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EFFECT OF IRON ON THE AVAILABILITY OF PLANT NUTRIENTS IN SOIL DURING DIFFERENT GROWTH STAGES OF GROUNDNUT

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A pot culture experiment conducted to study the effect of iron application on available nutrients of the soil grown with groundnut revealed that, the availability was the highest for N at vegetative stage; P, K, Mg and Fe at reproductive stage and Ca at harvest. Application of iron had practically no influence on available N and Ca, but it's depressive effect on available P, K, and Mg status of the soil was manifested. The availability of Fe at all stages of crop growth increase on account of Fe application.

The availability of plant nutrients is considered to be the most important factor in deciding the yield of crops. Continuous use of high analysis fertilizers and growing crops of high yield potential in the present day exploitive agriculture had further depleted the micronutrient reserves of the soil. Among the micronutrients the importance of iron in plant nutrition has also been recognised and has been stressed in recent publications Singh and Singh,1975; and Chandrasekaran,1976) Iron was found to have little influence on the availability of major nutrients in soil (Woods and Nolan, 1968) but its influence on the availability of other secondary and micronutrients was found to be significant. The present investigation was carried out with a view to elucidate information on the effect of iron application on the availability of plant nutrients in soil.

MATERIAL AND METHODS

To find out the effect of different levels and methods of iron application on the soil available nutrients at different growth stages of groundnut crop, a pot experiment was conducted on red loam soil (available N: 110 ppm, available P: 2.45 ppm, available K: 125 ppm, available Ca: 1740 ppm and available Fe: 0.40 ppm with a pH of 6.7) adopting a factorial randomised block design, replicated four times. A uniform dose of N, P and K (24:44 66 Kg/ha N: P_2O_5/K_2O respectively) was applied for all treatments over which iron as $FeSO_4$ with two modes of application at four levels each viz, soil application at O, 122, 224 and 336 Kg/ha and foliar application at 0, 3.75, 7.50 and 11.25 Kg/ha were superimposed. POL. 2 a bunch variety of groundnut of 105 days duration was grown as test crop. For foliar application of Iron 0.75% $FeSO_4$ solution @ 500 lit/ha was used with teepol as the sticking agent. To study the influence of treatments on the available nutrients of soil viz., N, P, K, Ca, Mg and Fe, soil samples

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were collected at 30 and 70 days after sowing from the two replications which were allowed for stage analysis, Final Soil samples were collected after the harvest of the crop from the remaining two replications. The soil samples thus collected were analysed for the above constituents following standard procedures (Jackson, 1967). The data were subjected to statistical scrutiny to find out the influence of treatments on the available nutrients and possible correlations were also worked out to determine the relationship between various nutrients in soil.

RESULTS AND DISCUSSION:

Soil samples collected at vegetative, reproductive and post harvest stages of the crop growth were analysed for available N, P, K, Ca, Mg and Fe and the results are presented in Table 1

The availability of N in soil with reference to the stages of crop growth was statistically significant. Vegetative, stage recorded the maximum available N (107 ppm and it decreased significantly at reproductive stage (98 ppm) due to utilization of N by the growing crop. Again there was a significant increase in the available N at post harvest stage (103 ppm) over reproductive stage which signifies that there has been a build up of soil N due to fixation by symbiotic bacteria as was explained by Magee and Burris (1954). Application of iron whether by soil or foliar application failed to produce perceptible differences in the available N content of the soil and this also agreed with the findings of and Chandrasekaran (1976).

The available P content of the soil was higher at reproductive stage than at other stages Slow solubilization process led to increased availability of P at reproductive stage than at vegetative stage. The utilization of P by the growing crop led to the minimum value of available P at post harvest stage. The different levels of iron had no effect on soil available P. However between soil application and foliar spraying, soil application depressed the available P. Similar antagonistic effects have been reported by Dev and Mann (1972).

As regards the available K, it was significantly higher at reproductive stage than at other stages. The release of K from the mineral source to the available form was gradual over the period and it attained peak value at reproductive stage and declined thereafter due to utilization of K by the growing crop. Bhide and Motiramani (1964) also reported increased available K in soil at 45th day of the crop. The depressing effect of iron application on K availability was evident. Comparison of the two methods of iron application namely soil and foliar application showed that soil application of iron registered significantly lower values than foliar application. Thus there was added evidence of the depressing effect of applied iron on K availability.

The available Ca content of the soil decreased drestically from vegetative stage (2334 ppm) to reproductive stage (1519 ppm) and thereafter increased (2508 ppm) at harvest. Utilization of Ca by the growing crop resulted in a decrease in the available Ca from vegetative to reproductive stage, However there was an increase in the available Ca content at the later stages. indicating that the crop utilization of soil Ca had practically ceased after the reproductive stage resulting in an increased accumulation of available Ca in soil at harvest. Mizuno (1961) observed that the Ca is absorbed directly by the developing pods and that the most benificial period for applying Calcium to groundnut crop was 10-30 days after the gynophores reach the soil. The different levels of iron and the method of application had no influence on the available Ca content of the soil.

