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Correlation Studies on Available Nutrient and Leaf Nutrient of Groundnut Growing Soils of Srikalahasti Division in Chittoor District, Andhra Pradesh, India

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A B S T R A C T

The index leaf (recently mature leaf) and soil samples were analysed for nutrient content and available nutrient in intensively Groundnut cultivated areas. Based on the nutrient contents the leaf samples are categorize into as severely deficient, deficient, marginally adequate and adequate classes. The correlation studies also reveals that the leaf nutrient content was significantly and positively correlated with available N (r =0.804**), available P (r= 0.817**) available K (r = 0.930**), available S (r = 0.835**), available Fe (r = 0.855**), available Zn (r = 0.761**), available Cu (r = 0.814**), available Mn (r =0.744**) in groundnut growing soils of Srikalahasti Division in Chittoor District of Andhra Pradesh. In the collected leaf analysis most of the leaf samples were severely deficient in N, severely deficient to deficient in P, marginally adequate to adequate in Zn and adequate in K, S, Fe, Cu and Mn.

Introduction

Groundnut (*Arachis hypogaea* L.) is the most popular oilseed crop in India. This is known as Peanut, Earthnut, Monkey nut, Goober panda and Manilanut and contains about 45 per cent oil and 26 per cent protein. Groundnut kernels as a whole are highly digestible. India has prime position in average area (5.31 million ha) and production (7.17 million tonnes) of groundnut. In Andhra Pradesh, it is cultivated in an area of about 13.86 lakh ha with an annual production of 12.34 lakh tonnes. India stands first in area and second in production and fifth in productivity. The reason for low productivity (1305 kg ha^{-1}) of groundnut in India as compared to other countries like USA (3000 kg ha^{-1}) and China (2600 kg ha^{-1}) are mainly due to rain dependency (85%), monoculture (60%) and cultivation on marginal soils of low fertility.

Jain *et al.*, (1990) reported that uptake of nitrogen by groundnut plant significantly increased with the increasing levels of P and similar trend was observed with increasing doses of K (from 0 to 25 kg ha^{-1}). Uptake of phosphorus and potassium increased significantly with an increase in P level. The contents of P and K in chickpea leaf samples varied from 0.04 to 0.50 per cent and 1.00 to 2.50 per cent respectively with the

corresponding average values of 0.31 and 1.66 per cent (Chhibba *et al.,* 1995). Kumar and Arun (1983) opined that groundnut at flowering stage, the concentration of K in plant increased with P and S application which might be due to intense utilization of K in the early stage of the crop. No definite trend was noticed at the time of pegging and harvesting. Through the studies the soil fertility in relation to the plant growth will help to increase the production of Groundnut with adequate application of manure and fertilizer.

Materials and Methods

A reconnaissance soil survey was conducted in groundnut growing soils of Srikalahasti division in Chittoor district as per the procedure outlined by AIS & LUS (1970) on 1:50,000 scale. Twenty master profiles (pedons) were identified in groundnut growing areas of Srikalahasti Agricultural division in Chittoor district, Andhra Pradesh. Soil samples were collected from each profile site and analyzed for available nutrient in the soil sample using standard procedures. Index leaf samples (Recently matured leaflets) collected from the plants growing in and around each profile site. The collected leaf samples were washed in sequence with tap water, 1/10 HCl solution and distilled water and extra moisture was wiped out and dried in shade. Finally, the samples were dried in hot air oven at 70°C.

The dried samples were powdered in by using pestle and mortar and preserved in butter paper bags for chemical analysis. The nutrient contents in leaf samples were classified as severely deficient, deficient, marginally adequate and adequate categorized as per the limits suggested by Bell (1990). The data were subjected to statistical analysis by adopting the simple correlations to find out the extent of relationship between soil characteristics and leaf nutrients status as per the procedure described by Gomez and Gomez (1984).

Results and Discussion

Leaf Nutrients Status of Groundnut crop

Leaf nutrients concentration of macro (N, P and K) and micro (Fe, Zn, Cu and Mn) nutrients are presented in Tables 1, 2, 3 and depicted in Figures 1 and 2.

