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Depth wise distribution of micronutrient status in groundnut growing soils of Srikalahasti division in Chittoor district of Andhra Pradesh

V Nagarjuna and MVS Naidu

Abstract
Groundnut growing soils of Srikalahasti division of Chittoor district were sufficient in DTPA extractable Cu, Fe and Mn. However, DTPA extractable Zn was sufficient in surface horizons and deficient in most of the sub-surface horizons expect P13, P15 and P18 wherein the DTPA extractable Zn was found to be sufficient. The total zinc, copper, iron and manganese content in groundnut growing soils ranging from 10.23 to 98.95 mg kg^{-1}, 8.00 to 48.00 mg kg^{-1}, 0.34 to 3.72 per cent and 53.25 to 842.50 mg kg^{-1} soil respectively. The available zinc, copper, iron and manganese content in groundnut growing soils ranging from 0.27 to 2.73 mg kg^{-1}, 0.30 to 8.89 mg kg^{-1}, 4.58 to 96.54 mg kg^{-1} soil and 2.06 to 78.85 mg kg^{-1} soil respectively.

Keywords: Horizon wise distribution, groundnut crop, available micronutrients and total micronutrients

1. Introduction

Intensification of agriculture, usage of straight fertilizers, rising crop requirements due to increasing productivity levels have heightened the secondary and micronutrients demand in soil fertility management and are increasingly becoming major constraints to achieve augmented agricultural production. Among the crops, groundnut responds well to secondary and micronutrient fertilization. Groundnut is relatively sensitive to the deficiency of micronutrients especially zinc (Zn), iron (Fe) Manganese (Mn) and Copper (Zn). The Zn deficiency in groundnut occurs mainly in the upper leaves showing irregular mottling with yellow-ivory interveinal chlorosis. Reduction in size of young leaves which are sometimes clustered or borne very closely. Faint chlorosis of the lower leaves between the vein, leaf margin and tips are also observed. The Zn deficiency can be separated from Fe with its wider strip which may not run entire length of the leaflets. The bands are always on the leaf portion nearest to the petiole. Under severe deficiency, the entire leaflets become chlorotic. Iron is a component of cytochrome oxidase, ferredoxin protein, chlorophyll and several enzyme systems. It is involved in nitrate and sulphate reductase nitrogen assimilation and energy (NADP) production. Among all micronutrients, iron deficiency is most commonly observed in groundnut. The Mn deficiency appears as interveinal chlorosis of younger leaves and continues on older leaves. Chlorosis produces bold pattern of dark green major veins. The Mn deficiency is distinguishable from iron deficiency by appearance of varied but characteristic necrotic spotting or lesions on the leaf margins. In the copper deficient groundnut plant the young leaves are curled. The plant become stunted, rosettes, interveinal crinkling and marginal wilting occur due to weakness of cell wall, but not due to water stress. The entire leaf becomes cupped and leaflet margins turn upwards. Irregular leaflets with marginal necrosis and mild chlorosis and small yellow-white spots on the foliage. Bronzing and necrosis of the outer edges of the leaflet occur if deficiency is prolonged. Copper deficiency also reduces root growth more than shoot growth creating an unfavorable shoot: root ratio. The present study was taken for study the micronutrients status in groundnut growing soils in Srikalahasti division of Chittoor district of Andhra Pradesh.

2. Material and Methods

Twenty master profiles (pedons) were identified in groundnut growing areas of Srikalahasthi Agricultural division in Chittoor district, Andhra Pradesh representing different types of soils by taking into consideration geology, climatic conditions, geomorphic characters and other related pedological information pertaining to the study area. Horizon-wise soil samples were collected from each pedon for laboratory analysis. The samples were air dried under shade, ground with wooden mallet, sieved through a 2 mm sieve and preserved in polyethylene bags for laboratory analysis. One gram of oven dried soil sample was transferred into a 150 ml Erlenmeyer flask to which 20 ml of concentrated nitric acid was added and a small funnel was placed over the Erlenmeyer flask to prevent rapid evaporation of acid. The contents were heated on a hot plate to oxidize the organic matter. Then 10 ml of 60 per cent perchloric acid was added and the digestion was continued until dense white fumes appeared. A little quantity of perchloric acid was added to wash down the sides of the flask and the heating was continued for another 15 minutes to dehydrate the silica. The residue was dissolved in 25-30 ml of warm double distilled water and filtered through Whatman number 42 filter paper and the filtrate was collected in 250 ml volumetric flask. The residue was washed with 0.5 *M* HCl and finally the volume was made upto 250 ml (Hesse, 1971). The acid extract was directly aspirated into atomic absorption spectrophotometer (VARIAN AA240FS) for the determination of total Zn, Cu, Fe and Mn. The results were expressed in mg kg^{-1} soil (Hesse, 1971). The available micronutrients in soil samples were extracted by using DTPA extractant solution of pH 7.3 (Lindsay and Norvell, 1978) and the extract was aspirated to atomic absorption spectrophotometer (VARIAN AA240FS).

