measures should be adopted to combat these pests and diseases thereby enhancing the yield.

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Iron Chlorosis in Soybean and Maize in Central Farm, Agricultural College and Research Institute, Coimbatore

by

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Introduction: Micronutrients play a very important role in crop growth and animal nutrition. With the introduction of new crops and high yielding varieties along with intensive use of fertilizers for increasing production in multiple and relay cropping, the role of micronutrients assumes greater importance.

Among the micronutrients, iron is closely concerned with chlorophyll formation and activation of several enzyme systems. A continuing supply of iron is essential to the welfare of the green plant. Any factor that interferes with absorption or utilization of iron may cause the plant to become iron deficient and chlorosis to develop. Iron chlorosis refers to the yellowing of plants which can be alleviated by suitable iron compounds.

Review of Literature: Several reviews of iron metabolism, including iron chlorosis, have been published recently. Brown (1961) had reviewed in detail the causes for iron chlorosis in plants. Among them (a) low iron supply, (b) calcium carbonate in soil, (c) bicarbonate in soil or irrigation water, (d) over-irrigation or high water condition, (e) high phosphate, (f) high levels of heavy metals such as manganese, copper and zinc, (g) low or high

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temperatures, (h) high light intensities, (i) high levels of nitrate nitrogen, (j) unbalanced cation ratios, (k) poor aeration, (l) certain organic matter additions to the soil, (m) viruses and (n) root damage by nematodes or other organisms are mentioned. Thus, it can be seen that the problem of iron deficiency in relation to soil conditions are very complex due to the fact that in most cases it is induced.

Materials and Methods: In connection with the conduct of experiments for the award of M. Sc. (Ag.) degree in the Agronomy Division, experiments were conducted by the Junior authors in field No. 52-B of Central Farm to raise their crops of soybean and maize respectively. The experiment on soybean was conducted to study the response of two soybean varieties (E.C. 39821 and E.C. 39824) under three levels of N (0, 30 and 60 kg/ha) and four levels of P (0, 50, 100 and 150 kg/ha), while on maize, it was conducted to determine the water requirements (supplied at five moisture levels of 0, 20, 40, 60 and 80% available moisture) along with herbicides. The crops were raised during July–October 1969.

The soil was sandy clay loam with a pH of 7.5. The fertility status was fairly medium with respect to availability of nitrogen, phosphoric acid and potash. But the water used for irrigation from well No. 50 was having an E.C. of 6.0 m.mhos/cm with a pH of 6.9. The iron content of Central farm soil, as reported, was 4.06% as ferric oxide and considered as normal and enough for crop growth.

In the course of raising the crops of soybean and maize, acute iron chlorosis was noticed in both the crops first in soybean. Here, visible symptoms were seen by about 43rd day. In the initial stages the upper leaves were slightly bent downwards and the colour turned pale yellow in the leaf blades. Later the veins and midribs also turned yellow and the entire affected leaves became almost paper white. Great variation in the incidence between varieties and treatments were noticed.

Similarly, in maize the leaves particularly the younger ones turned chlorotic from about 50th day in many plants. The symptoms were typical of iron deficiency, but the incidence varied in the different plots of moisture level.

The iron chlorosis of both crops were corrected by foliar spray of ferrous sulphate (0.4%) neutralized with lime sprayed on 50th day in Soybean and 60th and 68th day (2 sprayings) in maize.

Results and Discussion: i) *Soybean:* The effects of different treatments on their chlorotic effects along with the varieties are indicated below:

TABLE 1. *Iron chlorosis on soybean*

Levels of P_2O_5 applied kg/ha	No. of plants affected			
	E.C. 39821 (V_1)		E.C. 39824 (V_2)	
	No.	% of total plants	No.	% of total plants
0	56	16	36	10
50	61	17	46	13
100	89	25	73	20
150	122	34	101	28
Mean	82	23	64	17

	S.E.	C.D.
i) Treatments	0.45	2.03
ii) Varieties	0.32	1.44

Conclusion: P_{150} P_{100} P_{50} P_0 ; V_1 V_2

The table clearly shows that the chlorosis is found more under higher levels of phosphorus application in both varieties although there is definite variation among the two varieties.

The phosphorus content of soybean in bloom stage (35th and 43rd day) is given in Table 2.

TABLE 2.

Level of P_2O_5	P %	S.E.	C.D. (P: 0.05)
0	0.344		
50	0.393	.002	0.006
100	0.446		
150	0.449		

Conclusion: P_{150} P_{100} P_{50} P_0

The above table indicated that though there was iron chlorosis the uptake of phosphorus was not affected. Higher the application of P, higher was the absorption of phosphorus while higher dose of P application had caused higher percentage of chlorotic plants indicating less uptake of iron.

ii) *Maize*: The number of plants affected along with the effect of spraying an iron content of leaves at three different stages are furnished below:

TABLE 3.

