

# Copper sprays for inland orchards

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Copper sprays applied in autumn in inland areas will control Septoria spot, greasy spot, Phytophthora brown rot, and may help control anthracnose.

They can also reduce frost damage, control black pit and partially control snails.

## Particle size key to control

Copper fungicides are preventative and act only to inhibit spore germination. The key to good control of citrus diseases is the particle size of the formulation and the ability of the particles to stay on the fruit, not the rate of active ingredient of copper per hectare. Particles do not redistribute over the fruit surface and coverage is lost with time as the fruit grows and with weathering.

Copper applied in autumn should not weather very much since there is little fruit growth - unless there is a lot of rainfall. Most of the rainfall effect is the dislodgement of particles, not the dissolving of copper.

Current copper fungicides are more effective than older products per unit of metallic copper, and can be used at lower rates. A neutral copper fungicide, which does not contain lime, is preferred in areas with parasite populations.

## Expert opinion on formulations

Professor 'Pete' Timmer of University of Florida advises that "liquid and flowable formulations of copper provide no better control than dry products per unit of metallic copper and are much more expensive to manufacture, but are more convenient to use".

"Differences in efficiency between products are relatively small. There is not a lot of difference between the hydroxides, basic sulphates or oxychlorides, but there can be a lot of differences in quality of individual products."

## Can copper sprays be phytotoxic?

Copper sprays can cause necrotic spots between the oil glands giving the rind a speckled appearance (stippling), or blacken or enhance existing blemishes and cause a build up of copper to toxic levels in some soils.

Phytotoxic effects on fruit occur most commonly when copper is applied in complex tank mixes with other pesticides, petroleum spray oils or nutritional materials; in combination with acidic products and when applications are made at high temperatures; and when humidity is low and cloud cover is zero.

The exact causes of stippling and blemish darkening are not clear, but may be related to fruit surface temperature rather than residue levels or copper formulation. Liquid copper formulations tend to be more phytotoxic than powders.

Copper damage can usually be reduced by applying lower rates of fungicide in larger volumes of water.



Figure 1: Darkening of wind blemish by copper spray

## **Diseases that can be controlled with copper**

### **Septoria spot**

Controlling Septoria spot is very simple and effective. It involves the application of one fungicidal copper spray in early autumn (mid March), before the autumn rains.

A spray applied before autumn rains leaves a protective residue, which should last on the fruit throughout the danger period. Sprays applied in early spring (August) do not give any protection against Septoria spot.

### **Is spraying necessary every year?**

In orchards where spot is critical only in epidemic years, spraying can be looked on as an insurance, which will save very heavy losses - perhaps two out of 10 years. However, fruit grown for export must be sprayed.

### **Periods of susceptibility:**

Infection of the rind can take place as early as the beginning of March, while the fruit is still green and not full size. Should unseasonable weather occur for four to six days in January or February (ie, continuous wet weather with high humidity's), it is possible that infection could take place.

The susceptibility of the rind probably ends by late May, both in Washington navel and Valencia oranges.

### **Conditions necessary for infection:**

Prolonged periods of moisture from heavy rains, fogs or dews are regarded as important for infection. Moist weather enables the fungus to produce spores, and permits the spores to germinate on the fruit surface and penetrate the rind. These spores - and the fungus growth made from them - are very delicate and can only live in an atmosphere approaching saturation. Therefore, showery weather or long periods of dew are required.

### **When do symptoms show up?**

There is a widespread belief among citrus growers that frost injury is necessary before Septoria shows up. The fungus establishes in the rind before frosting; it does not invade frosted tissue. It is true that Septoria spot develops very quickly in fruit weakened by frost, but it does so from well established infections already in the rind.

### **Greasy spot**

Greasy spot is a very minor disease in Australian orchards. Symptoms are usually only seen in unsprayed orchards, especially those with a nutrient imbalance. Abnormally wet conditions during spring and/or autumn favour greasy spot development.

Greasy spot infections are caused by spores of the fungus *Mycosphaerella* produced on leaf litter on the orchard floor. Leaves in an advanced state of decomposition and capable of supporting mature fruiting bodies of *Mycosphaerella* (and *Septoria*) are mostly present under trees in Sunraysia during summer and early autumn in wet seasons.

Greasy spot can be controlled by a single spray of copper fungicide in early to mid autumn - **before autumn rains**.



Figure 2: Greasy spot symptoms on a leaf

### **Anthracnose**

The term 'anthracnose' is applied to any lesion on fruit that contains fruiting bodies of the fungus *Colletotrichum gloeosporioides*. This fungus is a common invader of citrus rind (also leaves and twigs) and forms a latent infection in the upper layers of the peel. In oranges and grapefruit, anthracnose is usually a post-harvest disease and generally only occurs if the peel is injured or the fruit is overly ripe.

A symptom known as 'anthracnose tear staining' mainly occurs in grapefruit when cold water (from heavy dews) runs down the surface of a fruit injuring the rind.

Field control is maintained through good cultural practices, pruning out dead wood (on which the fungus fruits) and applying copper sprays.

### **Phytophthora brown rot**

Fruit loss caused by brown rot is directly related to the total amount and frequency of rainfall - and to fruit maturity at the time rainfall occurs.

Fruit is most susceptible to brown rot just after colour break. Citrus growers should apply a copper spray in March to April before the onset of the autumn rains. One application is enough in a normal season to protect fruit against brown rot.

If rainfall is unseasonal, a second spray should be applied one month later. This is a full tree coverage spray and includes the skirts of the trees, which protects fruit against splash dispersal of *Phytophthora* zoospores. The full tree coverage spray also protects against infection by the deciduous fruiting bodies of *P. hibernalis* that are air borne during cold winter storms.

Improve ventilation under the tree canopy and minimize long periods of wetness and high humidity in the orchard to reduce the severity of brown rot. Proper irrigation management, mowing to prevent growth of ground vegetation, pruning to remove low hanging branches and maintaining adequate soil drainage are essential. Skirting - or removing low hanging branches as well as improving air movement - removes fruit close to the soil, which are more likely to become infected and promote splash dispersal of the brown rot fungus to healthy fruit higher in the canopy.



Figure 3: Phytophthora symptoms on lemon