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Observationson Chloro sis in Groundnut

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Chlorosis is acute during prolonged drizzling rain in groundnut grown on medium black calcareous soils of the Saurashtra region. The typical yellowing of leaves is attributed to poor drainage, lime induced Fe chlorosis and other causes as well. An investigation was initiated to study the effect of soil moisture regimes on availability of iron, and its uptake and translocation in groundnut.

An incubation study was carried out on a calcareous medium black clayey soil which contained 2.01 per cent total iron and 1.02 ppm available iron (1 N NH_4 OAc—pH 4.8). A bulk surface soil to a depth of 20 cm was collected from the university farm, Junagadh. One kg air dried soil (2 mm sieved) was incubated using different treatmens. Only the data pertaining to moisture regimes viz; 50% of field capacity (M_1), field capacity (M_2) and saturation (M_3), are presented here. Periodical sampling of soil was done and available iron was determined using 1 N NH_4OAc (pH 4.8) extractant.

In a separate experiment pots were filled up with soil. Two healthy groundnut plants, variety GAUG-1, were maintained in each pot. The following soil moisture regimes were studied:

Soil moisture regimes	*Symbol*
0 bar soil moisture potential	0 bar
0 to—1/3 bar soil moisture potential	1/3 bar
0 to—5 bar soil moisture potential	5 bar
0 to −10 bar soil moisture potential	10 bar
0 to −14 bar soil moisture potential	14 bar
Moisture stress during flowering stage (30 to 50 days after sowing)	SF
Moisture stress during pegging Stage (40 to 65 days after sowing)	SP
Moisture stress during pod development stage (60 to 85 days after sowing)	SD
Surface soil moist with normal irrigation	M
Surface soil dry, irrigated through upward flow from bottom of the pot	D

Treatments were imposed after 20 days of sowing. To apply required quantity of water, an average water content of 30 cm soil profile was estimated from soil samples drawn from 5, 15, and 30 cm soil depths. The soil water potentials in bars were read out from soil moisture retention characteristics curve of this soil which was construct-

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ed by using pressure membrane apparatus. The soil moisture stress of about 10 bar was imposed at flowering, pegging and pod development stages. The crop was fertilized with recommended doses of nutrients. The crop was harvested after 111 days. Roots, shoots and pods were analysed separately for Fe content (Jakson 1967).

Incubation study revealed that the soil maintained at saturation recorded significantly higher available Fe content than that was kept at 50% of field capacity throughout except on the day of incubation (Table 1). Progressive increase

TABLE 1 **Influence of moisture regimes and incubation period on the available iron (ppm) (Oven dry basis).**

Incubation period (days)	Moisture regimes			C.D. at 5%
	M_1	M_2	M_3	
0	1.46	1.48	1.48	N.S.
3	1.48	1.58	1.76	0.11
5	1.54	1.74	2.27	0.17
7	1.67	2.02	2.96	0.26
14	1.75	2.64	3.49	0.31
21	1.92	3.31	6.36	0.89
28	2.48	4.28	9.11	1.01
42	2.76	5.92	14.46	1.67
56	2.01	5.10	12.00	2.13
Pooled over the period	1.90	3.12	6.06	0.32
Period x Moisture C.D. (5%)	0.98			

in incubation period increased the available Fe content under all the moisture regimes, however, the rate of increase was maximum with saturation. It was highest with $P_{42} \times M_3$ combination and least with $P_0 \times M_1$ combination. Pooled analysis showed that with increase in moisture content from M_1 to M_2, there was 64 per cent increase in available Fe content, further increase in moisture content to saturation (M_3) the availability of Fe increased by 94 per cent over the field capacity (M_2).

Results of pot experiment revealed that the Fe content of root, shoot and pod was maximum with saturation which decreased significantly with decrease in soil water potential (Tale 2).

TABLE 2 **Effect of different soil moisture regimes on concentration and uptake of iron by groundnut (oven-dry basis).**

Treatments	Concentration of Fe (ppm)			Uptake of Fe (mg/pot)		
	Root	Shoot	Pod	Root	Shoot	Pod
O bar	2320	573	883	5.89	19.58	7.97
1/3 bar	2080	427	566	8.02	22.34	16.14
5 bar	1933	340	387	4.67	13.28	6.25
10 bar	1427	300	320	2.54	10.40	3.04
14 bar	827	240	260	1.15	6.39	1.83
SF	1773	427	333	2.72	13.49	4.18
SP	1293	393	307	1.40	10.50	3.19
SD	1080	307	320	1.66	9.45	3.28
M	2013	400	527	6.56	19.79	11.20
D	1800	360	400	6.59	22.07	6.82
C. D. at 5%	124	48	122	0.79	00.88	0.90

Treatment M was at par with 1/3 bar for Fe content in various plant parts. Crop subjected to moisture stress during different stages of growth also recorded lower concentration of Fe in root, shoot and pod than 1/3 bar. Accumulation of Fe decreased progressively with increase in moisture stress from 1/3 bar. Generally, saturation treatment recorded higher uptake of Fe than the rest of the treatments except 1/3 bar, M and D.

Since Fe is largely assimilated by plants as ferrous ion, moist calcareous soils would not favour Fe availability owing to following reactions (Bear 1965.)

$$Fe^{2+} + CaCO_3 \rightleftharpoons FeCO_3 + Ca^{2+}$$
$$4FeCO_3 + O_2 + Ca\ (HCO_3) \rightleftharpoons 2Fe_2(CO_3)_3 + Ca(OH)_2$$
$$Fe_2\ (CO_3)_3 + 3H_2O \rightleftharpoons Fe_2O_3 + 3H_2CO_3$$

In the present investigation it appears that with the increase in moisture content of soil there was an increase in availability of Fe which in turn resulted into greater concentration of Fe in plant body. Thus lime induced Fe-chlorosis in calcareous soils does not seems to be tenable for groundnut chlorosis in Saurashtra region of Gujarat. It appears that poor aeration is the primary cause for chlorosis as could be seen from saturation treatment. Plants were quite green under other treatments indicating that soil has supplied sufficient Fe to meet the requirement of plant. While studying the chlorotic phenomenon in groundnut, Gopalakrishnan and Srinivasan (1976) reported that chlorosis occurred due to poor drainage. With regard to transplocation of Fe, roots retained more quantity of Fe than shoots and pods. Babaria and Patel (1980) also reported that the concentration of Fe was maximum in sorghum roots followed by shoots and grains. When the concentration of Fe is low in plant tissues, mobility of Fe injected into phloem is highest. This mobility decreases with increase in concentration of in tissues (Rediske and Biddulph 1953). It seems that roots did not translocate Fe proportionately with increase in concentration of Fe. These findings again confirmed that lime-induced chlorosis caused by Fe dificiency is not due to non-availability of Fe in soil but it may be due to restricted translocation of Fe from root to shoot or inactivation of Fe within plant body. Secondly the widespread groundnut chlorosis in fields under wet conditions can be attributed to migration of clay particles from surface soil to a depth of 1 or 2 cm owing to heavy downpour followed by prolonged drizzling might resulting in the formation of a layer which restricts the permeability of air to root zone. Subsequent drying of the soil with formation of cracks permits free movement of air to rhizosphere which reduces the chlorosis.

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