3. Result and Discussion

Depth wise distributions of micronutrient status (total and available micronutrients) in groundnut growing soils are presented in Table 1.

3.1 Total and available Zinc

Total zinc was ranging from 10.23 to 98.95 mg kg^{-1} soil. The lowest (10.23 mg kg^{-1} soil) and the highest values (98.95 mg kg^{-1} soil) were noticed in Bw3 and BC3 horizons of pedons 3 and 17, respectively. Pedons 11 and 19 showed a decreasing trend with depth while pedons 7 and 15 showed an irregular increasing trend with depth. The remaining pedons did not show any specific depth function. The mean values of total zinc were between 14.32 and 60.14 mg kg^{-1} soil. Parent material and nature of associated minerals were the predominant determinants of the total micronutrients in soils (Murthy *et al.*, 1997) [4]. Similar results were also reported by Samanta *et al*. (2002) [9] in soils of West Bengal.

The available zinc ranged from 0.27 to 2.73 mg kg^{-1} soil. The lowest value (0.27 mg kg^{-1} soil) was noticed in Bw4 horizon of pedon 9. The highest value (2.73 mg kg^{-1} soil) was observed in Ap horizon of pedon 6. Pedons 6, 7, 11, 13 and 20 showed almost a decreasing trend with depth whereas remaining pedons did not show any specific depth function. The mean values of available zinc were between 0.41 and 1.30 mg kg^{-1} soil. Considering 0.6 mg kg^{-1} soil as critical level (Lindsay and Norvell, 1978) for available zinc, available zinc status was found to be deficient to sufficient. Surface horizons of the all the pedons were sufficient in available zinc whereas most of the sub-surface horizons were deficient in available zinc except pedons 13, 15 and 18 wherein the available zinc was sufficient.

Deficiency of zinc in sub-surface horizons was due to low amount of organic carbon in these deeper layers. These results were in accordance with the results of Murthy *et al*. (1997) [4]. The available zinc was significantly and positively correlated (r = +0.395**) with organic carbon. DTPA-extractable Zn was higher in surface horizons and decreased with depth generally in most of the pedons. Similar observations were made by Kumar and Naidu (2012a) [2] in soils of Vadamalapeta mandal of Chittoor district. Zinc deficiency was wide spread in soils with high pH, low organic matter and calcareousness (Rattan and Sharma, 2004) [7].

3.2 Total and available Iron

The total iron content in groundnut growing soils ranged from 0.34 to 3.72 per cent. The lowest value of 0.34 per cent was observed in C1 horizons of pedon 6 and the highest value of 3.72 per cent was noticed in 3A3 horizon of pedon 4. Pedons 11 and 16 showed an increasing trend while pedons 7, 14 and 15 exhibited an irregular increasing trend with depth Pedon 18 showed decreasing trend with depth whereas remaining pedons did not exhibit any specific trend with depth. The mean value of total iron varied from 0.72 to 3.08 per cent.

Variation in total iron among the pedons could be attributed to variation in ferro-magnesium minerals present in these soils. Further, the irregular decreasing trend with depth might be due to weak pedogenic manifestation and alluvial nature of these soils (Sangwan and Singh 1993) [10].

