Control of copper, zinc and manganese deficiencies in fruit trees

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CONTROL OF COPPER, ZINC AND MANGANESE DEFICIENCIES IN FRUIT TREES

By N. J. HALSE, M.Sc. (Agric.), Research Officer, Plant Research Division

The three elements copper, zinc and manganese are plant nutrients of the type often referred to as minor or trace elements. Although essential elements for plant growth, they are required in comparatively small quantities.

Fertile soils normally supply enough of these elements for crop plants but most Australian soils, unfortunately, are not so kind. Probably in no other part of the world are minor element deficiencies as common as in this State.

Several treatments are available for these deficiencies, and which one is used should depend on what time of the year the deficiency is identified. Spray treatments normally give a quick response but need to be repeated annually, or at least biennially. Soil treatments should give lasting control for up to five years.

Copper deficiency occurs on all kinds of fruit trees on sandy or gravelly surfaced soils as well as on some heavier soils such as gravelly loams.

Zinc deficiency affects deciduous fruit trees on deep sands and similar poor soils, but is much more common on citrus. Older citrus trees show zinc deficiency on almost any soil.

Manganese deficiency, in its milder forms, is likely to occur on any fruit tree on almost any soil type. Severe manganese deficiency is most common on very gravelly soils and especially severe where the gravel is of the large unevenly shaped type.

(Note.—In all cases the gravel referred to is ironstone gravel).

SYMPTOMS

Copper Deficiency

The general symptom of copper deficiency is death of the terminal growth leading to a profusion of dead sticks on the tree.

Apples

The symptom is referred to as “wither-tip.” The terminal leaves on a shoot develop shiny dead flecks; subsequently the leaves fall and several inches of the wood dies back from the tip.

Copper deficiency on Yates apple, showing brown spotting of terminal leaves and shoots just starting to die back.
Manganese deficiency on Granny Smith apple. Typical severe symptoms.

Pears
The symptoms are similar but the leaves turn black and cling to the dead twigs.

Citrus
Terminal shoot growth stops, the leaves fall and subsequently the twig dies. This leads to a profusion of dead twigs. Multiple budding is often noticed in severe cases. Fruit damage shows as dead gummy patches if the deficiency is severe.

Zinc Deficiency
The general symptoms are rosetting and yellowing of the terminal growth. Instead of making normal shoot extension on the terminals the leaves appear in tight clusters.
The leaves are small and pointed with bright yellow interveinal blotching.

Deciduous Trees
Terminals at the ends of leaders are worst affected. Healthy growth appears from lower on the affected leaders. Other leaders may be unaffected.

Citrus
Rosetting is not as marked as on deciduous trees. As well as on small pointed terminal leaves yellow blotching may be present on larger leaves.

Manganese Deficiency
The general symptom of manganese deficiency is loss of green colour in an interveinal pattern. It can usually be differentiated from zinc deficiency by the following characteristics:

(a) Older and shaded leaves are affected.
(b) Leaves may be thinner but are not reduced in size.
(c) The interveinal colour is pale green rather than yellow as in zinc deficiency.

The general symptoms are the same on deciduous and citrus fruit trees.
A phenomenon noticed on stone fruit particularly, is a manganese deficiency which shows up in spring but disappears during the season. Control of such deficiency can improve tree growth.

CONTROL METHODS
Control methods for these minor element deficiencies fall into three groups—soil treatment, foliage spray and dormant spray. The third method is of course, only suitable for deciduous fruit trees. The recommended control treatments are listed in the Table below. The abbreviations used are:

- Copper sulphate crystals—CuSO₄.
- Zinc sulphate crystals—ZnSO₄.
- Manganese sulphate crystals—MnSO₄.

A new treatment which has been used successfully for non-bearing deciduous
Zinc deficiency on Dunns Seedling apple. Interveinal yellowing, rosetted growth and die back are typical. Marginal scorch only appears late in the season.

Trees is to spray the foliage in spring with 1 lb. CuSO₄ plus 1 lb. ZnSO₄ per 100 gals., unneutralised.

**Notes on Soil Treatment**

Soil treatments should be applied during the winter.

Copper sulphate is very toxic and must be kept away from the butt of the tree. Use lighter rates on sandy soil and heavier rates on loam or clay soils.

Manganese sulphate should be dug into the soil or placed in a number of holes 12 in. to 18 in. deep around the tree.

Copper sulphate should be left on the surface.

Although more expensive, soil treatment is often worthwhile because of its lasting effect.

**Notes on Dormant Spray**

Dormant sprays should be applied late in the winter. Probably the best time is just before the late winter oil spray if one is used.

This spray is very effective for zinc deficiency.

**CONTROL TREATMENTS**

<table>
<thead>
<tr>
<th></th>
<th>Soil</th>
<th>Dormant Spray</th>
<th>Foliage Spray</th>
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</thead>
<tbody>
<tr>
<td><strong>Copper</strong></td>
<td>8 oz.-2 lb. CuSO₄ per tree</td>
<td>10-20 lb. CuSO₄ per 100 gals.</td>
<td>10 lb. CuSO₄ 10 lb hydrated lime per 100 gals.</td>
</tr>
<tr>
<td><strong>Zinc</strong></td>
<td>Not recommended</td>
<td>20 lb. ZnSO₄ per 100 gals.</td>
<td>10 lb. ZnSO₄ 5 lb hydrated lime per 100 gals.</td>
</tr>
<tr>
<td><strong>Manganese</strong></td>
<td>1-2 lb. MnSO₄ per tree below surface</td>
<td>40 lb. MnSO₄ per 100 gals.</td>
<td>10 lb. MnSO₄ 3 lb. hydrated lime per 100 gals.</td>
</tr>
</tbody>
</table>

**Note.**—Concentrations listed are maximum rates; refer to notes before using any treatment.
Notes on Foliage Spray

(1) Foliage sprays for any two or all three elements can be combined. When combining these sprays reduce the concentration to the same total concentration of salt as the single spray, for example—

5 lb. CuSO₄ + 5 lb. ZnSO₄, or

Use the same proportion of lime to each salt when combining sprays.

(2) When applying sprays on an annual basis for prevention of a deficiency lower concentrations can be used.
When applying sprays to tender foliage or especially on young fruit, the concentration should be reduced.
On fruit varieties prone to russet, foliage copper sprays should not be applied.

(3) Manganese sulphate sprays can be applied to most foliage quite safely without neutralisation, although the spray will stick better if it is neutralised. An alternative neutralising agent to lime is washing soda, this may give a less unsightly deposit on fruit. It should be used at equal quantities with the manganese sulphate, for example, 10 lb. MnSO₄ + 10 lb. washing soda.

(4) Foliage sprays will be most effective when applied to young fully expanded foliage. For both deciduous and citrus trees November is usually a suitable time.
The addition of wetting agent to the spray is advisable.

(5) Compatibility of minor element sprays is similar to that for Bordeaux mixture.

(6) In making up minor element sprays the lime should be dissolved in at least half the quantity of water; the minor element salts are dissolved in the remainder of the water and poured into the lime solution.