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SOIL TREATMENTS WITH IRON CHELATES TO CURE CHLOROTIC AVOCADO TREES IN ISRAEL

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Iron deficiency chlorosis is common in Israel. Interveinal chlorosis develops on leaves on affected trees, followed by a complete yellowing of the leaves. In severe cases the leaves die and drop prematurely and the trees decline.

Such phenomena are not necessarily connected with soils. Chlorotic trees may be found on high calcareous soils as well as on soils which do not contain lime. Since it has been suspected that such chlorosis on high calcareous soils is connected with higher susceptibility of certain rootstocks, experiments were carried out to select rootstocks more tolerant to calcareous soils. Certain seedlings were found to be more tolerant, mostly of the West Indian race. At the same time, experiments were carried out to cure chlorotic avocado trees in the orchards by the use of different iron-containing compounds. In most cases, the trees didn't respond at all. In a few cases, some cure was noted which lasted only for one season.

It was decided then to try the influence of some iron chelates on chlorotic seedlings and grafted avocado trees. These experimentations are described below.

1) Experiment with chlorotic seedlings on high calcareous soils—On July 1959, avocado seedlings of 8 different varieties, including: Mexicola, Etinger, Hass, Nabal, Lula, Fuchsia, Hall, and pure West Indian, 5 plants of each, were used for the experiment. The seedlings, which were germinated in cans, were taken out, their roots thoroughly rinsed, and then transferred to special cans that contained high calcareous soil (about 65% $CaCO_3$). Each plant was planted in an individual can.

Within about a month after the seedlings were transplanted, symptoms of chlorosis were recognized on some of the Mexican seedlings. These symptoms became more and more pronounced during the summer, and later were found on the Mexican x Guatemalan hybrids (Etinger), and also on the Guatemalan (Nabal and Hass). Finally, the West Indian x Guatemalan hybrids, (Lula, Fuchsia, and Hall) were also affected. The only plant which did not show any symptoms of chlorosis were the pure West Indian seedlings.

Toward the end of the summer and the fall, most of the plants were in a serious chlorotic stage, and some of them were declining. In most cases, though, the chlorosis disappeared during the winter of 1960. The chlorosis showed again and even more pronounced during the summer of 1960 in all seedlings except the pure West Indians.

At that time, it was decided to try some treatments with iron chelate substances. Since, in former experiments, only one compound (iron chelate 330*), showed some improvement of the affected plants, it was decided to use this compound as well as another compound (iron chelate 138**), which had not been tested in our former experiments.

**Sequestrene* 330 *Fe = NaFeDTPA* ***Chel* 138 *HFe = HFe EDDHA*

In August, 1960, the plants were treated by spreading on the soil 5 grams each of these two compounds to 2 chlorotic seedlings of each variety. One of the 5 seedlings of each variety was left for control with no treatment.

All plants received an irrigation of a half liter of distilled water immediately after the treatment. After 10 days, symptoms of quick curing were shown by plants which received treatment with Chel. 138. Two weeks later, all symptoms of chlorosis disappeared completely in these plants. They began to grow new growth of a dark green color, whereas the plants which were treated with Chel. 330 showed only slight symptoms of cure within a month from treatment, and the control seedlings either remained chlorotic or declined.

2) Experiment to cure chlorotic avocado trees in orchards—In July, 1960, experiments were carried out in avocado orchards in two different places:

a) In a privately owned orchard on medium-lime content soil (10-15% $CaCO_3$). The orchard was 5 years old. Ten Fuerte trees with more or less the same degree of chlorosis were selected for this experiment. Four trees received treatment with Chel. 138, two of which received 30 grams per tree and the other two received 60 grams per tree. Four other trees were treated with Chel. 330 (2 with 30 grams and 2 with 60 grams per tree). Two chlorotic trees were left as control with no treatment. The treating substances were spread on the soil around the trees and immediately after the treatments all trees were irrigated.

In about three weeks after the treatments, the trees which received Chel. 138, either 30 or 60 grams, showed considerable improvement, and within two months they were in excellent condition with new healthy growth and with no chlorotic symptoms. The trees that were treated with Chel. 330 showed only slight improvement, whereas the control trees remained chlorotic.

b) In the experimental avocado orchard of the National and University Institute of Agriculture where some of the 3-year-old trees were planted on medium to heavy clay soil free of lime, trees showed chlorosis in different stages, some of which were in severe condition. Twenty chlorotic trees were selected for this experiment. They were divided into 5groups with 5 replications for each group which included all 5 treatments. One group received 50 grams Chel. 138, the second group 100 grams Chel. 138, the third group 50 grams Chel. 330, the fourth group 100grams Chel. 330, and the fifth group was left as the control with no treatment. In this experiment as in the former, the substances were spread in the basins around the trees and irrigated after the treatment. After ten days, considerable improvement was noticed on the trees which were treated with Chel. 138, with either 50 or 100 grams, and within 2-3 weeks they were completely

green with new growth. The trees which were treated with Chel. 330 showed only slight improvement, whereas the control trees were in worse condition.

Following the positive results of these experiments, treatments with Chel. 138 were applied to chlorotic avocado trees in different privately owned orchards. In one orchard, one-year-old avocado trees were inter-planted with bananas, many of the trees showing severe chlorosis. Twenty-five grams of Chel. 138 was applied to each tree and within 2-3 weeks all the treated trees recovered. The same positive results were obtained also in some other commercial orchards where chlorotic trees were treated with Chelate 138. No symptom of chlorosis has been noticed within two years since the trees were treated with Chel. 138.

CONCLUSIONS

According to the different iron compounds applied to chlorotic avocado trees, it seems that Chel. 138 promises the best cure for such affected trees. The main problem is its high price. It seems, therefore, advisable to try what might be the optimum amount of this substance under various conditions and age of trees. It is also worthwhile to try this compound as a spray to the trees. In such cases, the amount applied to a tree may be reduced to one tenth the amount applied to the soil.

Observations should be made as to the duration of the effect of such treated trees (soil or spray applications), as well as for the best season for such treatments.

LITERATURE CITED

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