Original Research Article

NUTRIENT STATUS OF SOILS FROM THE KALESHWARAM PROJECT COMMAND AREA OF *ERSTWHILE* NIZAMABAD DISTRICT IN TELANGANA STATE

ABSTRACT

A research was conducted to study the fertility status of soils from kaleshwaram project command area of Nizamabad district in Telangana. A total of 72 geo-referenced soil samples collected from surface (0-15cm) by using GPS coordinate. Samples were analysed for important soil parameters viz., pH, EC, available macronutrients (N, P, K) and micronutrients (Fe, Zn, Mn, Cu). Correlation study was done to study the relation between the various soil properties. The soil pH and EC showed wide variation that soils are low acidic to medium alkaline in reaction and low salinity. Whereas available N content is low (75 to 298 kg ha^{-1}), available P_2O_5 content medium to high (18-358 kg ha^{-1}) and available K_2O content low to high (90 to 630 kg ha^{-1}). The soil available Zn, Cu, Fe and Mn contents of surface soils are very low to adequate. Correlation study depicts that soil reaction was negatively related with soil available N, P_2O_5, Fe and Mn. the results of the study area showed that these soils are need proper management, supplement with organic manures and inorganic fertilisers.

Keywords : ***GIS-mapping, Kaleshwaram, macronutrients, micronutrients, Nutrient status, Nizamabad***

1. INTRODUCTION

Insufficient nutrients is the main constraint in crop production and productivity improvement of India. The soil fertility estimation encompasses the amount of available macro and micronutrients and assessment of capacity of soil to maintain and supply nutrients to plants [1]. Fertility status of soils is decreasing continuously in India due to intensive agriculture, while meeting the demand of food for growing population. Hence, the knowledge related to nutrient limitations and their suitable management has remarkable significance for

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sustainable development of agriculture and better crop production. Evaluation of farm level fertility status of soil in a particular area provides the required information on nutrient status which helps the farmers to apply need based fertilizers to the crops and soils. In the present study undertaken, we evaluated the nutrient status of soils of Kaleshwaram project command area of Nizamabad district in Telangana state.

2. Study area

The Nizamabad district of Telangana, extends over an area of about 7956 km^2 and is bordered on the East by Karimnagar district, North by Godavari river, West by Manjira river and South by Medak district. It lies between east longitude 77°31´41"-78°40´1.2" and north latitude 18°04´4.8"-19°00´54". The district is located at a significant distance from the sea coast. About 1,17,306 ha ayacut area is under various irrigation projects and out of this 10900 ha of gross cropped area is under surface canals water irrigation (9%). Irrigation is mainly through ground water. The major rock types in Nizamabad district are Granites, Granite, Gneisses and Basalts. The black and red chalka (Sandy loams) soils prevailing in the district which are covering 55% and 45% respectively of the total area. The Armoor, Bheemgal areas are mostly dominated with red chalka soils followed by black soils. in the study area of Nizamabad district, the natural vegetation existing are grasses, shrubs, thorny bushes such as *Cyprus rotundus*, *Cynodon dactylon, Terminalia tomertose, Butea frondosa, Azadirachta indica, Tectona grandis, Dalbergia latifolia, Acacia spp. Cacia sp and Prosopis juliflora,* broad leaved weeds such as *Selotia, Parthenium, Eucalyptus, Euforbia* sps., *etc.* The major crops grown are turmeric, maize, rice, sugarcane, sunflower, cotton, groundnut and pulses *etc*.

3. MATERIAL AND METHODS

Geo-referenced 72 composite surface soil samples (0-15cm) were collected from same fields. Soil samples collected from the study area are air dried in shade and crushed with a wooden pestle and mortar, sieved through sieve (2 mm) and stored in properly labeled

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polythene bags for further analysis. The details of rating of soils based on available nutrients contents.

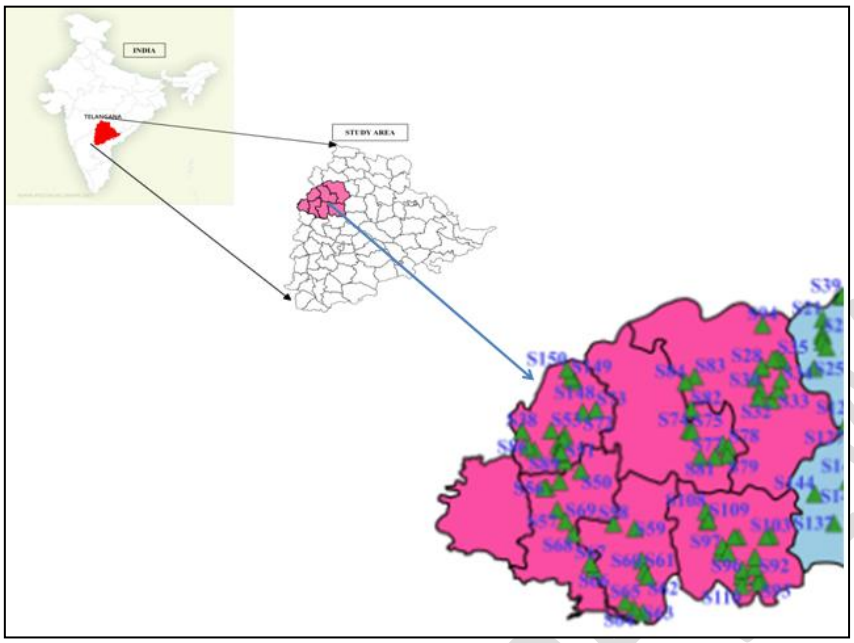

Fig 1. Sample location map of the study area

3.1 Laboratory Analysis

The soil reaction and salinity (EC) were determined with 1:2.5 ratio soil and water suspension by using pH meter (Model Systronics 361) and EC meter (Model Elico CL 180) respectively [2]. Soil available nitrogen is determined by alkaline potassium permanganate method using Semi Auto Nitrogen Analyser (Kel Plus-Distillation) [3]. Available phosphorus in soil was estimated with 0.5M $NaHCO_3$ (pH-8.5) extractant in 1:20 ratio [4]. Available K by neutral normal NH_4OAC (pH 7.0) extractant method. Available micronutrients (Fe, Mn, Zn and Cu) were determined on an Atomic Absorption Spectrophotometer (AAS) by using DTPA extactant [5].

