TEXAS GUIDE
for controlling
PESTS and DISEASES on CITRUS
FRUIT GROWERS should give careful consideration to the choice of chemicals to use in citrus groves in order to obtain effective and economical control of insects and diseases and still make maximum use of natural control agents.

The authors of this guide do not intend to encourage spraying over dusting, but spraying is far superior to dusting for melanose disease control. Spraying also is the only practical control procedure for scale insects. Applications following the post-bloom application should be made on the basis of pests in the grove.

**DISEASES**

Melanose (sand paper) disease is controlled effectively through the use of neutral copper. Spray before the young fruit average 1/2 inch in diameter. A single high pressure spray treatment usually gives commercial control of melanose. Greasy spot disease can be controlled with zineb, neutral copper or oil emulsion. Zineb is favored for the control of greasy spot, since it is also highly effective against citrus rust mites. Mottle-leaf can be controlled effectively by using neutral zinc in the first spray application of the crop year. Neutral zinc is more convenient to use than the old zinc sulfate-lime mixture, and does not leave as much undesirable residue on the leaves. Mottle-leaf is a problem principally on orange trees. See Table 2 and discussion of material for rates to use.

**DUSTS**

See discussion of pesticidal dusts for recommended amounts to use.

**PROPER APPLICATION**

Dusting should be done when the air is calm and when temperature ranges from 75 to 90 degrees F. Spraying is a costly operation, and thorough coverage is important. The spray should be applied at a pressure of 500 to 600 pounds per square inch and in amounts sufficient to wet all parts of the tree including both sides of the leaves, all fruit, twigs and branches. If dusts are used, 50 to 80 pounds per acre should be used on mature trees, and it is best to blow the dust in from two sides of the tree. The degree of control will be affected by completeness of coverage, type of application and conditions under which application is made.

**MATERIALS FOR CITRUS TREES**

**Pesticidal Sprays**

Amounts given are based on 100 gallons of spray mixture.

1. NEUTRAL COPPER—3/4 pound metallic copper (controls melanose and greasy spot.)
2. WETTABLE SULFUR—10 pounds plus 3/4 pound metallic copper (controls citrus rust mites, melanose disease and greasy spot disease, and partially controls “Texas citrus mites”. See Table 2.)
3. WETTABLE SULFUR—10 pounds plus 1 pound of 75 percent Zineb wettable powder (controls citrus rust mites, greasy spot and partially controls “Texas citrus mites”).
4. ZINEB—1 pound of 75 percent wettable powder (controls citrus rust mites and greasy spot disease.) Zineb may be used in combination with materials 1, 2, 5, 6, 7, 8, 9, 10, 11, 12 and 13.
5. TEDION—1 pound of 25 percent wettable powder (controls “Texas citrus mites”). Do not apply more than once per season while fruit is present. Tedion may be used in combination with materials 1, 2, 3, 4, 7, 8, 9, 10, 11, 12 and 13.
6. KELTHANE—1 quart of the emulsifiable concentrate (controls “Texas citrus mites” and false spider mites.) Kelthane may be used in combination with materials 1, 2, 3, 4, 7, 8, 9, 10, 11, 12 and 13.
7. PETROLEUM OILS—1.6 percent of actual oil as the emulsive or emulsified material (controls scale insects, white
**SPRAY PROGRAM**

*See discussion of materials for rates to use and compatibility.*

### Post-bloom Application

(Apply before fruit in ½ inch in diameter.)

1. Zineb plus Tedion  
   or
2. Zineb plus Kelthane  
   or
3. Wettable sulfur plus Zineb  
   \*Add copper to the above sprays if melanose is a problem.*

### Summer (Apply June 1-August 15.)

1. Zineb plus oil  
   or
2. Zineb plus oil plus Sevin  
   or
3. Wettable sulfur plus Zineb  
   or
4. Chlorobenzilate

### Fall (Apply in October or November if needed.)

1. Zineb plus Tedion  
   or
2. Zineb plus Kelthane

### Supplemental Application (Apply when needed.)

1. Sevin plus oil plus Zineb  
   or
2. Sevin plus Zineb

**Remarks**

- Apply for control of citrus rust mites and “Texas citrus mites.”
- Apply for control of citrus rust mites, “Texas citrus mites” and false spider mites.
- Apply for control of citrus rust mites.

### DUST PROGRAM

(Apply immediately after fruit is set.)

1. Sulfur  
   or
2. Sulfur plus Kelthane  
   \*If melanose is a problem, see spray schedule.*

### Additional Application (Apply as infestations warrant.)

1. Sulfur  
   or
2. Sulfur plus Kelthane

**Remarks**

- Apply for control of citrus rust mite control only. (Also gives partial control of “Texas citrus mites” and false spider mites.)
- Apply for control of citrus rust mites, “Texas citrus mites” and false spider mites.
flies, "Texas citrus mites," false spider mites, and greasy spot). Oil sprays should be used in combination with Zineb (material 4) to control citrus rust mites. To obtain control of brown soft scale, add 0.6 pounds of 80 percent Sevin wettable powder. Continued agitation is necessary to prevent separation of Sevin and oil in the spray tank. Oils should not be applied to drouth-stricken trees or to trees loaded with young fruit (under \( \frac{3}{4} \) inch diameter). Oil sprays applied during the fall season may interfere with the coloring of early harvested fruit and make the trees more susceptible to cold injury. Never use oil in combination with sulfur in any form.