Leaf Nitrogen Content

Perusal of the data presented in Table 1 and depicted in Fig 4.39 indicated that leaf nitrogen content of groundnut crop grown in different villages of Srikalahasti division in Chittoor district was ranged from 2.02 to 3.22 per cent with a mean value of 2.43 per cent. The highest leaf nitrogen content of 3.22 per cent was recorded in groundnut crop grown in poyya village while the lowest leaf nitrogen content of 2.02 per cent was registered in groundnut crop grown in M.D. Puttur village. The coefficient of variation (CV) was found to be low (11.99) with respect to leaf nitrogen content in groundnut crop. Leaf samples were found to be severely deficient (< 3.2 %) in leaf N content as per the critical limits suggested by the Bell (1990). The leaf N in groundnut crop was significantly and positively correlated (r =0.804**) with available N in groundnut growing soils indicating that leaf N content increases with increase in available N in groundnut growing soils. These findings were in accordance with findings of Gupta *et al.,* (1980).

Leaf Phosphorus Content

Leaf phosphorus content in different groundnut growing village of Srikalahasti division in Chittoor district varied from 0.13 to 0.23 per cent with a mean value of 0.18 per cent. The highest leaf phosphorus content of 0.23 per cent was recorded in groundnut crop grown at M.D. Puttur village while the lowest leaf phosphorus content of 0.13 per cent was

registered in Brahmanapalle village. The coefficient of variation (CV) was found to be low (12.97) with respect to leaf phosphorus content in groundnut crop. Considering the limits suggested by Bell (1990), majority of the leaf samples (13 villages) were severely deficient (< 0.19 %) in leaf P content and 7 leaf samples (7 villages) were deficient (0.19 – 0.23 %) in leaf P.

The leaf P in groundnut crop significantly and positively correlated (r= 0.817**) with available P in groundnut growing soils indicating that leaf p content increases with increase in available P in groundnut growing soils (Table 1). Similar findings were also reported by Laxminarayana and Rajagopal (2005).

Leaf Potassium Content

Critical examination of the data revealed that leaf potassium content of groundnut growing soils in different villages of Srikalahasti division in Chittoor district ranged between 1.80 and 2.93 per cent with a mean value of 2.24 per cent. The highest leaf potassium content of 2.93 per cent was recorded in Ramapuram village and whereas lowest leaf potassium content of 1.80 per cent was registered in groundnut grown in Chukkalanidigallu village of Srikalahasti division in Chittoor district.

The coefficient of variation (CV) was found to be low (13.16) with respect to leaf potassium content in groundnut crop. The aforesaid results revealed that the groundnut index leaf K content was found to be adequate (1.8–2.5%) as per the critical limits suggested by Bell (1990). The correlation studies indicated that leaf K content was significantly and positively correlated with available K (r = 0.930**) (Table 1). Similar results were reported by Nagaraj and Kumar (1983) and Patel and Zalwadia (1982) in groundnut crop.

Leaf Sulphur Content

The leaf sulphur content in groundnut growing soils in different village of Srikalahasti division in Chittoor district varied from 0.24 to 0.68 per cent with a mean value of 0.53 per cent. The highest leaf Sulphur content of 0.68 per cent was recorded in groundnut crop grown at Vedam and Kanamanambedu villages while the lowest leaf sulphur content of 0.24 per cent was registered in Chukkalanidigallu village of Srikalahasti divison of Chittoor district. The coefficient of variation (CV) was found to be high (17.59) with respect to leaf sulphur content in groundnut crop. The leaf sulphur content in groundnut crop in the study area was found to be adequate (0.26-0.30 %) as per the ratings given by Bell (1990). The leaf sulphur content showed highly significant and positive correlation with (r = 0.835**) available sulphur in groundnut growing soils (Table 1). Similar findings were reported by Ram *et al.*, (1999).

Leaf Iron content

It is apparent that leaf iron content in different groundnut growing villages of Srikalahasti division in Chittoor district varied from 158.5 to 195.0 mg kg^{-1} with a mean value of 175.02 mg kg^{-1}. The highest leaf iron content of 195 mg kg^{-1} was recorded in Kommanagradu village while the lowest leaf iron content of 158.50 mg kg^{-1} was registered in Kanamanambedu and Durgiperi villages. The coefficient of variation (CV) was found to be low (6.81) with respect to leaf iron content in groundnut crop. Groundnut leaf samples collected from all the villages were found to be adequate (50-300 mg kg^{-1}) in leaf Fe content as per the ratings given by Bell (1990). The leaf Fe content had shown highly significant and positive correlation (r = 0.855**) with available Fe in groundnut growing soils (Table 1).