3.2 Generation of thematic maps

Soil sampling sites are Geo-referenced and then exported into QGIS (Quantum- GIS) software. The thematic maps on distribution of the micro and macronutrients were generated by ordinary krigging module available in the sub mode of interpolation in the spatial analyst tools of QGIS software [6]. Database on soil available macronutrients and micronutrients status of the study area was developed using Microsoft Excel package. The database was exported to QGIS software and the thematic maps on available nutrients status were

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generated. Each soil sample was categorized into low, medium and high categories based on the ratings of available micronutrients.

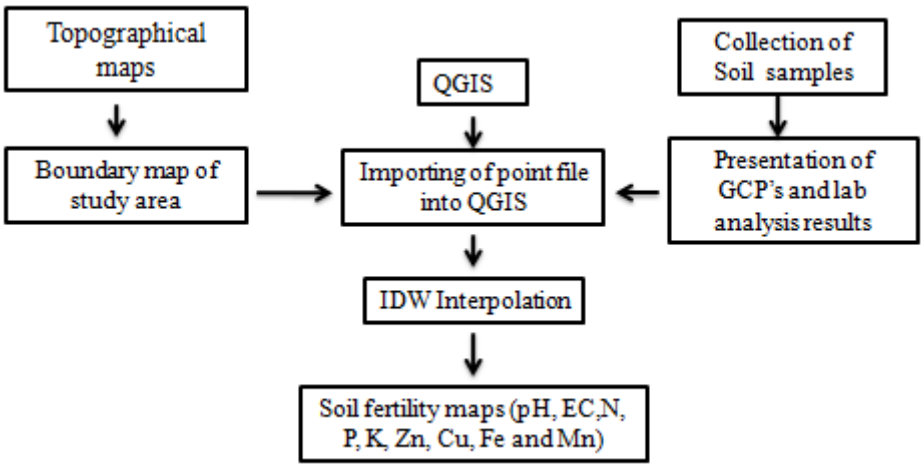

Figure 2. Flow chart showing the procedure for soil fertility mapping

4. RESULTS

4.1 Soil pH and EC:

The pH of soils from the study area of Nizamabad district was varies from 6.38 to 8.22 with overall mean value of 7.46 (Table 1). The surface soils of study area from Nizamabad district are low acidic to medium alkaline in reaction (fig.3). The observations on soil reaction of surface soils shown that 2.78% samples are acidic, 51.39% samples are neutral and 45.83% samples are alkaline in reaction This trend was agreed with the results revealed by [7,8,9]. Correlation study (Table 2) dipicted that soil reaction was negatively correlated with Fe and Mn (r= -0.245 and -0.097). Electrical conductivity of surface soils from different mandals (Table 1) are varied from 0.13 to 1.81 dS m^{-1} with an overall mean value of 0.39 81 dS m^{-1}. The similar results were reported by [10], in central Telangana zone. All most all soils in this district had low level of salinity and no problem for growing crops.

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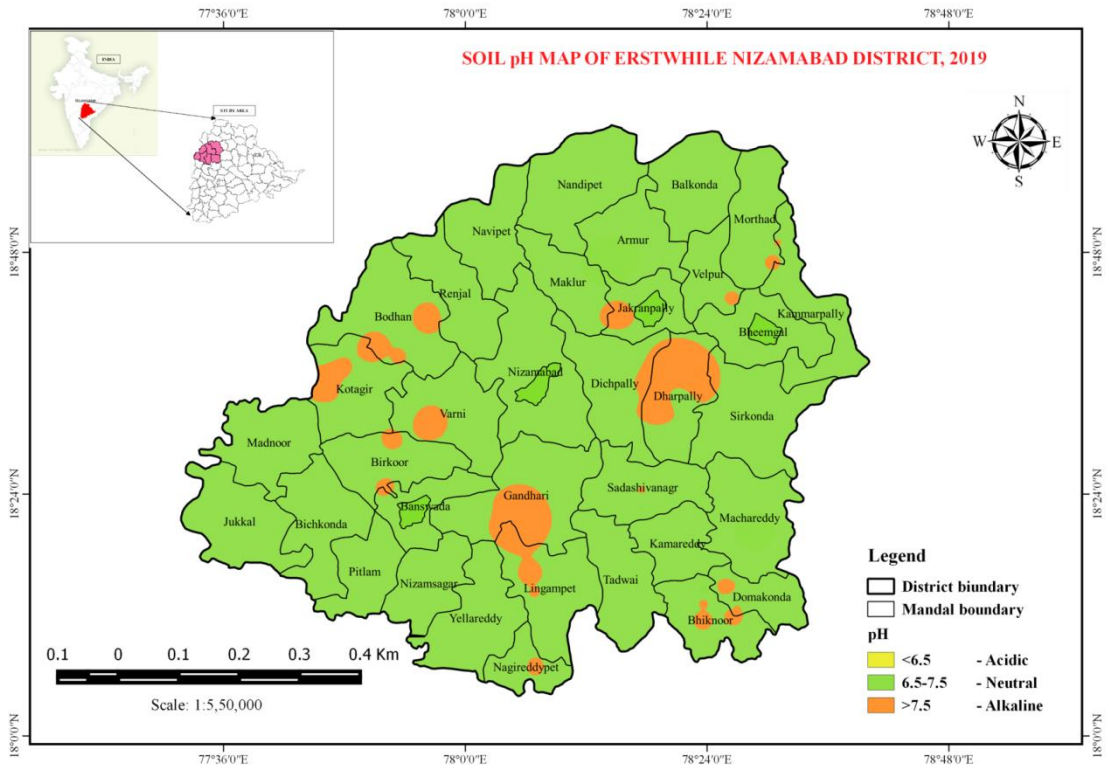

