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THE INVESTIGATION OF FACTORS INDUCING IRON DEFICIENCY (CHLOROSIS) IN FRUIT TREES IN ESFAHAN[1]

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Abstract

Iron deficiency damages pome fruit trees especially quince orchards in Esfahan. It is not due to a lack of iron in the soil, but such conditions ais pH, soil water, aeration, temperature and the percentage of organic matter affect iron availability. In order to investigate the factors and also relationship between chlorophyll and the elements in soil, water and leaf, 51 quince orchards in three regions were selected. The soil, water and quince leaf samples were analyed. The summary of the observations and results are as follws:

1 - Soil is alkaline, with high lime, sufficient total iron and poor organic matter.

2 - Rootstocks are quince or azarole (*Crataegus oxycantha*).

3 - The symptoms of Fe - deficiency are frequently observed in quince trees which have the age more than five years and the aggravation with the

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age increasing, (of course the Fe - deficiency appears in nurseries on young trees) .

4 - The intensity of chlorosis decreases to some extent in late summer.

5 - The accumulation of iron in the chlorotic leaf was confirmed.

6 - The symptoms of chlorosis is visible when Fe/Mn > 2. 07 in the leaf.

7 - Total content of iron in the leaf is not associated with the occurrenc of chlorosis.

8 - The amount of chlorophyll (a, b) in chlorotic leaves is less than green one , but the ratio of Chl. a to Chl. b is constant in green leaves, while it is variable in chlorotic ones.

Chl. a and Chl. b are not decreased in a certain ratio in chlorotic leaves but Chl. b is more decreased.

9 - There is no correlation between Chl. (a, b) in leaf with the elements in the soil and water.

10 - Total amount of chlorophyll is related to phosphorus, manganese and nitrogen in the leaf.

Introduction

Iron chlorosis is one of the important physiological plant diseases and severe problem of fruit trees in Esfahan.

The main symptom is always severe chlorosis of the leaves and young growths are always most severely affected (Wallace, T. 1961).

The area between veins becomes light green, then yellow, while the veins green and finally deficiency advances, leaf becomes white and necrosis in dead brown tissue.

Iron availability is governed primarily by pH, but is affected by Mn, Cu, organic matter and free CO3Ca (Vose, 1981).

Iron deficiency has long been considered to be the most difficult of nutrient deficiencies in plants to understand and correct (Wallace, A 1981). Quince trees are susceptible to iron chlorosis in Esfahan and the use of iron chelate to cure, is not economic.

Materials and methods

The practices started both in the orchards and laboratory in september 1980, and continued for three years. The appearance status of trees, rootstock, age and the management considered. More than a hundred orchards were visited and finally 51 of those chosen. The trees had the age between 8 to 10 years. 17 quince orchards non - chlorosis (green leaves), 17 semi - chlorosis (light green to greenish yellow), and 17 - full - chlorosis (yellow with some necrosis), totally 51 orchards in three regions incluing Borkhar, Marbin, and Ghohab were selected in Esfahan. The intensity of chlorosis were determined by the amount of total chlorophyll in the leaf, soil profile was studied, the method, interval, duration of irrigation and the soil aeration were considered. Soil texture was determined. The kinds of lime as powder, concretion, mycellium and conglomerate were observed in soil profile. About six weeks after flowering the leaves (recently matured) were sampled for analyse. Chemical analyses of soil, irrigtion water and leaf samples were also done.

Results and discussion

Iron chlorosis was observed in quince trees in spite of sufficient iron in the oil (total iron from 2. 2% to 3. 4%). On the other hand, total lime varies from 25%to 55% (depending on region and the soil depth), and active $CaCO_3$ is about 20% to 50% of lime total.

Lime - induced chlorosis has long been known, but the severity depends on the kinds, distribution and activity of it in the soil, and also the rate of roots area in contact with it.

The percentage of organic carbon is less than 0. 5, PHs from 7. 9 to 8.4, PHw from 7. 0, to 8. 3, and the concentration of bicarbonate in irrigation water varies from 3 to 10 mg/L.

The attempts to relate the amount of the elements or analysis results in the soil and water with the occurrence of Fe - deficiency failed but found the relationship between chlorophyll and the elements in the leaf. The Fe/Mn ratio equals 2. 07 and 3. 04 in green and chlorotic leaves respectively.

Total iron equals 14. 08 and manganese 67. 9 ppm in green leaf while Fe=175. 9, Mn=57. 9, in chlorotic one, so the accumulation of iron in chlo - rotic quince leaf is confirmed and total content of iron is not associated with chlorophyll content, although Fe may relate with Chl, but extraction of Fe^{2+} by the present methods was not successful, so it was impossible to find the relationshinp between Fe^{2+} and Chl.

The correlation between Chl. a, Chl. b, with manganese and total Chl with manganese, phosphorus and nitrogen are shown by the following equations :

$Y_1 = -0.053 + 0.005\ Mn$ $\quad Y_1 = Chl.\ a$

$Y_2 = -0.039 + 0.002\ Mn$ $\quad Y_2 = Chl.\ b$

$Y = 0.794 + 0.006\ Mn - 1.954\ p - 0.189\ N$ $\quad Y = Chl.\ t$

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