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Copper requirements for the south-eastern wheatbelt

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FARM experience and the results of five years intensive research have shown copper deficiency to be widespread in the south-eastern wheatbelt.

On many areas of the south-eastern wheatbelt, copper deficiency is likely to restrict wheat yields unless the equivalent of 220 lb. of the new No. 1 copper-zinc-molybdenum-superphosphate has been applied. The worst affected soil types, which occur in Zone 5 on the map below, are—

- The yellow and brown loamy sands. These are the major soil type of the district and usually carry wodgil, tamma, light mallee or scrub.
- The grey gravelly sands or grey sands over gravel which normally carry blue mallee, mallee, tamma, wodgil or scrub. These are more common south of Lake Grace-Lake King.

**Effect on wheat yields**

The effect of copper deficiency in lowering wheat yields is shown clearly in Table 1. The Table shows the average results of several trials carried out on problem soil types.

<table>
<thead>
<tr>
<th>Type of fertiliser</th>
<th>Rate*</th>
<th>Yield— bus. per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain super</td>
<td>180 lb./ac.</td>
<td>8.2</td>
</tr>
<tr>
<td>No. 2 super-Cu-Zn-Mo</td>
<td>183 lb./ac.</td>
<td>13.2</td>
</tr>
<tr>
<td>Original No. 1 super-Cu-Zn-Mo</td>
<td>186 lb./ac.</td>
<td>15.4</td>
</tr>
<tr>
<td>New No. 1 super-Cu-Zn-Mo</td>
<td>186 lb./ac.</td>
<td>15.4</td>
</tr>
</tbody>
</table>

* Rates include 180 lb./acre super.
Effect of fertiliser mix

Differences in wheat yields shown in Table 1 can be explained partly by the different levels of trace elements present in the various types of mixes available. In Table 2, the composition of the original No. 1 mix is compared with the composition of currently available mixes.

Fertilisers for problem soils

Yellow brown sandy loams and gravelly soils

The original recommendation for these soils was for a high rate of No. 2 mix. There were two reasons for this. Firstly, yields obtained with the original No. 1 mix were no more than for the cheaper No. 2 mix; secondly, super rates of at least 220 lb. per acre appeared profitable for first crops on new land.

In early 1969 however, the quantity of zinc in the old No. 1 mix was halved and the recommendation for these soils was altered to 220 lb. of No. 1 super-copper-zinc-molybdenum per acre.

Trials with the new No. 1 averaged 1½ bushels per acre more than those with the old mix because of the lower quantity of zinc (Table 2).

To prevent copper deficiency, it is suggested that where only the No. 2 mix has been applied, at least 180 lb. copper-super be applied with the next crop.

Grey gravelly sands and grey sands over gravel.

Where only the No. 2 mix has been applied, at least 180 lb. per acre of super-copper-zinc B would be worthwhile with the next crop. In the first year on these soils, 220 lb. per acre super-copper zinc A gives best returns although it may be necessary to add molybdenum later if molybdenum deficiency appears in pasture legumes.

Antagonistic effects of zinc

Zinc is needed to grow clover and oats on light soils in the south-eastern wheatbelt but if applied in greater quantities than recommended it is likely to induce copper deficiency in wheat and barley. This applies particularly to wheat grown on yellow and brown loamy sands and gravels.

On such soils it is essential that the zinc is applied with the copper at a rate no greater than the equivalent of ½ lb. zinc oxide per acre. Higher rates usually result in lower wheat yields in the year of application.