Fig 3. Soil pH map of Nizamabad district

4.2 Soil Available Macronutrients

In the soils Nizamabad district, available nitrogen content varies between 75 to 298 kg ha^{-1} with an overall mean value of 198 kg ha^{-1} (Table 2). From the all mandals soils of this district are had low in available nitrogen content (fig. 4). On an average 91.67% and 8.33% samples are rated as low available nitrogen. The soils available P_2O_5 content of Nizamabad district exhibited extreme variations from 18 to 358 kg ha^{-1} with an mean value of 96 kg ha^{-1} (Table 2). The soils from Nizamabzd district are medium to high available P_2O_5 (fig. 5) [10]. About 6.94% and 93.06% samples are found to be low and medium available phosphorus status respectively. Correlation study (Table 2) revealed that soil reaction was negatively correlated with available N and P_2O_5 (r= -0.024 and -0.130). The obtainable K_2O content of soils of Nizamabad district varies from 90 to 630 kg ha^{-1} with an overall mean value of 369 kg ha^{-1} (Table 2). The all soils from Nizamabzd district are low to high available K_2O (fig. 6) [11]. About 1.39%, 27.78% and 70.83% samples are found to be low, medium and high in availability of K.

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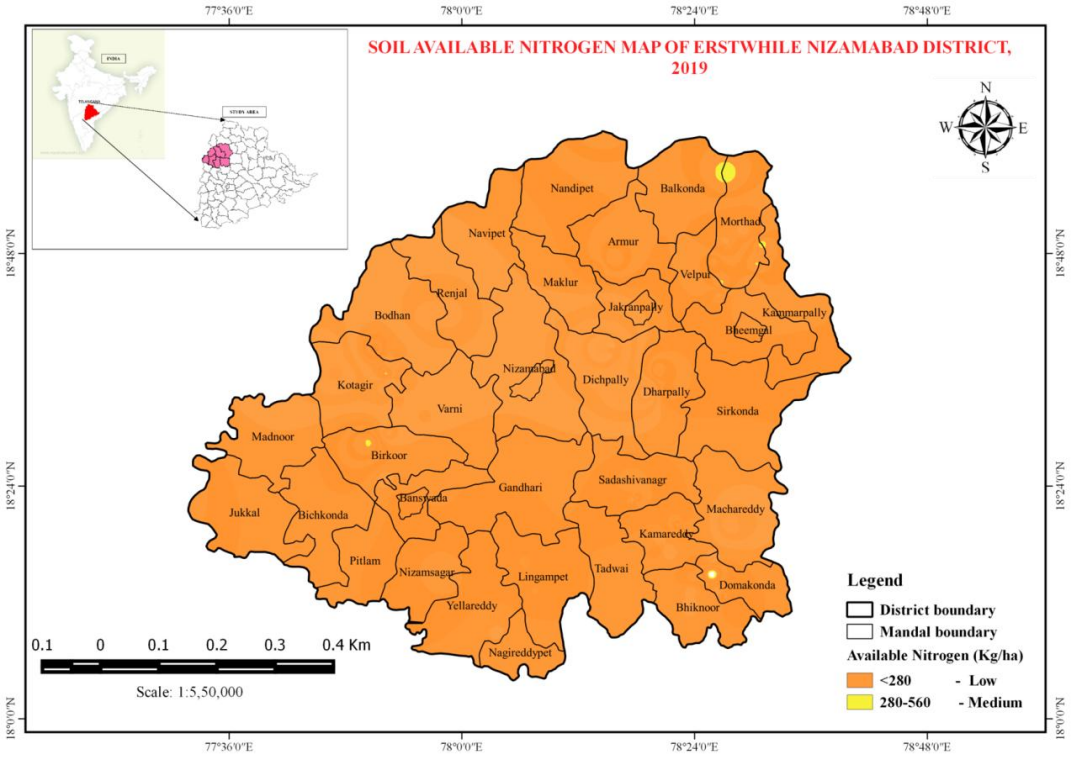

Fig 4. Soil Available Nitrogen status in Nizamabad district (Kg ha^{-1})

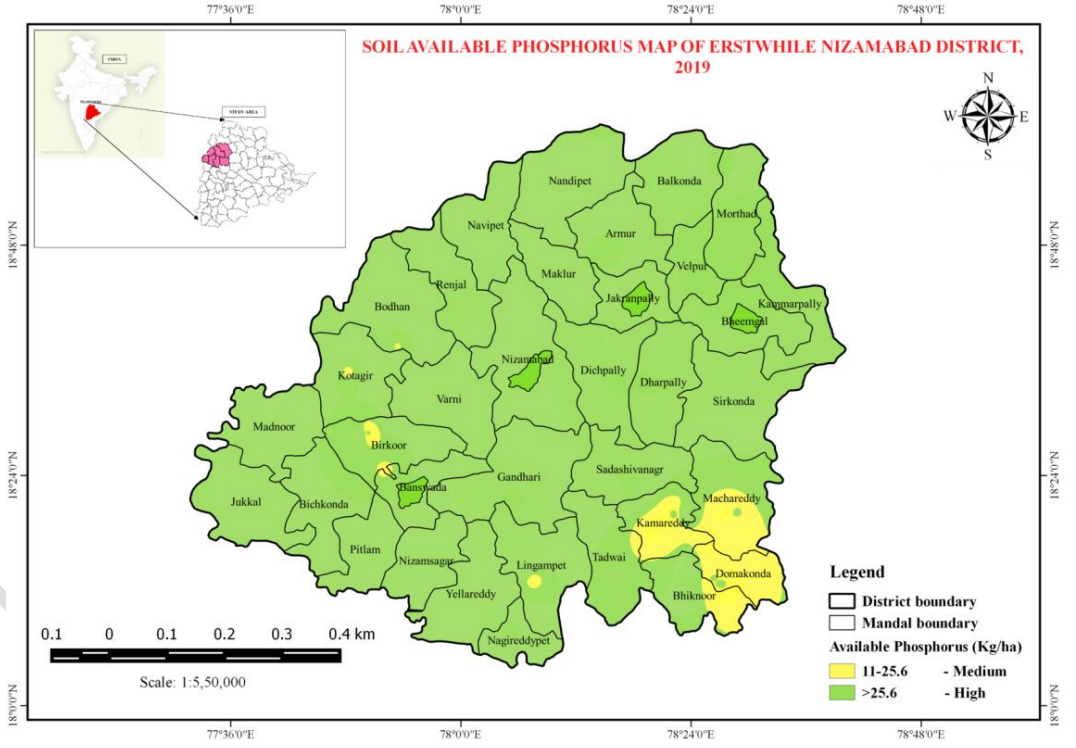

Fig 5. Soil Available P_2O_5 status in Nizamabad district (Kg ha^{-1})

