.5	7.5	**6.8**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	9	9	10.5	9	10.5	7.5	-	**9.2**
	(15-30)cm	7.5	7.5	7.5	7.5	7.5	6		**7.2**

soil is acidic in nature with dominance of H^+, Al^{3+} and Fe^{3+} in colloidal exchange sites, replacing all the bases from the exchange sites resulting in low base saturation percentage and low concentrations of exchangeable Ca^{2+}, Mg^{2+} and K^+(Brady and Weil, 1999)

Table 10 Available copper status (ppm) of Agriculture College and Research Institute, Thanjavur farm soil

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	43	35	88	25	70	-	-	**49.6**
	(15-30)cm	21	20	20	7	45	-	-	**22.6**
		B1	B2	B3	B4	B5	B6		
B	(0-15)cm	90	50	16	42	31	69	-	**52.2**
	(15-30)cm	59	30	9	13	10	26	-	**24.5**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	109	36	76	54	112	90	-	79.5
	(15-30)cm	58	21	57	43	21	59	-	**43.1**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	50	63	97	61	56	66	37	**61.4**
	(15-30)cm	42	35	28	52	35	32	12	**33.7**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	46	83	60	43	41	95	51	**59.8**
	(15-30)cm	35	24	47	19	24	22	24	**27.8**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	74	35	51	56	61	51	-	**54.6**
	(15-30)cm	32	25	24	34	36	24	-	**29.1**

Available micronutrients

The available zinc content of farm ranged from 21 to 112 ppm in the surface and 17 to 100 (Table 12) in the subsurface. The farm soils are sufficient in zinc status, which might be due to the accumulation of organic matter, as the organic matter have a better chelating action with a metal ion (Meena et al., 2006) The DTPA extractable Cu varied from

Table 11. Available manganesestatus (ppm) of Agriculture College and Research Institute, Thanjavur farm

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	118	64	74	109	112	-	-	**95.4**
	(15-30)cm	52	20	39	92	34	-	-	**47.4**
		B1	B2	B3	B4	**B5**	**B6**		
B	(0-15)cm	105	91	91	105	58	113	-	**93.8**
	(15-30)cm	57	20	30	16	15	29	-	**27.8**
		C1	**C2**	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	110	54	101	99	106	105	-	**95.8**
	(15-30)cm	72	10	79	18	12	57	-	**41.3**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	105	70	98	77	25	117	107	**85.5**
	(15-30)cm	91	14	20	21	19	35	19	**31.2**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	81	115	82	84	108	119	104	**99.1**
	(15-30)cm	23	23	21	17	24	60	59	**32.4**
		F1	F2	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	111	66	104	111	66	104	-	**93.6**
	(15-30)cm	87	61	59	87	36	59		**64.8**

25 to 109 ppm in surface and 7 to 59 ppm (Table 10) in the sub-surface respectively. The available Mn content of these soils varied from 64 to 118 ppm in surface and 20 to 91 ppm (Table 11) in subsurface soils. The higher Mn status in farm soils may be attributed to the acidic nature of the soils,

Table 12. Soil available zincstatus(ppm) of Agriculture College and Research Institute, Thanjavur farm

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	65	51	95	38	112	-	-	**72.2**
	(15-30)cm	64	42	24	16	109	-	-	**51**
		B1	**B2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	21	83	41	43	49	29	-	**44.3**
	(15-30)cm	17	46	35	9	31	12	-	**25.1**
		C1	C2	C3	C4	**C5**	**C6**		
C	(0-15)cm	35	74	40	37	36	21	-	**40.5**
	(15-30)cm	24	37	31	27.1	25	17	-	**26.8**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	46	118	102	101	115	80	120	**97.4**
	(15-30)cm	36	56	72	87	86	77	78	**70.2**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	117	108	116	93	111	113	105	**109.1**
	(15-30)cm	92	96	100	31	73	24	76	**70.2**
		F1	**F2**	**F3**	**F4**	**F5**	**F6**		
F	(0-15)cm	110	98	105	110	98	105	-	104.3
	(15-30)cm	79	68	99	79	68	99	-	**82**

Table 13. Soil available ironstatus (ppm) of Agriculture College and Research Institute, Thanjavur farm

Block	Depth	A1	A2	A3	A4	A5			Mean
A	(0-15)cm	51	63	71	109	45	-	-	**67.8**
	(15-30)cm	5	15	69	14	26	-	-	**25.8**
		B1	**B2**	**B3**	**B4**	**B5**	**B6**		
B	(0-15)cm	63	59	82	103	74	49	-	**71.6**
	(15-30)cm	56	10	25	22	7	17	-	**22.8**
		C1	C2	**C3**	**C4**	**C5**	**C6**		
C	(0-15)cm	112	44	40	97	43	63	-	**66.5**
	(15-30)cm	28	20	23	11	42	56	-	**30**
		D1	D2	D3	D4	D5	D6	D7	
D	(0-15)cm	59	84	62	53	54	65	66	63.2
	(15-30)cm	22	35	22	6	16	50	57	**29.7**
		E1	E2	E3	E4	E5	E6	E7	
E	(0-15)cm	83	88	76	59	36	91	115	**78.2**
	(15-30)cm	60	23	30	21	18	38	61	**35.8**
		F1	F2	F3	F4	F5	F6		
F	(0-15)cm	90	61	78	90	61	62	-	**73.6**
	(15-30)cm	38	29	61	38	29	31		**37.6**

and low oxidation (Sharma and Chaudhary, 2007). The available Fe content ranged from 36 to 109 ppm in surface and 5 to 69 ppm (Table 13) in the subsurface, acidic nature of the soil, low oxidation, nature of parent material might be the reason for the high Fe content (Sharma and Chaudhary, 2007)

CONCLUSION

The result obtained from the present evaluation showed that the fertility status of the farm soils is poor due to low Nitrogen content ranging from 63 to 112 kg ha^{-1} in the surface and 50 to 88 kg ha^{-1} in the sub-surface, with Phosphorus ranging from 11 to 15 kg ha^{-1} in surface and 5 to 9 kg ha^{-1} in subsurface and potassium content ranging from 21 to 110 kg ha^{-1} in the surface and 12 to 26 kg ha^{-1} in subsurface of farm soil. The basic limitation in the study area is its poor organic carbon status ranging which is from 3.8 to 6.9 g Kg^{-1} in the surface and 2 to 5.4 g Kg^{-1}in the subsurface, which might be due to barren nature of the farm soil over the decades. In addition, the soil structure of surface soil doesn't have any aggregation, mostly of compact or loose, because of higher silt content in the surface soil coupled with poor organic carbon content. As a whole, the structure has to be improved, towards better aggregation, which leads to overall improvements in this farm soil health. (Malavath and Mani, 2018)

The available micronutrients content of Zn, Cu, Fe, Mn, were high due to the acidic nature of soil with low oxidation and the parent material, with Zn status ranging from 21 to 112 ppm, Cu ranging from 25 to 109 ppm, Fe content ranging from 36 to 109 ppm and Mn with 64 to 118 ppm of the farm soil. Proper nutrient management as per soil test recommendations should be followed for proper land use and management options for practicing sustainable agricultural with respect to limitations prevailing in this area. After making all possible improvements for soil productivity constraints, it is possible to enhance the productivity of crops in the area.

This section can also be subtitled for clarity. Salient results must be highlighted and discussed with related works. A brief conclusion of the research finding and future line of work may be given at the end.

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