The available iron ranged from 4.58 to 96.54 mg kg^{-1} soil. The lowest value of 4.58 mg kg^{-1} soil was observed in 4A5 horizon of pedons 16 and 19 while the highest value of 96.54 mg kg^{-1} soil was noticed in Ap horizon of pedon 11. Pedons 7, 11 and 19 showed almost a decreasing trend with depth. Pedon 12 exhibited almost an increasing trend with depth. No specific trend was observed in remaining pedons. The mean value of available iron varied from 4.58 to 58.83 mg kg^{-1} soil. According to the critical limit (4.5 mg kg^{-1} soil) of Lindsay and Norvell (1978) [3], the soils were sufficient in available iron. The distribution of available iron in all the pedons did not show a definite pattern. The surface horizons contain more Fe than sub-surface horizons. It might be due to accumulation of organic carbon in the surface horizons. The organic carbon due to its affinity to influence the solubility and availability of iron by chelation effect might have protected the iron from oxidation and precipitation, which consequently increased the availability of iron (Prasad and Sakal, 1991) [5]. These results were further supported by significant and positive correlation of available iron with organic carbon (r = +0.135) and significant and negatively correlation with pH (r = -0.308**). These findings were in good agreement with those of Sarkar *et al*. (2000) [11].

3.3 Total and available Manganese

The total manganese content in groundnut growing soils ranged from 53.25 to 842.50 mg kg^{-1} soil. The lowest value of 53.25 mg kg^{-1} soil was observed in Bw2 horizon of pedon 1 and the highest value of 842.50 mg kg^{-1} soil was noticed in Bt2 horizon of pedon 12. The mean value of total manganese varied from 78.20 to 691.90 mg kg^{-1} soil. All the pedons showed more or less an irregular trend with depth except pedons 7, 10, 11 and 20 which exhibited an increasing trend with depth and pedon 18 showed a decreasing trend with depth. The total manganese showed wide variation and this could be ascribed to the variation in the content of manganese bearing minerals, clay, organic carbon, CEC and other associated elements (Prasad, 1994) [6].

The available manganese in groundnut growing soils ranged from 2.06 to 78.85 mg kg^{-1} soil. The lowest value of 2.06 mg kg^{-1} soil was observed in Bt1 horizon of pedon 1 and the highest value of 78.85 mg kg^{-1} soil was noticed in A1 horizon of pedon 15. The mean value of available manganese varied from 4.08 to 42.07 mg kg^{-1} soil. Pedons 11 and 18 showed a decreasing trend with depth. Pedon 12 showed an increasing trend with depth whereas pedons 8 and 10 exhibited an irregular increase with depth. However, remaining pedons showed no specific trend with depth.

The available manganese was sufficient because these values were well above the critical limit (1.0 mg kg^{-1}) of Lindsay and Norvell (1978) [3]. These observations were confirmed with the findings of Sarkar *et al*. (2000) [11] and Bhaskar *et al*. (2004) [1] in soils of Bihar and in soils of Meghalaya, respectively.

In conclusion, the groundnut growing soils in Srikalahasthi division of Chittoor district, Andhra Pradesh were deficient to sufficient in available zinc and sufficient in available iron, copper and manganese.

3.4 Total and available Copper

The total copper content in groundnut growing soils varied from 8.00 to 48.00 mg kg^{-1} soil. The highest copper content (48.00 mg kg^{-1} soil) was noticed in Bt2 horizon of pedon 2 and the lowest copper content (8.00 mg kg^{-1} soil) was observed in C1 horizon of pedon 6. Pedons 10, 11 and 16 showed almost an increasing trend with depth while pedons 1 and 6 exhibited more or less a decreasing trend with depth. No specific trend was noticed in the remaining pedons. The mean values of total copper content ranged between 9.57 and 35.88 mg kg^{-1} soil. The variation in total copper content among the pedons might be due to variation in copper bearing minerals in the soils.

The available copper in groundnut growing soils ranged from 0.30 to 8.89 mg kg^{-1} soil. The lowest value of 0.30 mg kg^{-1} soil was observed in 2C2 horizon of pedon 6 and the highest value of 8.89 mg kg^{-1} soil was noticed in Ap horizon of pedon 15. Pedons 2, 3, 5 and 7 showed almost a decreasing trend with depth. The mean values of available copper varied from 0.65 to 6.77 mg kg^{-1} soil. The higher concentration of copper in the surface horizon might be due to higher biological activity and the chelating of organic compounds, released during the decomposition of organic matter left after harvesting of crop. Similar findings were made by Reddy and Naidu (2016) [8] in soils of Chennur mandal of Kadapa district in Andhra Pradesh.