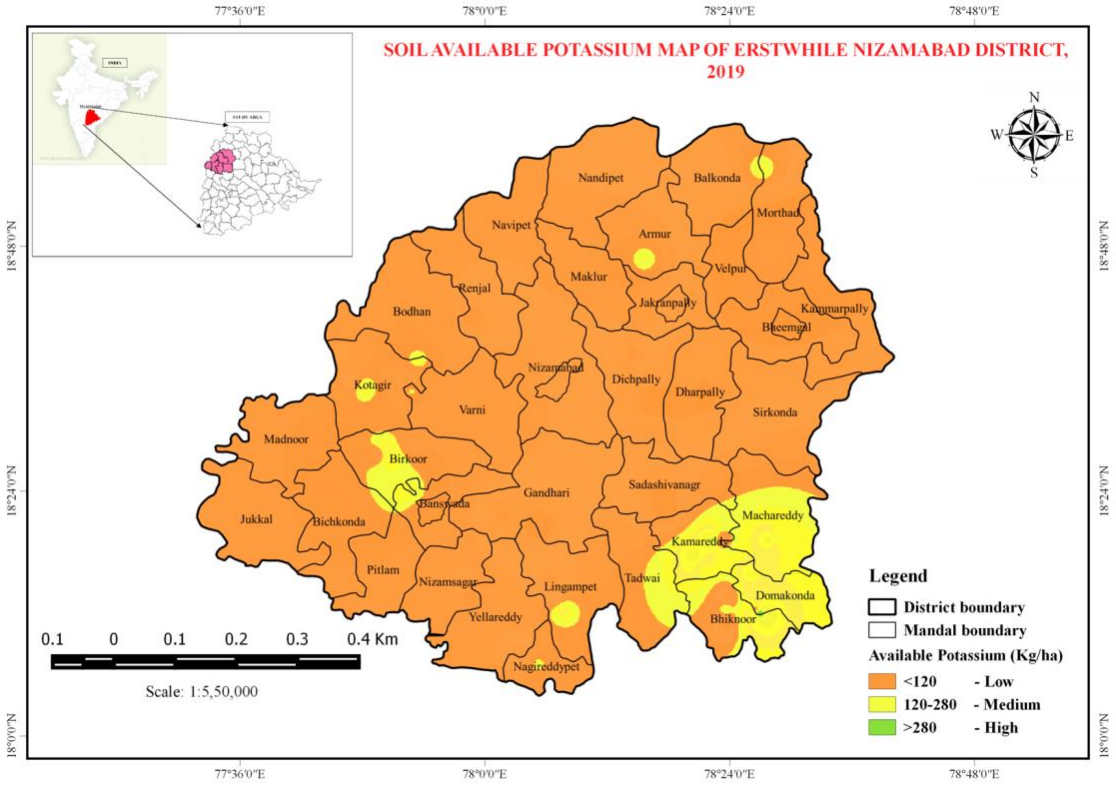

Fig 6. Soil Available K_2O status in Nizamabad district (Kg ha^{-1})

4.3 Soil Available Micronutrients

The available Zn, Cu, Fe and Mn contents of surface soils varies from 0.17 to 3.19, 0.20 to 2.76, 3.05 to 19.44 and 0.81 to 17.98 mg Kg^{-1} with mean values of 1.05, 0.99, 9.05 and 7.92 mg Kg^{-1} respectively (Table 2). The availability of Zn, Fe and Mn in these soils are very low to adequate (fig 7, 8, 9 & 10) [12]. where as Cu availability in these soils are marginal to adequate (fig. 9). About 30.56%, 50.00% and 19.44% samples are found to be low, marginal and adequate in available Zn content respectively. An average 2.78%, 6.94% and 90.28% samples are low, marginal and adequate in available Cu content. About 9.72%, 40.28%, 50.00% samples are fall under low, marginal and adequate in available Fe content. The 6.94% samples are low, 22.22% samples are marginal and 70.83% samples are adequate in available Mn content in soils.

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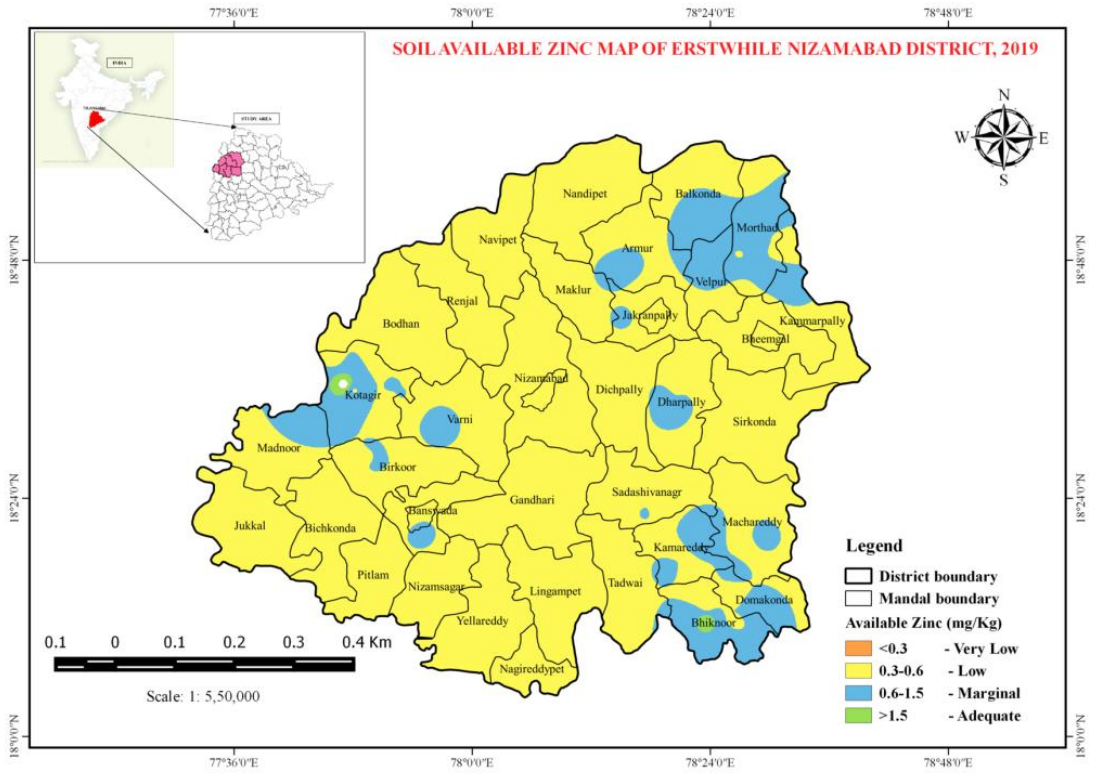