Repeat applications

Repeat applications of copper are not worthwhile unless symptoms of copper deficiency appear in the crops, pasture or wool. Such symptoms should be confirmed

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Table 2.—Composition of trace element fertiliser mixtures

<table>
<thead>
<tr>
<th>Fertiliser Mixture</th>
<th>Super (based on 22% P₂O₅)</th>
<th>Copper Sulphate</th>
<th>Zinc Oxide</th>
<th>Molybdenum Trioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Super</td>
<td>174</td>
<td>2½</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 2 Super Copper Zinc Molybdenum</td>
<td>174</td>
<td>2½</td>
<td>2½</td>
<td>2</td>
</tr>
<tr>
<td>No. 1 Super Copper Zinc Molybdenum</td>
<td>170</td>
<td>5</td>
<td>2½</td>
<td>2</td>
</tr>
<tr>
<td>Original No. 1 Super Copper Zinc Molybdenum (not now available)</td>
<td>170</td>
<td>5</td>
<td>1½</td>
<td>2</td>
</tr>
<tr>
<td>A Super Copper Zinc</td>
<td>170</td>
<td>5</td>
<td>1½</td>
<td></td>
</tr>
<tr>
<td>B Super Copper Zinc</td>
<td>174</td>
<td>2½</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: One bag of No. 1 mix contains the same quantities of trace elements as one bag of No. 2 mix plus one bag of Copper Super.
by a district agricultural adviser as symptoms like those of copper deficiency can have other causes.

Excess copper applications are expensive and may be harmful to stock.

**Recommendations for new land**

Superphosphate and trace element recommendations for new land in the southeastern wheatbelt are shown in Table 3. A bag of the recommended mixes usually supplies sufficient trace elements but the higher rates recommended are more profitable because of the additional super applied.

Table 3.—New land fertiliser recommendations for the south-eastern wheatbelt

<table>
<thead>
<tr>
<th>Soil and vegetation</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow and brown loamy sands and gravel carrying wodgil, tamma, mallee and scrub. Mainly found in zone 5.</td>
<td>Mix No. 1 super copper zinc and molybdenum 220 lb./acre.</td>
</tr>
<tr>
<td>Grey sands and gravelly sands carrying blue mallee, tamma, wodgil, mallee. Mainly found in Zone 6.</td>
<td>Mix A super copper zinc 220 lb./ac. in first year. Super molybdenum 180 lb. per acre in second year.</td>
</tr>
<tr>
<td>Grey brown sands over clay carrying mallee and broom bush. Mainly found in Zone 6.</td>
<td>Mix B super copper zinc 220 lb./acre.</td>
</tr>
<tr>
<td>Heavy loam and clay soils carrying heavy timber and heavy mallee.</td>
<td>Plain super 135-180 lb./acre.</td>
</tr>
</tbody>
</table>

**Fertiliser for mixed soil types**

Where two or more soil types occur in the same paddock it is often impractical to apply the recommended fertilisers on each. In such cases the sensible approach would be to apply to the whole paddock the mix appropriate to the main soil type.

Gravelly soils usually occur on the ridges and merge with sands underlying clay on the mid and lower slopes. In turn, the sands merge with heavier valley soils.

If a paddock is mainly gravelly, it is suggested that the high copper mixes be used over the whole paddock. Providing only the rates recommended for gravels are used, the excess trace elements will have no harmful effects on the sand/clay or heavy land.

Where only plain super is used on a predominately heavy paddock, it is likely that patches of trace element deficiency will appear on light land areas.

**Mixing trace elements on the farm**

If fertilisers are to be mixed on the farm, the following points must be remembered.—

- It is essential that the correct quantities of trace elements (Table 2) are thoroughly mixed with the super.
- If sources of trace elements other than those shown in Table 2 are used, it is vital that the correct equivalents are mixed.
- 5 lb. of copper sulphate (25 per cent. copper) is equivalent to 15 lb. of copper ore containing 8½ per cent. copper.
- Deep-mined ore generally contains less available copper than surface ore. A sulphide ore is practically useless in the year of application.
- Copper is more available in finely ground ore than in coarsely ground materials.

**Summary**

- Yellow and brown loamy sands and soils associated with gravel are the most copper deficient soils in the south-eastern wheatbelt.
- The recommended fertiliser should be used for each soil type.
- Repeat applications of copper should not be applied without referring to an agricultural adviser.

**Acknowledgments**

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