The results of the available Mg content at different stages of crop growth showed that the pattern of utilization of Mg was different from Ca and probably even at early stages of vegetative growth, Mg absorption had been more and this corroborates with the findings of Loganathan (1973). Levels of iron did not produce discernible change though the highest level of iron application (336 Kg/ha) had markedly decreased the available Mg content of the soil.

Marked reduction of available iron at harvest, indicated that the crop had utilized more of iron during the latar stages of crop growth. There was a very distinct trend in the results with regard to the effect of levels of iron on available iron content as could be expected. Higher levels of available iron were associated with increased doses of applied iron (Mahendra Singh and Dahiya, 1975).

The available iron content of the soil was found to have positive correlation with the available Ca content at vegetative, reproductive and post harvest stages (r=0.373**, 0.385** and 0.361** respectively) of the crop growth.

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Table 1 Effect of iron on the soil available nutrients (ppm).

Nutrients	Stages	Iron-Soil application (M 1) ($FeSO_4$ Kg/ha.) 0	1:2	224	336	Mean	Iron-Foliar application (M2) ($FeSO_4$ Kg/ha.) 0	3.25	7.50	11.25	Mean	Grand Mean	Statistical analysis	C.D (5%)
	S1	104	105	110	107	107	109	110	103	109	108	107.1	Stages (s)	2.6
N	S2	100	105	102	95	100	102	98	91	90	95	97.6	Fe-levels	N.S.
	S3	106	100	103	99	102	100	103	107	106	104	103.0	Methods (M)	N.S.
	Mean	103	103	105	100	103	104	104	100	102	102	102.2	Int S x Fe	N.S.
	S1	11.13	9.75	9.75	9.25	9.97	9.25	13.38	12.50	14.88	12.50	11.23	Stages (s)	1.60
P	S2	14.50	10.88	13.88	15.50	13.69	16.00	16.00	14.88	14.50	15.35	14.52	Fe-levels	N.S.
	S3	10.40	10.25	10.03	8.83	9.88	9.78	12.00	10.90	11.33	11.00	10.44	Methods (M)	1.40
	Mean	12.01	10.29	11.22	11.18	11.18	11.68	13.79	12.76	13.57	12.95	12.08	Int. S x Fe	N.S.
	S1	220	234	231	209	224	245	241	253	238	244	233.8	Stages (s)	4.1
K	S2	231	238	238	213	230	235	255	250	246	247	238.1	Fe-levels	6.7
	S3	207	210	214	201	208	213	215	210	218	214	211.0	Methods M)	3.3
	Mean	220	227	228	207	220	231	237	237	234	235	227.6	Int. S x Fe.	N.S.

Table. 1 (Contd.).

Nutri-ents	Stages.	Iron Soil application (M 1) ($FeSO_4$ Kg/ha)					Iron Foliar application (M.2) ($FeSO_4$ Kg/ha).					Grand Mean	Statistical analysis C. D. (5%)	
		0	112	224	336	Mean	0	3.25	7.50	11.25	Mean			
	S1	2430	2370	2480	2370	2413	2330	2200	2200	2290	2255	2334	Stages (S)	82
Ca	S2	1460	1700	1350	1620	1533	1410	1530	1540	1550	1508	1519	Fe-levels	N.S.
	S3	2335	2165	2545	2590	2409	2585	2655	2470	2720	2608	2508	Methods (M)	N.S.
	Mean:	2075	2078	2125	2193	2118	2 08	2128	2070	2187	2124	2120	Int. S. x Fe	233
	S1	306	294	282	270	288	312	330	342	342	332	31[illegible]	Stages (S)	36
Mg.	S2	642	468	774	558	611	684	600	618	655	639	625	Fe-levels	59
	S3	585	666	582	473	576	513	495	477	441	482	529	Methods (M)	N.S.
	Mean.	511	476	546	434	492	503	475	479	479	484	488	Int. S x Fe.	102
	S1	0.39	0.53	0.87	0.86	0.66	0.50	0.50	0.65	0.64	0.57	0.82	Stages (S)	0.10
Fe	S2	0.52	0.51	0.58	0.80	0.6[illegible]	0.64	0.77	0.85	0.81	0.77	0.68	Fe-levels	0.17
	S3	0.33	0.33	0.60	0.55	0.45	0.40	0.53	0.62	0.68	0.56	0.50	Methods (M)	N.S.
	Mean.	0.41	0.45	0.68	0.74	0.57	0.51	0.60	0.71	0.71	0.63	0.60	Int. S x Fe.	N.S.

S1 Vegetation stage (30th day of sowing), S2: Reproductive stage (70th day), S3: Post harvest.