Fig 7. Soil Available Zinc status in Nizamabad district (mg Kg^{-1})

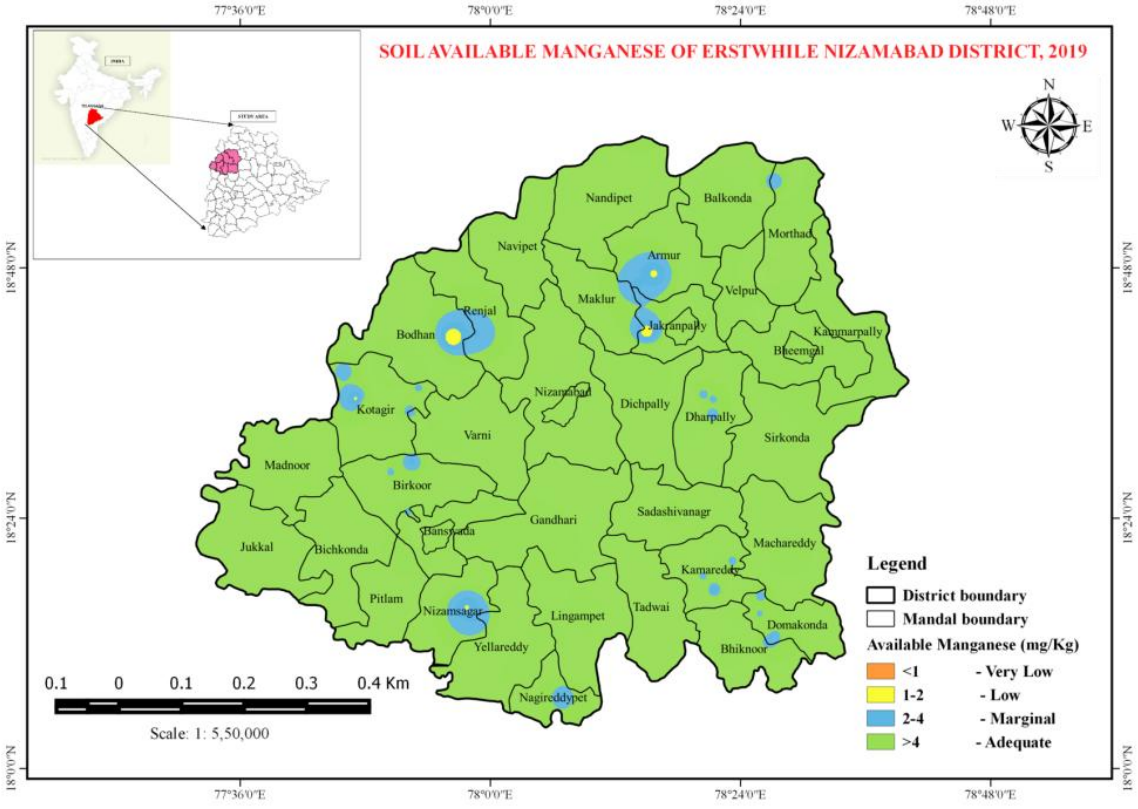

Fig 8. Available Mn status in Nizamabad district (mg Kg^{-1})