Table.1 Nutrient content in index leaf of groundnut

Pedon No.	Tentative Soil series	N %	P %	K %	S %	Fe	Zn	Cu	Mn
						mg kg^{-1}			
1	Suryanarayanapuram	2.24	0.175	2.12	0.535	163.5	18.00	7.58	123.5
2	M.D. Puttur	2.02	0.225	2.40	0.560	177.5	25.00	6.65	158.0
3	Musalipedu	2.38	0.190	2.35	0.430	178.5	25.50	6.46	150.0
4	Bonupalle	2.54	0.180	1.95	0.545	191.5	18.50	6.19	129.5
5	Poyya	3.22	0.185	2.86	0.635	171.5	23.50	6.51	135.0
6	Kommanagradu	2.31	0.175	1.85	0.570	195.0	21.25	6.69	122.5
7	Durgiperi	2.38	0.205	2.35	0.540	158.5	24.00	7.30	145.5
8	Sarswathi Kandriga	2.95	0.210	2.05	0.580	177.0	22.50	7.50	142.5
9	Vedam	2.24	0.185	1.98	0.675	185.0	24.00	8.13	155.0
10	Kallivettu	2.56	0.200	2.21	0.480	162.5	21.50	7.40	142.5
11	Gajulapellore	2.45	0.195	2.25	0.470	190.0	24.00	8.45	158.0
12	Kanamanambedu	2.41	0.173	2.11	0.675	158.5	23.50	5.17	150.0
13	Kalathuru	2.60	0.182	2.16	0.635	179.0	25.50	7.70	165.0
14	Chukkalanidigallu	2.54	0.136	1.80	0.240	162.5	29.00	7.50	148.0
15	Thimmasamudram	2.18	0.180	2.38	0.545	185.0	25.25	7.85	156.0
16	Ramapuram	2.41	0.175	2.93	0.520	169.5	26.00	6.80	141.0
17	Chinamitti kandriga	2.30	0.210	1.95	0.480	191.5	24.25	6.30	136.0
18	Chittathur	2.02	0.189	2.32	0.460	162.5	18.00	6.25	150.0
19	Kirlapudu	2.10	0.150	2.43	0.570	165.5	25.50	6.50	152.0
20	Brahmanapalle	2.32	0.130	2.14	0.515	172.5	22.00	7.14	130.0

Table.2 Nutrient status of surface soils in groundnut growing soils of Srikalahasti division of Chittoor district

Pedon No.	Tentative Soil series	N %	P %	K %	S %	Fe	Zn	Cu	Mn
						mg kg^{-1}			
1	Suryanarayanapuram	106.40	11.55	84.71	26.35	0.69	1.53	27.33	3.84
2	M.D. Puttur	142.00	21.67	165.15	31.81	1.69	3.11	13.99	16.90
3	Musalipedu	134.40	14.33	141.27	22.49	1.17	1.96	12.31	15.54
4	Bonupalle	185.20	10.21	94.13	22.93	2.62	0.78	4.95	5.73
5	Poyya	247.60	13.00	257.80	37.59	1.05	2.18	10.25	6.49
6	Kommanagradu	124.60	8.50	46.89	35.90	2.73	1.02	15.41	2.91
7	Durgiperi	195.20	14.13	157.51	32.13	1.10	2.46	21.34	12.95
8	Sarswathi Kandriga	198.40	13.65	87.97	36.47	1.09	1.21	22.33	12.24
9	Vedam	122.40	13.61	87.72	39.16	1.79	2.41	66.12	24.71
10	Kallivettu	185.10	14.50	144.07	29.80	0.80	1.36	24.30	13.74
11	Gajulapellore	129.60	14.27	116.53	17.15	2.07	3.52	96.54	67.46
12	Kanamanambedu	122.00	9.67	113.17	39.80	0.64	1.42	3.63	16.20
13	Kalathuru	178.40	12.70	138.73	33.30	1.30	3.61	28.72	76.28
14	Chukkalanidigallu	178.00	9.00	51.01	10.08	0.95	4.83	25.06	14.61
15	Thimmasamudram	107.60	10.33	111.95	20.41	1.08	2.58	36.52	35.76
16	Ramapuram	124.40	11.33	337.34	20.45	0.97	3.94	16.46	11.22
17	Chinamitti kandriga	146.40	14.10	77.33	19.68	2.11	2.54	8.75	11.18
18	Chittathur	95.20	9.33	112.46	17.95	0.76	2.05	7.00	20.34
19	Kirlapudu	155.20	8.67	142.09	37.39	0.80	2.55	15.15	19.56
20	Brahmanapalle	121.20	7.67	81.90	19.76	0.53	1.48	18.59	6.91

