Magnesium deficiency of apples and oranges

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Magnesium deficiency is a common problem of orchards in Western Australia. The deficiency affects both apples and oranges, but in most cases is not particularly severe. Leaf sprays of magnesium sulphate (Epsom Salts) have successfully controlled the deficiency. Two per cent. strength is recommended. Soil treatment to give long-term control has not yet been demonstrated successfully in Western Australia.

Magnesium is an essential element for all plant growth. Although it is not usually included in fertiliser mixtures it is needed in considerable quantities. Plants usually contain more magnesium than phosphorus, but magnesium is deficient less often than phosphorus because most soils contain adequate supplies of magnesium for successful plant growth.

Like potassium, magnesium is frequently present in greater quantities in the subsoil. Where intensive cropping of any kind is followed it is likely that the supplies of magnesium in the soil will be exhausted. Under these conditions crops show deficiency symptoms.

Magnesium is closely related to potassium in plant nutrition and excess application of potash frequently causes magnesium deficiency. The converse effect is not as common, although it can occur.

OCCURRENCE OF MAGNESIUM DEFICIENCY

Magnesium deficiency is fairly general on orchards in the fruit growing areas of the Darling Ranges within 25 miles of Perth. Pickering Brook, Kalamunda, and Karragullen are districts in which magnesium deficiency is found on apples and oranges. Symptoms of the deficiency have also been noted on other citrus species, and other fruit trees may be affected. In the South-West fruitgrowing districts, Donnybrook, Bridgetown and Manjimup, the deficiency does occur on apples, although generally speaking the soils in these areas have higher reserves of magnesium initially.

Magnesium deficiency is closely connected with cropping. Large amounts of magnesium are removed from the tree by
the developing fruit. Both in apples and oranges the magnesium required by the fruit is taken from the leaves and not directly from the soil. In consequence leaves which are close to developing fruit, particularly older leaves, first show magnesium deficiency symptoms. In very deficient areas a similar effect is seen on shoot growth of apples when the young leaves at the tip take magnesium from the older leaves at the base of the shoot. Movement of magnesium into fruit leads to a typical pattern of symptoms throughout the season on fruit trees, particularly navel oranges. The symptoms on navel oranges are usually at a minimum at the beginning of summer. As the fruit grows, magnesium is removed from the leaves and the symptoms start to show, increasing in intensity until June of the following year. In mid-winter there is usually a heavy leaf-fall in which all leaves showing severe magnesium deficiency symptoms fall off. The pattern is naturally somewhat different in apples; but the increasing severity of symptoms from October to January reflects the same process.

SYMPTOMS ON APPLES

Leaf symptoms of magnesium deficiency for apples are as follows:

Most varieties show a marked yellowing around the margin of the leaf and in between the veins. As the deficiency increases in severity, this yellowing is followed by burning around the margins and then be-

Fig. 2.—Leaves of Washington Navel orange showing magnesium deficiency ranging from severe to slight with unaffected leaves.

between the veins. The yellow or yellow-white of magnesium deficiency is quite different in colour from the pale green chlorosis caused by manganese deficiency. Another difference is that in magnesium deficiency the tip of the leaf is usually affected first, whereas manganese deficiency uniformly affects the whole leaf.

Dougherty and Yates do not show as much interveinal yellowing as other varieties; they tend to have only a marked yellow band around the outside of the leaf.

Typical symptoms of magnesium deficiency on older leaves of shoot growth of Cleopatra apples are shown in Fig. 1.

SYMPTOMS ON ORANGES

Symptoms of magnesium deficiency in oranges are as follows:

Both Washington Navel and Valencia oranges show a pattern of yellowing on the
leaves; this starts as a yellow elongated blotch on each side of the mid rib, and increases in size until only the base and tip of the leaf are green. The next step, when the tip yellows, is soon followed by the fall of the affected leaf. A typical progressive series of symptoms is shown in Fig. 2.

The premature defoliation of trees affected by magnesium deficiency is a typical characteristic. It is found that when the deficiency occurs severely on young apple trees, at the end of the growing season only a few leaves on the tip of each leader remain, the rest having fallen off during the season.

**CONTROL MEASURES**

In other parts of the world where magnesium deficiency is a problem in orchards, a satisfactory method of control is to treat the soil with large quantities of magnesium-containing minerals. Dolomitic limestone, a naturally occurring mixture of calcium carbonate and magnesium carbonate, is often used. Under soil management systems usually followed in orchards in Western Australia, many fertilisers applied to the soil are not readily taken up by the trees. This has been a bar to successful treatment of magnesium deficiency with soil applications in Western Australia. Apples and oranges have been treated with heavy amounts of magnesium-containing fertilisers in a number of cases, but usually control of the deficiency has been unsatisfactory.

There is available in Western Australia a suitable magnesium containing mineral known as magnesite. Its use as a soil treatment for magnesium deficiency could only be recommended however, where conditions were favourable for it to penetrate the soil and be taken up by the tree. These favourable circumstances include adequate summer irrigation and also acid soil conditions.

Where long term control of magnesium deficiency with soil applications cannot be achieved, leaf sprays of magnesium sulphate are recommended to control the deficiency. Even when soil treatment is used, sprays may have to be used for a few years until the soil treatment exerts its influence. Unfortunately, such sprays have to be applied each year as they have little or no residual effect. As magnesium deficiency is so closely related to cropping it is advisable with both apples and oranges suspected of suffering from this deficiency to spray trees whenever they are carrying a heavy crop. The concentration of spray used is 2 per cent. Epsom Salts (magnesium sulphate). Such a spray is made up with 20 lb. of Epsom Salts to 100 gallons of water. This spray is improved by adding a suitable wetting agent. The same concentration is used for both apples and oranges. Apples should be sprayed one or more times in November or December depending on the severity of the deficiency; up to three sprays may be needed. Oranges can be sprayed at any time of the year that there is sufficient new growth on the tree to effectively absorb the magnesium. Autumn spraying is generally recommended, as the deficiency is usually most severe at this season.

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