All the pedons were found to be sufficient in available copper (0.30 to 8.89 mg kg^{-1} soil) as all the values were well above critical limit of 0.2 mg kg^{-1} soil as suggested by Lindsay and Norvell (1978) [3]. Available copper was significantly and positively correlated (r = +0.386**) with organic carbon. Similar findings were made by Sarkar *et al.* (2000) [11] and Verma *et al*. (2005) [12] in soils of Madhubani district in Bihar and in soils developed on different physigrphic units of Fatehgarh Sahib district of Punjab, respectively. Higher available copper in surface horizons of all the soils may be due to its turnover by plant residues. Similar findings were observed by Verma *et al*. (2007) [13].

Table 1: Depth wise total and available micronutrient content (mg kg^{-1}) of the soils.

Pedon No. & Horizon	Depth (m)	Available micronutrients				Total micronutrients			
		Zn	Cu	Fe	Mn	Zn	Cu	*Fe (%)	Mn
Pedon 1									
Ap	0.00 – 0.20	0.69	1.53	27.33	3.84	39.18	37.75	1.12	117.75
A1	0.20 – 0.40	0.33	1.21	7.98	5.80	21.55	26.00	1.97	197.75
Bw1	0.40 – 0.69	0.70	1.17	5.90	2.06	26.20	27.00	1.82	525.50
Bw2	0.69 – 0.90	0.75	0.75	5.14	5.80	70.10	28.50	0.86	53.25
Bw3	0.90 – 1.10	0.54	0.62	5.87	3.20	32.33	27.00	3.02	269.50
Pedon 2									
Ap	0.00 – 0.30	1.69	3.11	13.99	16.90	31.53	21.25	2.65	335.50
E	0.30 – 0.60	0.63	2.43	7.84	9.59	63.25	31.00	3.57	501.00
Bt1	0.60 – 0.90	0.53	1.29	10.92	12.32	42.93	37.00	2.65	117.75
Bt2	0.90 – 1.10	1.01	1.52	22.25	11.81	60.75	48.00	3.34	842.25
Bt3	1.10 – 1.50	0.87	1.55	19.49	05.10	51.25	43.00	3.21	472.50
Bt4	1.50 – 1.80+	0.80	1.04	14.85	11.30	32.98	37.50	2.99	591.50
Pedon 3									
Ap	0.00 – 0.20	1.17	1.96	12.31	15.54	18.33	22.75	2.78	300.00
Bw1	0.20 – 0.54	0.28	1.48	5.90	6.70	15.48	15.50	2.17	264.00
Bw2	0.54 – 0.84	0.78	1.25	8.38	19.90	10.23	19.00	2.57	342.75
Bw3	0.84 – 1.12	0.53	0.75	7.40	9.06	16.65	22.25	2.82	359.00
Bw4	1.12 – 1.50	0.89	0.62	11.46	10.82	23.85	22.50	1.99	244.50
Bw5	1.50 – 1.80+	0.63	0.49	4.99	3.80	19.55	19.50	1.99	181.00
Pedon 4									
Ap	0.00 – 0.23	2.62	0.78	4.95	5.73	10.90	10.50	1.51	231.50
2A1	0.23 – 0.55	0.57	0.58	7.56	14.11	19.55	16.00	2.01	355.75
3A2	0.55 – 0.90	0.71	1.10	6.97	11.54	10.30	18.00	2.77	458.75
3A3	0.90 – 1.20	0.43	1.05	9.56	25.78	19.28	21.75	3.72	557.25
4A4	1.20 – 1.60	0.50	1.09	10.09	12.62	17.25	9.75	1.18	152.00
5A5	1.60 – 2.00+	0.32	0.85	8.76	18.98	14.15	19.25	2.99	358.75
Pedon 5									
Ap	0.00 – 0.30	1.05	2.18	10.25	6.49	19.38	21.25	2.32	324.00
Bt1	0.30 – 0.58	0.34	2.11	8.33	10.06	17.20	32.75	2.68	453.75
Bt2	0.58 – 0.90	0.46	1.72	9.83	6.69	24.98	30.50	2.51	477.50
Bt3	0.90 – 1.22	0.28	1.09	7.34	23.54	19.08	33.00	2.87	425.50
Bt4	1.22 – 1.80+	0.39	1.28	5.75	4.94	13.85	33.50	2.88	429.50
Pedon 6									