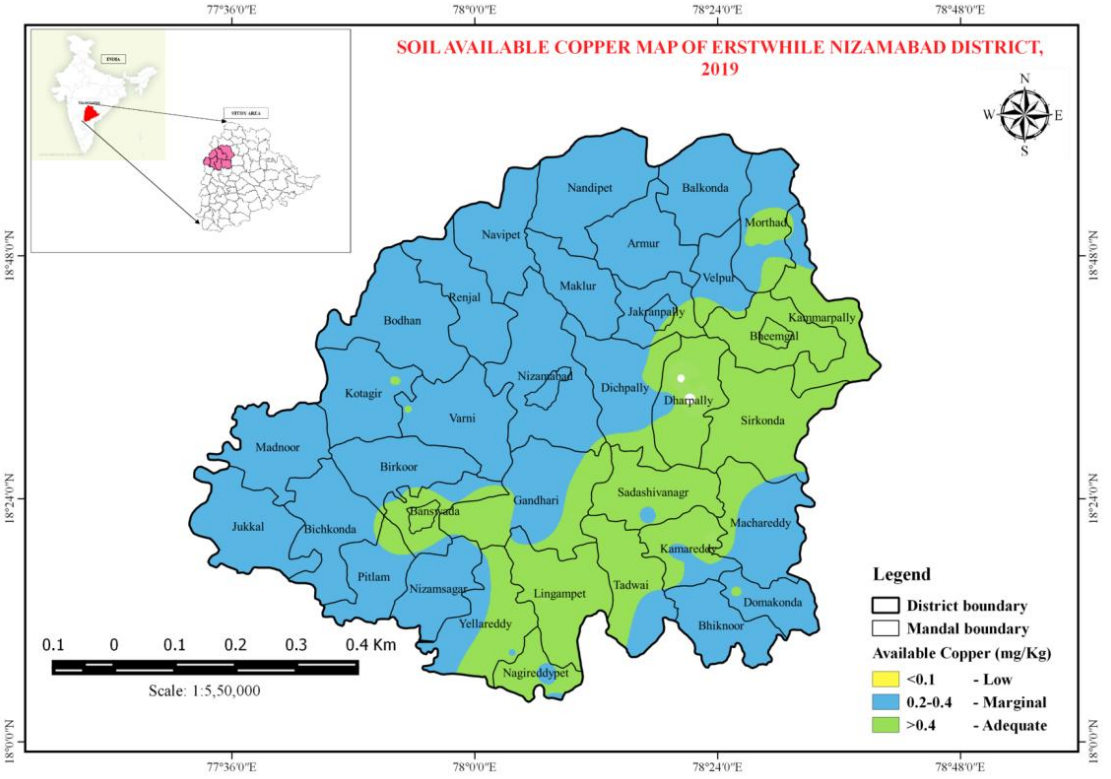

Fig 9. Available Cu status in Nizamabad district (mg Kg^{-1})

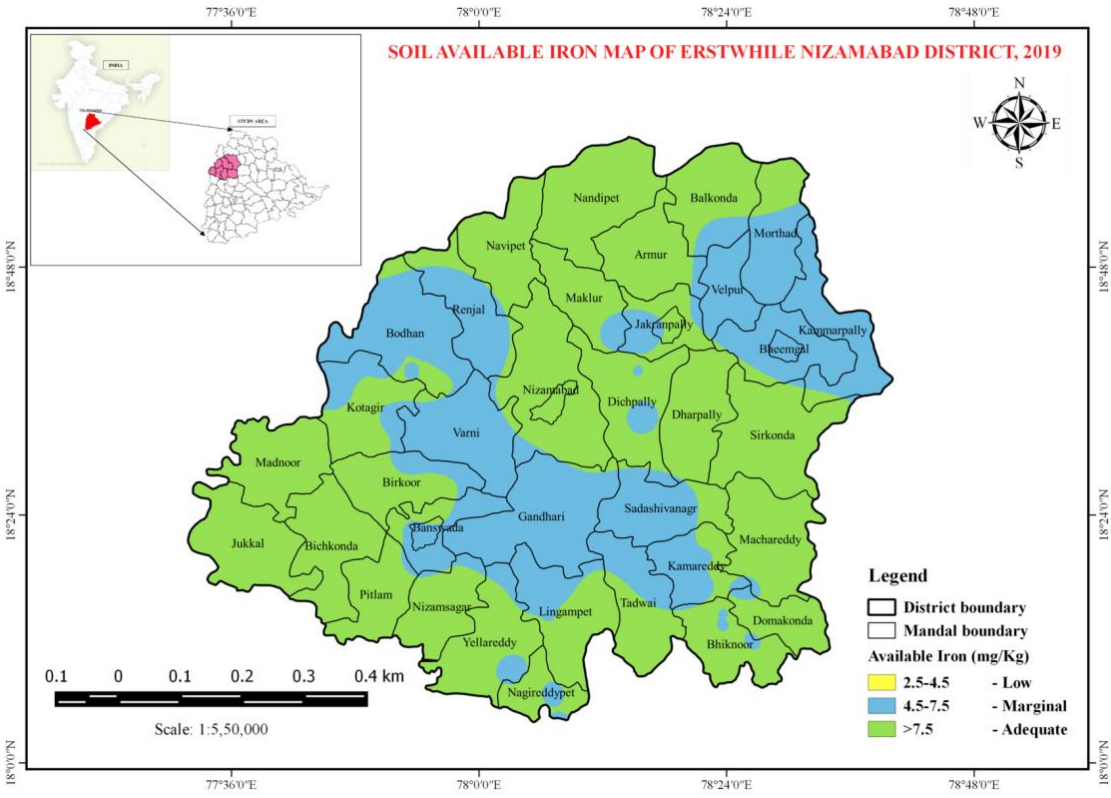

Fig 10. Available Fe status in Nizamabad district (mg Kg^{-1})

5. DISCUSSION

Our results showed that soil reaction was low acidic to medium alkaline. Due to accumulation of exchangeable sodium and calcium carbonate the soils become medium to strong alkalinity. The EC of most of the soils is normal. The modarate EC values of the soils could be ascribed to leaching of salts to lower horizon. Thus increasing soluble salts in irrigation water may increase the soil EC. The Low available nitrogen content in soils may be accredited due to high N requirement of the crops as well as intensive cropping. Higher Phosphorus availability in most of the soils may be attributed to adequate application of phosphatic fertilizers to the crops in these districts resulting in build-up of P in these soils. The availability of K is high, it may be attributed due to dominance of K rich minerals in these soils. The DTPA-extractable micronutrients (Zn, Fe, Cu and Mn) in surface soils are lower to adequate in these soils. Poor status of zinc in soils may be attributed due to low organic carbon content and high soil pH. In soil where available phosphorous content is high there are much chances of zinc deficiency and it is extremely important to use requisite amount of phosphatic fertilizers. Zinc is one of the most important components of recommended package in most of these soils. Specifically, soil Cu showed a strong positive relationship with soil pH.

6. CONCLUSION:

The study about Soil fertility status in Nizamabad district shown that these soils are low to medium in available N, medium to high in available P, high in available K, The availability of Zn, Fe and Mn in these soils are very low to adequate, where as Cu availability in these soils are marginal to adequate. The major fertility limitations observed in this studied area is, soils are low in N, Zn, Fe and Mn content. These soils should be properly managed, supplement with required amount organic manures and inorganic fertilisers.