<table>
<thead>
<tr>
<th>Percent oil shown on label</th>
<th>Gallons of actual oil needed to make 1.6 percent mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>97-98</td>
<td>1(\frac{1}{2})</td>
</tr>
<tr>
<td>90-92</td>
<td>1(\frac{1}{4})</td>
</tr>
<tr>
<td>80-84</td>
<td>2</td>
</tr>
</tbody>
</table>

Oils used on citrus trees should have an unsulfonated residue of at least 92 percent to minimize harmful effects to the trees.

8. SEVIN—1.25 pounds of 80 percent Sevin wettable powder (controls the brown soft scale.) Sevin may be used in combination with petroleum oils and Zineb. When Sevin is used alone it may create an environment favorable for spider mites.

9. CHLOROBENZILATE—2 pounds of 25 percent wettable powder per 100 gallons of spray gives good control of false spider mites and citrus rust mites and fair control of "Texas citrus mites". Based on work done in Florida, it gives faster kill of rust mites, but has a shorter residual than Zineb.

**Nutritional Sprays**

10. NEUTRAL ZINC—2 pounds of the 50 percent neutral zinc concentrate (corrects and prevents little-leaf or mottle-leaf of citrus.) Neutral zinc may be used in combination with materials 1, 2, 3, 4, 5, 6, 8, 9, 11, 12 and 13. See Table 2.

11. NEUTRAL MANGANESE—2 pounds of the 50 percent manganese concen-
trate (corrects and prevents mottle-leaf due to manganese deficiency.) Neutral manganese may be used in combination with materials 1, 2, 3, 4, 5, 6, 8, 9, 10, 12 and 13. See Table 2.

12. NEUTRAL IRON—2 pounds of the 30 percent neutral (partially chelated) iron concentrate (aids in correcting chlorosis due to iron deficiency.) Neutral iron may be used in combination with formulas 1, 2, 3, 4, 5, 6, 8, 9, 10, 11 and 13.

13. UREA—of low (under 0.3 percent) biuret content, 5 to 8 pounds (increases the nitrogen content of the leaves during the fruit setting period.) Urea may be used in the post-bloom spray in combination with materials 2, 3 and 4.

Table 2. Pounds of copper, zinc, manganese compounds to use per 100 gallons of water.

<table>
<thead>
<tr>
<th>Percent metallic content shown on label</th>
<th>34-36</th>
<th>48</th>
<th>52-56</th>
<th>75</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>2.2</td>
<td>1.6</td>
<td>1.4</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Zinc</td>
<td>-</td>
<td>-</td>
<td>1.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manganese</td>
<td>-</td>
<td>2.4</td>
<td>1.8</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Certain spreader-stickers may be added to spray mixtures containing only wettable powders to prolong their effectiveness in case of rain soon after application.

Pesticidal Dusts

1. SULFUR—50 to 80 pounds per acre of 325-mesh (primarily to control citrus rust mites, but gives some control of spider mites.)

2. SULFUR-KELTHANE—325-mesh sulfur, plus 3 percent Kelthane (controls citrus rust mites and spider mites.)

Table 3. Minimum days from application to harvest.

<table>
<thead>
<tr>
<th>Product</th>
<th>Minimum Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEVIN (Only one application per fruiting season, except for grapefruit)</td>
<td>5</td>
</tr>
<tr>
<td>ZINEB</td>
<td>0</td>
</tr>
<tr>
<td>KELTHANE</td>
<td>7</td>
</tr>
<tr>
<td>TEDION (Only 1 application per year)</td>
<td>0</td>
</tr>
<tr>
<td>MALATHION</td>
<td>7</td>
</tr>
<tr>
<td>SULFUR</td>
<td>0</td>
</tr>
<tr>
<td>NEUTRAL COPPER, ZINC, MANGANESE AND IRON</td>
<td>0</td>
</tr>
<tr>
<td>PETROLEUM SPRAY OIL</td>
<td>0</td>
</tr>
<tr>
<td>CHLOROBENZILATE</td>
<td>0</td>
</tr>
</tbody>
</table>
BIOLOGICAL CONTROL

Brown Soft Scale

Additional use of pesticides in orchards and in surrounding crops appears to be among the major factors causing increased brown soft scale populations. Climatic conditions also may be involved.

Use of Phosphate Insecticides

Organic phosphate insecticides should be used only when it would be unsafe to use oil sprays to control scale insects. The phosphate insecticides kill the beneficial insects that help keep scale pests under control.

Ants

Ants that infest citrus trees may interfere with parasites and predators which feed on certain pests. In addition, ants may spread insects which produce "honeydew" on which sooty mold develops. Soil inhabiting ants can be controlled effectively with 5 percent heptachlor or 2½ percent dieldrin or 5 percent chlordane dust or granules. Tree-inhabiting species also can be controlled by "painting" or "spot" spraying the nests with heptachlor, dieldrin or chlordane emulsions prepared according to the manufacturer's directions. Spray with a low-pressure, manually operated sprayer, since the pesticides should be applied only to the nests. Proper treatment of tree wounds will help control acrobatic (wood) ants that infest citrus trees.

This manuscript was prepared by entomologists, plant pathologists and horticulturists of the A&M College of Texas and Texas A&I College Citrus Center.

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