Ap	0.00 – 0.25	2.73	1.02	15.41	2.91	15.90	12.00	1.27	126.50
C1	0.25 – 0.58	0.54	1.01	5.22	5.99	14.75	8.00	0.34	148.50
C2	0.58 – 0.99	0.40	0.61	8.58	11.38	12.50	9.00	0.99	213.50
C3	0.99 – 1.33	0.33	0.36	7.74	2.54	10.25	8.75	1.06	122.75
C4	1.33 – 1.60	0.28	0.30	5.11	2.88	20.00	9.25	0.98	139.00

* Total iron status is presented in percentage (%) Cont…

Table 1: Contd…

Pedon No. & Horizon	Depth (m)	Available micronutrients				Total micronutrients			
		Zn	Cu	Fe	Mn	Zn	Cu	*Fe (%)	Mn
Pedon 7									
Ap	0.00 – 0.15	1.10	2.46	21.34	12.95	11.25	13.50	2.03	184.50
Bw1	0.15 – 0.46	0.98	1.47	18.00	42.50	11.43	27.25	2.78	228.75
Bw2	0.46 – 0.86	0.53	1.05	5.81	5.14	19.98	29.25	3.10	279.00
Bw3	0.86 – 1.00	0.44	0.57	4.99	8.71	12.05	11.25	1.32	256.25
Cr		**Weathered gneiss mixed with soil**							
Pedon 8									
Ap	0.00 – 0.29	1.09	1.21	22.33	12.24	18.75	12.00	0.98	123.25
A1	0.29 – 0.43	0.44	1.12	6.68	21.10	15.48	36.00	3.28	312.75
A2	0.43 – 0.71	0.48	0.84	5.12	16.77	14.25	17.75	2.22	399.00
A3	0.71 – 1.10	0.42	0.87	6.31	28.73	11.50	19.75	2.65	483.00
Bw1	1.10 – 1.40	0.61	1.14	7.04	32.33	16.73	22.00	3.16	508.75
Bw2	1.40 – 1.80+	0.49	1.27	7.92	31.88	17.30	22.00	3.13	475.25
Pedon 9									
Ap	0.00 – 0.15	1.79	2.41	66.12	24.71	13.18	26.75	3.22	276.00
Bw1	0.15 – 0.33	0.79	1.42	9.83	20.13	11.75	31.50	3.02	414.50
Bw2	0.33 – 0.64	0.67	2.58	29.10	15.42	24.75	22.75	2.98	279.25
Bw3	0.64 – 0.86	1.52	1.66	22.23	11.71	64.63	30.50	2.94	444.00
Bw4	0.86 – 1.10	0.27	1.51	6.76	8.11	14.60	14.00	1.02	104.75
Bw5	1.10 – 1.50	0.41	1.32	8.37	14.93	38.73	27.00	2.78	253.50
Cr		**Weathered gneiss mixed with soil**							
Pedon 10									
Ap	0.00 – 0.18	0.80	1.36	24.30	13.74	53.90	14.25	1.93	308.25
Bw1	0.18 – 0.55	0.83	1.48	12.87	24.78	33.48	14.75	1.15	308.00
Bw2	0.55 – 0.84	0.44	2.01	6.82	16.80	79.30	26.75	1.72	537.50
Bw3	0.84 – 1.02	0.91	1.95	8.25	24.54	80.05	28.50	2.23	557.00
Cr		**Weathered gneiss mixed with lime**							
Pedon 11									
Ap	0.00 – 0.22	2.07	3.52	96.54	67.46	46.28	16.00	1.41	367.00
A1	0.22 – 0.33	0.53	2.93	21.12	14.96	43.28	19.00	1.65	430.00
R		**Hard Rock**							
Pedon 12									
Ap	0.00 – 0.15	0.64	1.42	3.63	16.20	64.48	26.50	2.35	727.00
Bt1	0.15 – 0.34	0.42	1.29	4.99	18.60	23.03	13.75	1.26	524.00
Bt2	0.34 – 0.80	0.87	1.01	5.45	33.66	48.08	30.50	2.67	842.25
Cr		**Weathered gneiss**							
Pedon 13									
Ap	0.00 – 0.23	1.30	3.61	28.72	76.28	31.63	12.00	0.82	300.75
A1	0.23 – 0.44	0.98	3.57	7.64	23.38	16.43	10.25	0.17	71.75
A2	0.44 – 0.69	0.91	1.68	45.55	55.90	42.98	20.25	1.56	405.25
A3	0.69 – 0.92	0.91	1.70	15.42	27.20	38.98	19.75	1.52	380.75
A4	0.92 – 1.30+	0.82	1.31	12.69	17.74	31.78	20.50	1.52	235.75