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1 **Table 1. Soil physico-chemical properties and nutrients status in Kaleshwaram project area of Nizamabad district of Telangana state**

MANDAL	pH	EC (dS m^{-1})	Available macronutrients (Kg ha^{-1})			DTPA-micronutrients (ppm)			
			N	P_2O_5	K_2O	Zn	Cu	Fe	Mn
MORTHAD									
Range	7.23-7.36	0.17-0.37	174.30-256.74	24.52-31.90	306.00-485.00	0.87-1.87	0.79-1.20	6.43-6.68	10.07-16.23
Mean	7.29	0.28	212.42	27.11	388.67	1.51	1.00	6.56	14.09
S.D	0.07	0.10	41.57	4.15	90.28	0.55	0.20	0.12	3.48
C.V (%)	0.90	36.38	19.57	15.31	23.23	36.83	20.35	1.89	24.72
BHEEMGAL									
Range	7.10-7.75	0.13-0.23	183.75-286.33	27.68-32.30	384.00-475.24	0.86-1.02	0.68-1.46	6.25-7.09	7.46-17.96
Mean	7.42	0.18	230.49	29.29	421.99	0.95	1.05	6.68	12.67
S.D	0.33	0.05	51.89	2.61	47.50	0.08	0.39	0.42	5.25
C.V (%)	4.38	27.78	22.51	8.91	11.26	8.62	37.29	6.29	41.44
KAMMARPALLY									
Range	7.48-7.69	0.26-0.63	169.87-284.00	18.90-36.72	302.00-364.40	0.65-1.86	0.38-1.30	6.42-7.94	11.18-15.28
Mean	7.57	0.44	237.49	26.53	329.68	1.29	1.05	7.12	12.84
S.D	0.09	0.19	51.73	8.05	24.69	0.49	0.44	0.62	1.67
C.V (%)	1.14	42.52	21.78	30.34	7.49	37.60	42.32	8.70	13.04
VERNI									
Range	7.25-7.87	0.30-1.82	189.03-287.90	38.33-97.86	303.75-418.35	0.17-1.94	0.79-1.52	6.74-16.22	9.21-16.29
Mean	7.53	0.84	227.23	75.40	408.83	1.20	1.16	10.08	11.91
S.D	0.31	0.85	53.13	32.34	100.66	0.92	0.36	5.32	3.83
C.V (%)	4.17	100.51	23.38	42.89	24.62	76.90	31.37	52.76	32.17
BHODHAN									
Range	6.70-7.77	0.16-0.46	119.70-249.32	37.12-175.71	236.25-528.75	0.47-1.92	0.32-0.78	4.21-12.45	2.66-19.78
Mean	7.49	0.28	158.23	113.16	376.10	0.94	0.52	7.49	6.99
S.D	0.36	0.12	52.12	50.27	113.76	0.55	0.16	3.01	6.37
C.V (%)	4.86	43.44	32.94	44.43	30.25	58.04	30.84	40.24	91.06

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BIRKUR									
Range	7.13-7.24	0.38-0.42	264.82-296.30	33.00-275.00	123.75-135.00	0.65-2.18	0.55-0.90	16.65-17.26	3.30-8.59
Mean	7.19	0.40	280.56	154.00	135	1.41	0.73	16.96	5.95
S.D	0.08	0.03	22.26	171.12	#DIV/0!	1.08	0.25	0.43	3.74
C.V (%)	1.08	7.07	7.93	111.12	#DIV/0!	76.78	34.41	2.54	62.94
GANDHARI									
Range	7.59-8.03	0.38-0.62	209.60-212.20	30.45-49.29	337.50-393.75	0.17-0.48	0.79-1.33	3.99-6.72	10.19-11.23
Mean	7.81	0.50	210.90	39.87	365.63	0.32	1.06	5.35	10.71
S.D	0.31	0.17	1.84	13.32	39.77	0.22	0.38	1.93	0.74
C.V (%)	3.98	33.94	0.87	33.41	10.88	67.47	35.71	36.07	6.87
LINGAMPET									
Range	7.20-7.68	0.34-0.63	201.60-220.50	50.00-175.00	135.00-292.50	0.32-0.92	1.18-2.08	5.66-16.25	7.04-14.55
Mean	7.52	0.45	212.10	97.14	195.00	0.63	1.63	9.62	9.67
S.D	0.27	0.16	9.62	67.92	85.18	0.30	0.45	5.77	4.23
C.V (%)	3.65	34.92	4.54	69.92	43.68	47.88	27.59	59.98	43.75
NAGIREDDYPET									
Range	7.02-7.70	0.36-0.54	182.70-201.60	53.57-128.57	90.00-258.75	0.49-1.08	0.96-1.43	6.89-12.16	3.24-12.68
Mean	7.36	0.47	191.10	93.09	165.00	0.70	1.14	8.86	6.99
S.D	0.34	0.09	9.62	37.66	85.92	0.33	0.25	2.87	5.01
C.V (%)	4.62	20.25	5.04	40.46	52.07	47.49	21.98	32.44	71.74
YELLAREDDYPET									
Range	7.42-7.53	0.50-0.62	226.80-233.10	68.57-114.30	213.75-247.50	0.49-0.66	0.55-0.83	9.94-11.01	1.96-3.21
Mean	7.48	0.56	229.95	91.44	230.63	0.58	0.69	10.48	2.58
S.D	0.08	0.08	4.45	32.34	23.86	0.12	0.20	0.75	0.89
C.V (%)	1.04	15.15	1.94	35.37	10.35	20.54	28.82	7.20	34.31
BANSWADA									
Range	7.10-7.80	0.27-0.64	151.20-207.90	86.43-154.29	180.00-933.75	0.24-1.56	0.51-1.78	3.05-14.29	2.99-19.65
Mean	7.45	0.45	197.97	121.19	453.75	0.95	1.27	9.48	10.57
S.D	0.32	0.16	27.28	29.91	416.60	0.58	0.52	4.70	7.60