Table.3 Correlation coefficients (r) between available soil nutrients and leaf nutrients

	Ava N	Ava P	Ava K	Ava S	Ava Fe	Ava Zn	Ava Cu	Ava Mn
Leaf N	**0.804****	0.031	0.254	0.221	-0.029	-0.080	-0.037	-0.022
Leaf P	0.170	**0.817****	0.172	0.248	0.336	-0.125	0.067	0.109
Leaf K	0.138	0.206	**0.930****	0.083	-0.379	0.236	-0.105	0.016
Leaf S	0.059	0.112	0.204	**0.835****	0.087	-0.411	-0.009	0.098
Leaf Fe	-0.104	0.135	-0.264	-0.070	**0.855****	-0.106	0.315	0.232
Leaf Zn	0.182	0.183	0.247	-0.084	-0.109	**0.761****	0.173	0.312
Leaf Cu	-0.001	0.172	-0.146	-0.178	0.040	0.355	**0.814****	0.503
Leaf Mn	-0.061	0.366	0.136	0.038	-0.158	0.570	0.392	**0.744****

Fig.1 Leaf macro nutrients in groundnut grown soils of Srikalahasti division in Chittoor District

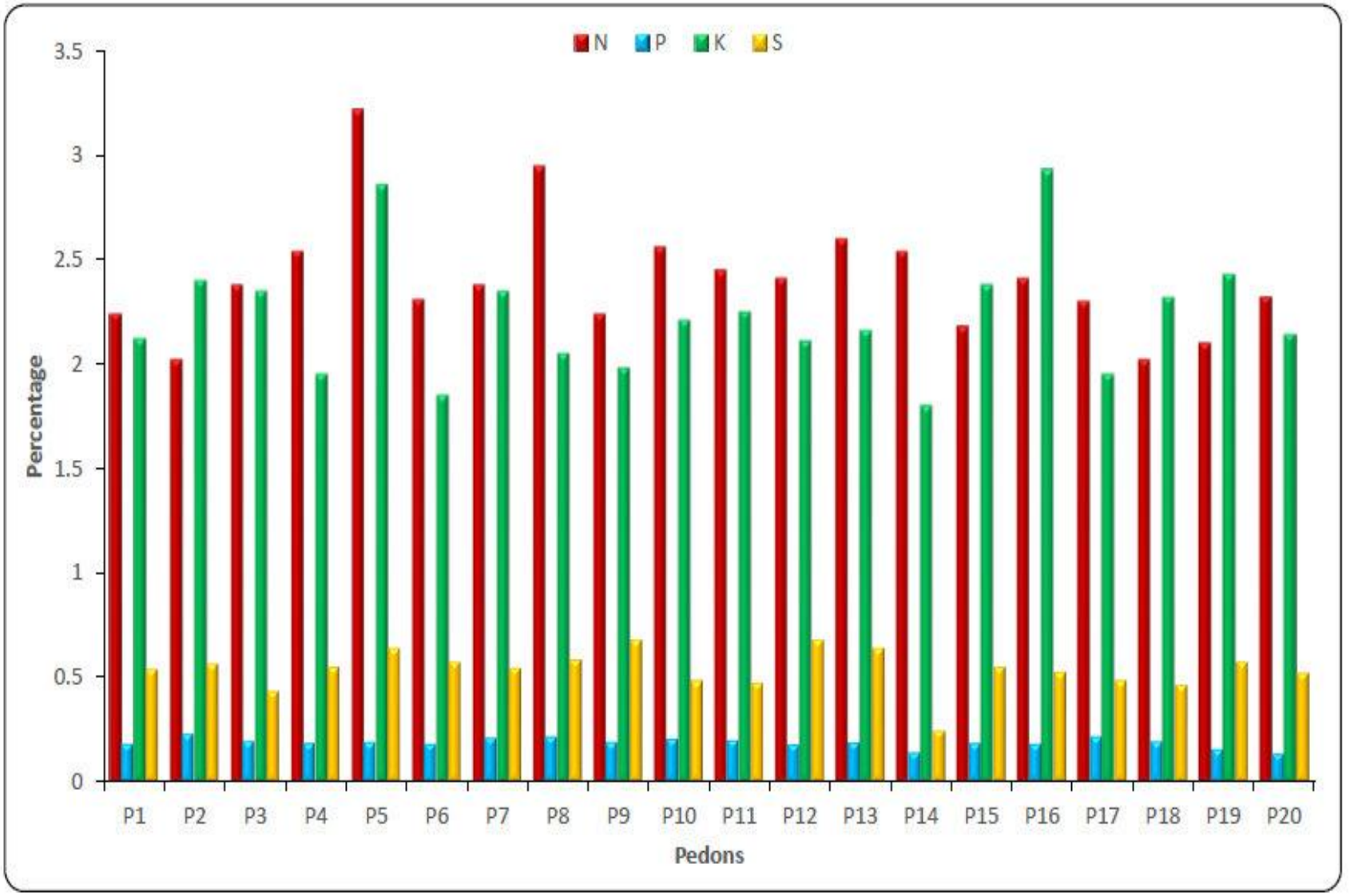
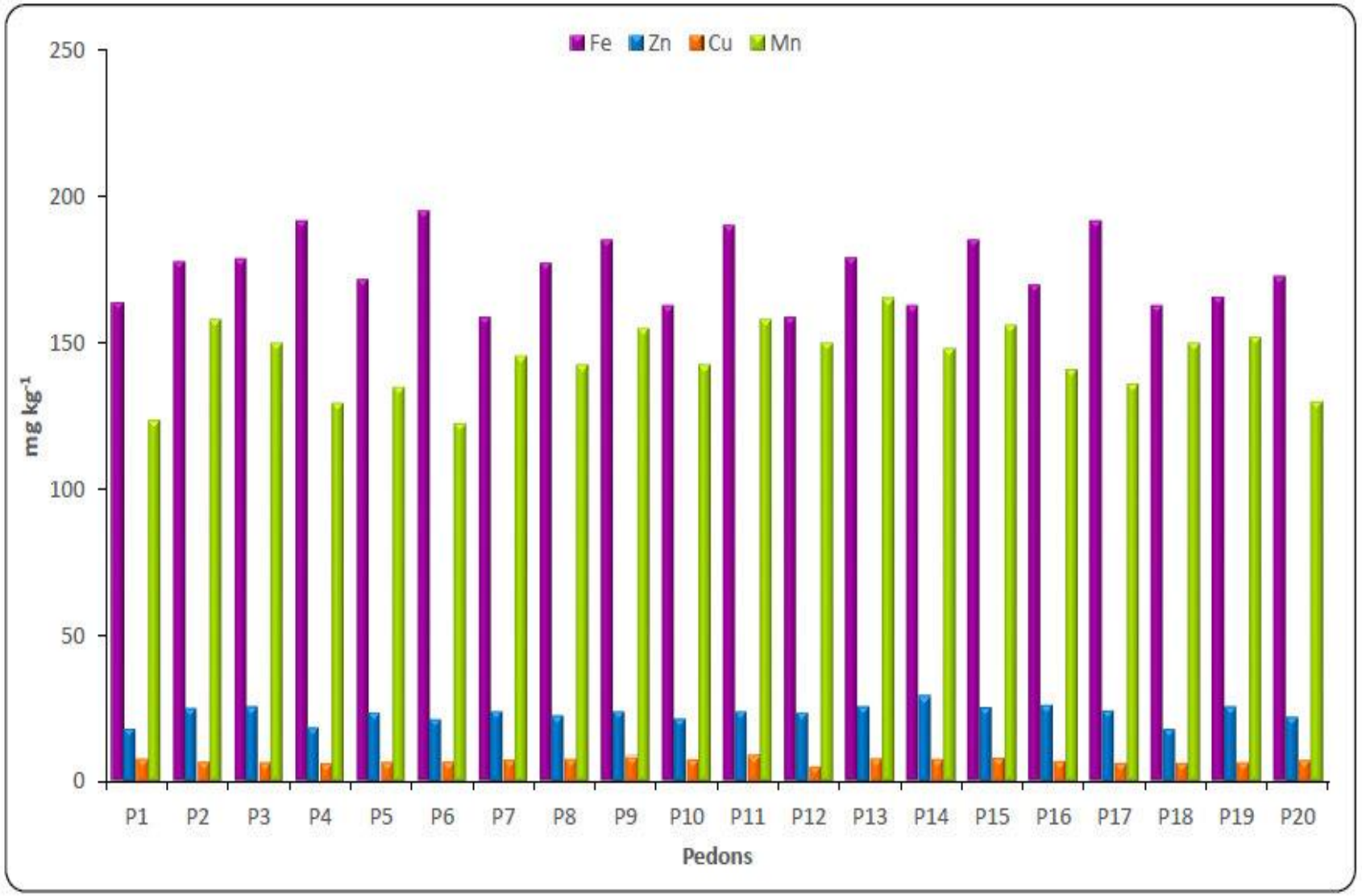