* Total iron status is presented in percentage (%) Cont…

Table 1: Contd…

Pedon No. & Horizon	Depth (m)	Available micronutrients				Total micronutrients			
		Zn	Cu	Fe	Mn	Zn	Cu	*Fe (%)	Mn
Pedon 14									
Ap	0.00 – 0.17	0.95	4.83	25.06	14.61	33.53	13.50	1.04	272.00
A1	0.17 – 0.41	0.75	2.89	8.62	25.00	29.60	17.75	1.29	639.25
A2	0.41 – 0.77	0.63	3.11	17.74	20.12	34.40	22.00	1.33	579.25
Bw1	0.77 – 1.19	0.31	2.53	5.13	12.56	30.30	23.00	1.48	592.50
Bw2	1.19 – 1.43	0.46	2.61	6.78	25.15	32.80	21.75	1.34	560.00
BC	1.43 – 1.80+	0.36	1.79	5.58	10.02	28.88	18.25	1.26	480.25
Pedon 15									
Ap	0.00 – 0.20	1.08	2.58	36.52	35.76	20.93	11.25	0.79	333.50
A1	0.20 – 0.54	0.86	1.37	52.60	78.85	31.15	17.75	0.81	564.75

Bw1	0.54 – 0.84	1.02	1.45	95.75	48.80	42.68	26.75	1.35	355.75
Bw2	0.84 – 1.07	1.22	1.89	12.97	12.75	40.98	22.25	1.31	283.75
Bw3	1.07 – 1.50+	1.50	1.76	23.10	23.47	52.33	35.75	2.10	393.50
Pedon 16									
Ap	0.00 – 0.20	0.97	3.94	16.46	11.22	21.75	9.50	0.45	129.00
A1	0.20 – 0.40	0.45	2.03	4.99	7.01	12.45	10.25	0.62	226.25
Bw1	0.40 – 0.80	0.88	2.49	32.25	25.95	19.43	20.00	0.90	127.50
Bw2	0.80 – 1.20	0.30	2.83	4.99	3.39	27.03	21.75	1.23	247.25
Bw3	1.20 – 1.50+	0.60	1.49	4.58	3.09	37.55	26.25	1.24	158.75
Pedon 17									
Ap	0.00 – 0.16	2.11	2.54	8.75	11.18	41.88	16.25	0.86	381.50
A1	0.16 – 0.50	0.59	2.28	17.90	24.16	98.95	29.00	1.39	448.25
A2	0.50 – 0.85	0.55	2.13	4.58	15.80	28.60	21.00	1.28	557.25
A3	0.85 – 1.28	0.50	2.49	4.68	15.10	26.10	24.25	1.06	405.50
A4	1.28 – 1.60+	0.86	2.09	10.30	39.14	29.93	20.75	1.19	458.00
Pedon 18									
Ap	0.00 – 0.22	0.76	2.05	7.00	20.34	25.53	16.50	1.15	270.00
A1	0.22 – 0.46	0.65	1.81	5.32	13.31	24.38	20.25	0.95	249.25
A2	0.46 – 0.81	1.07	1.95	5.79	11.32	26.70	17.00	0.94	232.00
Cr		**Weathered gneiss mixed with soil**							
Pedon 19									
Ap	0.00 – 0.15	0.80	2.55	15.15	19.56	43.98	10.00	0.99	235.75
A1	0.15 – 0.29	1.49	1.31	11.48	26.94	31.20	11.75	1.10	271.50
A2	0.29 – 0.49	0.40	1.19	4.99	12.61	22.40	9.00	0.93	234.25
R		**Weathered Rock**							
Pedon 20									
Ap	0.00 – 0.16	0.53	1.48	18.59	6.91	10.43	9.25	0.58	69.00
A1	0.16 – 0.34	0.34	0.97	15.03	5.11	22.55	13.25	0.92	80.50
A2	0.34 – 0.58	0.32	0.56	19.61	7.19	11.80	11.25	0.58	86.25
Cr	0.58	**Weathered gneiss mixed with soil**							