Moisture level (1)	Mean iron chlorotic plants in 55th day (2)	Iron content (ppm)		
		30th day (no symptom) (3)	60th day (before spray) (4)	110 days (harvest stage) (5)
I_0	24	172	152	97
I_1	21	183	150	97

TABLE 3. *(Contd.)*

(1)	(2)	(3)	(4)	(5)
I_2	29	195	145	95
I_3	29	188	151	97
I_4	45	184	135	94
S.E.	1.494	1.612	5.525	1.442
C.D. at 5%	4.602	4.966		
Conclusion:	$I_4 \quad \overline{I_3 \quad I_2} \quad \overline{I_0 \quad I_1}$		$\overline{I_2 \quad I_4} \quad I_3 \quad I_1 \quad I_0$	

From the table, it may be seen that the number of chlorotic plants was significantly higher at higher moisture levels than at lower moisture levels. This is also indicated by lower uptake of iron in the higher levels of moisture particularly at I_4. The defficiency was acute on 60th day before the spraying. But after the treatment at harvest stage the iron content was almost same under different moisture levels.

Among the possible causes of iron chlorosis, high phosphate content in soil and bicarbonate in soil or irigation water have been already mentioned. Biddulph (1951), Olsen (1935) and Franco and Loomis (1947) found that iron chlorosis developed in plants grown in solution cultures containing relatively high concentration of phosphate. Dekock (1955) refers to the P : Fe ratio as a useful index to the status of iron in plants. Calcium has an additive effect on the development of chlorosis in that more phosphorus and calcium are absorbed by the plant when the two elements are in solution together (Brown, 1961). In the experiment on soybean iron chlorosis was seen more in high phosphorus applied plots than low level plots, indicating the effect of phosphorus in inducing chlorosis.

As to the varietal differences in the chlorotic conditions of soybean the differential ability of varieties to exhibit iron chlorosis was demonstrated by Weiss (1943), Brown (1961) and Brown *et al.* (1967). Weiss (1938) classified soybean varieties into iron efficient and inefficient strains. Variety E.C. 39824 can be considered as iron efficient strain as compared to E.C. 39821.

Considerable evidence has been published in recent years in support of the view that the bicarbonate ion contributing iron chlorosis. Harley and Linder (1945) found that the application of irrigation waters relatively high in bicarbonate ion induced iron chlorosis in apple and pear trees. Subsequent irrigation with water low in bicarbonates ion tended to alleviate the iron chlorosis. Similar results were reported by Baxter and Belcher, (1955), Brown and Wadleigh (1955), Dekock (1955), Gauch and Wadleigh (1951), Porter and Thorne (1955) and others. Greenwald (1945) and Olsen *et al* (1960) had observed that bicarbonate increases solubility of P in solution.

The combined effect due to the high bicarbonate content (732 ppm of irrigation water used in this experiment along with the high dose of P would have caused the iron chlorosis.

The amount of irrigation water applied to a crop influenced iron chlorosis. Routher and Cramford (1946) found that grape fruit developed iron chlorosis when quantity of water irrigated was more. Quality of irrigation water, fertilizer and cultural practices all became factors which can aggravate the iron chlorosis problem. For example, a moist soil containing decomposing organic matter provides a condition for maximum HC_{03} accumulation. In maize the presence of high bicarbonate content of irrigation water applied at higher levels would have aggravated the iron chlorosis when the crop was supplied with phosphoric acid at 27 kg/ha and grown in lime rich soils.

Summary and Conclusions: While conducting agronomic field experiments on soybean and maize in Field No. 52B of Central Farm, acute iron chlorosis was noticed in both crops. An investigation on the factors causing iron chlorosis revealed the following information under Central Farm conditions.

1. In soybean, iron chlorosis was seen more under high dose of P application.
2. Between the two varieties of soybean grown, the variety E. C. 39824 was camparatively less affected than E. C. 39821 indicating varietal difference to iron chlorosis.
3. The uptake of P was not affected by the iron chlorosis.
4. In maize, the iron chlorosis was seen more under high moisture levels than under low moisture levels.
5. The uptake of iron was reduced considerably under high moisture levels.
6. The combined effect of high bicarbonate content (732 ppm) in the irrigation water with E.C. 6, high P application and moist soil conditions would have aggravated the iron chlorosis in the Central farm soils.
7. The iron chlorosis was controlled by two spraying of 0.4% ferrous sulphate solution neutralized with lime in maize and one spraying in soybean.

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A High Yielding Ash-gourd Strain - CO

by

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Introduction: Ash-gourd or wax-gourd or white pumpkin (*Benincasa hispida* Cogn.) is being commercially grown in Tamil Nadu and other States of India for its fleshy fruits. Inspite of the importance of the fruit for use as vegetables and in preparation of sweet-meats, there is no improved strain and only non-descript types are under cultivation in Tamil Nadu. These types give low and irregular yields for want of balanced production of staminate and pistillate flowers, resulting in wide sex ratio and low yields. According to Choudhury (1967) an ideal variety is one which has a narrow sex ratio of staminate to pistillate flowers. Towards this goal, breeding work was undertaken at Coimbatore for evolving a high yielding and better quality strain in ash-gourd combining desirable qualities.

Materials and Methods: Ten Types of ash-gourd were collected from different parts of the country and studied in an initial evaluation trial for their yield, quality and plant characters exercising selection in variable varieties. Six types adjudged to be high yielding with desirable plant characters were isolated from yield trials conducted at Coimbatore for three seasons. Yield of fruits (in terms of number and weight), number of days taken from sowing to opening of staminate and pistillate flowers and their respective node numbers and sex ratio of staminate to pistillate flowers and crop duration were recorded. The data were subjected to statistical analysis. Based on the results, three types were selected and tested for yield in comparison with local

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