Fig.2 Leaf micro nutrients in groundnut grown soils of Srikalahasti division in Chittoor District



These findings were in accordance with findings with Kanwar *et al.*, (1983).

Leaf Zinc Content

The leaf zinc content of groundnut crop in different villages of Srikalahasti division in Chittoor district varied from 18.00 to 29.00 mg kg^{-1} with a mean value of 23.35 mg kg^{-1}. The highest leaf zinc content of 29.00 mg kg^{-1} was recorded in Chukkalanidigallu village while the lowest leaf zinc content of 18.00 mg kg^{-1} was registered in Chinamittikandriga village of Srikalahasti division. The coefficient of variation (CV) was found to be low (12.14) with respect to leaf Zinc content in groundnut crop. From the aforesaid data, it is known that about 10 per cent index leaf samples (2 villages) were found to be marginally adequate (18-20 mg kg^{-1}) and 90 per cent (18 villages) were found to be adequate (20-50 mg kg^{-1}) in leaf Zn content by considering the critical limits established by Bell (1990). The leaf Zn content had shown highly significant and positive correlation (r = 0.761**) with available Zn of groundnut growing soils. (Table 1). Similar results were reported by Kanwar *et al.*, (1983).

Leaf Copper Content

The leaf copper content of groundnut crop in different village of Srikalahasti division in Chittoor district varied from 5.17 to 8.45 mg kg^{-1} with a mean value of 6.99 mg kg^{-1}. The highest leaf copper content of 8.45 mg kg^{-1} was recorded in groundnut crop grown in Gajulapellore village while the lowest leaf copper content of 5.17 mg kg^{-1} was registered in Kanamanambedu village of Srikalahasti division in Chittoor district. The leaf Cu content was found to be adequate (2.2-5.0 mg kg^{-1}) in status according to critical range suggested by Bell (1990). The coefficient of variation (CV) was found to be low (11.25) with respect to leaf copper content in groundnut crop. The correlation studies also revealed that the leaf Cu content was significantly and positively correlated with available Cu (r = 0.814**) in groundnut growing soils. These findings were amply supported by the findings of Kanwar *et al.*, (1983).

Leaf Manganese Content

The leaf Mn content of groundnut crop grown in different villages of Srikalahasti division in Chittoor district varied from 122.00 to 165.00 mg kg^{-1} with a mean value of 144.43 mg kg^{-1}. The highest leaf manganese content of 165.00 mg kg^{-1} was recorded in Kalathuru village while the lowest leaf manganese content of 122.50 mg kg^{-1} was registered in Kommanagradu village. The coefficient of variation (CV) was found to be low (8.30) with respect to leaf manganese content in groundnut crop. The index leaf samples collected from the groundnut crop in the study area was found to be adequate (50-350 mg kg^{-1}) in leaf Mn content as per the critical limits given by Bell (1990). Correlation studies also indicated that leaf Mn content had shown highly significant and positive correlation (r =0.744**) with available Mn content of groundnut growing soils (Table 1). These findings were in agreement with findings of Kanwar *et al.*, (1983).

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