* Total iron status is presented in percentage (%)

4. Conclusion
In conclusion, groundnut growing soils of Srikalahasti division of Chittoor district were sufficient in DTPA extractable Cu, Fe and Mn. However, DTPA extractable Zn was sufficient in surface horizons and deficient in most of the sub-surface horizons expect P13, P15 and P18 wherein the DTPA extractable Zn was found to be sufficient. Groundnut responds to fertilizer application. Substantial increase in groundnut production can be achieved through effective nutrient management only.

5. Competing Interests
Authors have declared that no competing interests exist.

6. References

1. Bhaskar BP, Saxena RK, Vadivelu S, Baruah U, Butte PS, Dutta DP. Pedogenesis in high attitude soils of Meghalaya Plateau. Agropedology 2004;14:9-23.
2. Kumar YSS, Naidu MVS. Characteristics and classification of soils representing major landforms in *Vadamalapeta mandal* of Chittoor district, Andhra Pradesh. Journal of the Indian Society of Soil Science. 2012;60(1):63-67.
3. Lindsay WL, Norvell WA. Development of DTPA soil test for zinc, iron, manganese and copper. Soil Science Society of American Journal 1978;43:421-428.
4. Murthy IYLN, Sastry TG, Datta SC, Narayanasamy G, Rattan RK. Distribution of micronutrient cations in Vertisols derived from different parent materials. Journal of the Indian Society of Soil Science 1997;45:577-580.
5. Prasad SN, Sakal R. Availability of iron in calcareous soils in relation to soil properties. Journal of the Indian Society of Soil Science 1991;39:658-661.
6. Prasad P. Characterisation, classification and mineralogy of predominent soil types in commands of Krishna, Godavari and Sarada rivers of Andhra Pradesh. *Ph.D. Thesis*, Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad 1994.
7. Rattan RK, Sharma PD. Main micronutrients available and their method of use. Proceedings IFA International symposium on micronutrients. 2004, 1-10.
8. Reddy KS, Naidu MVS. Characterization and classification of soils in semi-arid region of Chennur mandal in Kadapa district, Andhra Pradesh. Journal of the Indian Society of Soil Science. 2016;64(3):207-217.
9. Samanta A, Chatterjee AK, Mete PK, Biswapati Mandal. Status of total and available iron and zinc in soils of West Bengal under continuous cultivation of mulberry. Journal of the Indian Society of Soil Science 2002;50:35-42.
10. Sangwan BS, Singh K. Vertical distribution of Zn, Mn, Cu and Fe in the semi - arid soils of Haryana and their relationship with soil properties. Journal of the Indian Society of Soil Science 1993;41(3):463-467.
11. Sarkar D, Haldar A, Majumdar A, Velayutham M. Distribution of micronutrient cations in some Inceptisols and Entisols of Madhubani district, Bihar. Journal of the Indian Society of Soil Science. 2000;48:202-205.
12. Verma VK, Setia RK, Sharma PK, Singh C, Kumar A. Micronutrient distribution in soils developed on different physiographic units of Fatehgrah Sahib district of Punjab. Agropedology. 2005;15(1):70-75.
13. Verma VK, Setia RK, Sharma PK, Khurana MPS, Kang GS. Pedospheric distribution of micronutrient cations in soils developed on various land forms in north-east Punjab. Journal of the Indian Society of Soil Science. 2007;55(4):515-520.