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C.V (%)	4.23	35.06	13.78	24.68	91.81	61.29	41.28	49.54	71.94
NIZAMABAD									
Range	7.56-7.69	0.29-0.60	138.60-144.90	35.00-108.57	191.25-347.89	0.24-0.56	0.70-0.81	6.70-8.04	0.81-3.26
Mean	7.63	0.45	141.75	71.79	269.57	0.40	0.75	7.37	2.04
S.D	0.09	0.22	4.45	52.02	110.76	0.23	0.08	0.95	1.74
C.V (%)	1.21	49.26	3.14	72.47	41.09	57.73	10.43	12.87	85.27
DICHPALLI									
Range	7.11-7.43	0.34-0.57	37.80-243.07	35.50-236.43	270.00-630.00	0.35-1.24	0.70-2.07	8.17-17.59	10.58-12.36
Mean	7.32	0.44	131.42	123.74	397.50	0.72	1.23	11.74	11.49
S.D	0.18	0.12	103.82	102.67	201.66	0.47	0.73	5.11	0.89
C.V (%)	2.52	27.32	78.99	82.97	50.73	65.06	59.72	43.54	7.74
DARPALLI									
Range	7.32-8.22	0.13-0.41	240.00-278.70	41.22-69.85	232.00-357.00	0.32-1.38	1.66-3.15	10.32-11.60	3.80-4.44
Mean	8.06	0.40	259.35	60.11	336.00	0.70	2.34	11.10	4.35
S.D	0.46	0.16	21.05	14.62	63.61	0.55	0.82	0.67	0.33
C.V (%)	5.65	39.05	8.12	24.32	18.93	78.05	35.24	6.06	7.56
INDALWAI									
Range	7.57-7.90	0.54-0.66	75.60-125.86	33.00-37.92	236.25-345.25	0.26-2.19	0.42-0.59	6.86-13.18	7.50-13.18
Mean	7.74	0.60	100.73	35.46	290.75	1.22	0.50	10.02	10.34
S.D	0.23	0.08	35.54	3.48	77.08	1.37	0.12	4.47	4.02
C.V (%)	3.02	14.01	35.28	9.82	26.51	111.80	24.18	44.60	38.88
ARMOOR									
Range	6.38-7.90	0.23-0.63	157.50-270.00	104.29-132.68	281.25-335.20	1.21-1.31	0.49-0.60	6.06-13.41	1.33-3.21
Mean	7.02	0.37	213.67	119.16	308.23	1.26	0.54	9.73	2.14
S.D	0.79	0.22	56.25	14.24	26.97	0.05	0.06	3.68	0.96
C.V (%)	11.22	59.67	26.33	11.95	8.75	3.97	10.85	37.76	45.14
POTHANGAL									
Range	7.40-8.20	0.23-0.25	107.10-144.90	67.14-161.43	157.50-461.25	0.82-3.64	0.39-0.70	4.42-12.73	1.94-5.95
Mean	7.67	0.24	126.00	103.33	315.00	1.86	0.52	7.79	3.99

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S.D	0.46	0.01	18.90	50.82	152.19	1.55	0.17	4.37	2.01
C.V (%)	6.02	4.17	15.00	49.18	48.31	83.12	31.84	56.09	50.26
BHIKNOOR									
Range	7.10-7.80	0.14-0.95	157.50-298.80	34.89-358.57	326.25-1102.50	0.56-3.19	0.47-1.23	3.42-18.54	2.81-12.34
Mean	7.60	0.41	215.26	170.80	559.38	1.41	0.80	10.69	6.86
S.D	0.23	0.28	52.25	112.77	253.58	0.97	0.23	5.42	3.93
C.V (%)	3.06	68.31	24.27	66.02	45.33	68.51	29.08	50.65	57.30
KAMAREDDY									
Range	7.40-7.50	0.18-0.44	170.10-214.20	152.86-217.86	180.00-618.75	0.56-1.75	0.57-1.62	3.85-7.94	2.27-13.28
Mean	7.43	0.27	186.90	183.10	375.00	1.03	0.97	6.36	6.44
S.D	0.06	0.14	23.85	32.74	223.40	0.63	0.57	2.20	5.97
C.V (%)	0.78	52.93	12.76	17.88	59.57	60.72	58.68	34.61	92.68
DOMAKONDA									
Range	6.70-8.00	0.07-0.54	170.10-315.00	29.29-192.14	225.00-562.50	0.49-1.39	0.20-1.23	3.63-14.05	4.13-11.56
Mean	7.35	0.31	270.90	97.86	393.75	0.79	0.80	11.12	7.96
S.D	0.66	0.24	73.02	87.55	191.69	0.46	0.55	5.23	4.22
C.V (%)	8.92	79.57	26.95	89.47	48.68	58.33	69.05	46.98	53.01
MACHAREDDY									
Range	6.45-7.40	0.14-0.54	132.30-189.00	39.87-201.43	168.75-517.50	0.61-1.75	0.45-2.76	10.37-19.44	2.86-10.01
Mean	6.92	0.33	159.60	124.48	348.75	1.29	1.32	15.12	7.37
S.D	0.48	0.20	28.41	81.05	174.65	0.60	1.26	4.55	3.92
C.V (%)	6.87	61.63	17.80	65.11	50.08	46.62	95.49	30.11	53.21
SADHASHIVANAGAR									
Range	0.48-7.65	0.14-61.63	17.80-264.80	30.00-124.48	50.08-487.00	0.33-46.62	0.57-95.49	4.55-30.11	3.92-53.21
Mean	7.30	0.23	225.87	35.44	474.50	0.87	1.14	6.90	6.07
S.D	0.38	0.08	45.13	5.10	18.90	0.58	0.59	1.76	1.27
C.V (%)	5.17	33.41	19.98	14.40	3.98	67.53	51.84	25.51	20.87

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Table 2. Correlation between important soil properties

	pH	EC	N	P_2O_5	K_2O	Zn	Cu	Fe	Mn
pH	1								
EC	0.176	1.000							
N	-0.024	0.136	1.000						
P_2O_5	-0.130	-0.120	0.084	1.000					
K_2O	0.132	-0.056	-0.031	0.109	1.000				
Zn	0.042	0.123	0.004	0.115	-0.149	1.000			
Cu	0.098	0.125	0.377	-0.127	-0.033	-0.012	1.000		
Fe	-0.245	0.421	0.229	0.233	-0.247	0.280	0.219	1.000	
Mn	-0.097	0.090	0.125	-0.259	0.128	-0.001	0.150	-0.083	1.000

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