

FROST MINIMISATION WITH COPPER



Several growers / farmers reported a reduction in frost damage following an application of Coppox® WG. We therefore decided to pay the subject of frost minimisation a lot more attention.

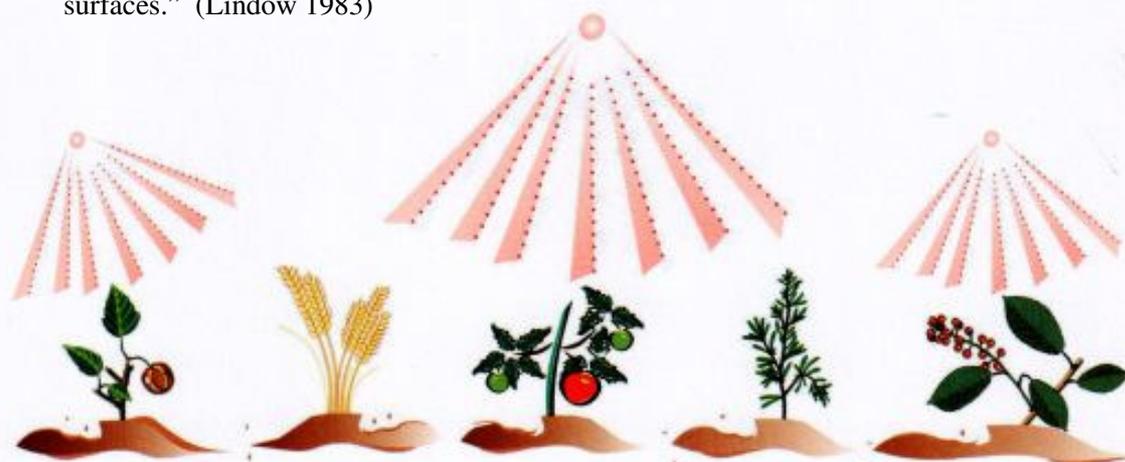
Findings and Observations:

1. There is evidence that applications of copper based products at the correct time reduce the incidence of frost. Having said that copper is no silver bullet, and results are inconsistent and mixed.
2. INA (Ice-Nucleation Active) bacteria concentrations were "...reduced by 10 to 100 fold..." following 3 weekly applications of a bactericide such as cupric hydroxide. Bacteria are killed quickly but will repopulate.
3. "Killing, competing with, or inactivating INA bacteria will reduce the chances of freezing and help avoid frost damage..."

Mechanism – Ice Formation:

Frost results in the formation of ice crystals in plant cells and this disrupts the movement of fluids. "Frost damage is as a result of damage to cell walls which is caused by dehydration of the plant cells..." Once ice forms on the plant surface, ice then propagates through the stomata into the plant and initiates damage. Symptoms in leaves and twigs include a withering, turning dark brown or black.

"Above -5°C ice-nucleation (INA) bacteria cause most ice formation on the plant surfaces." (Lindow 1983)



Phone: (08) 9312 3200
Mobile: 0402 310 854

Facsimile: (08) 9312 3233
Email: melpat@melpat.com.au
Website: www.melpat.com.au

4/22 Parry Avenue
Bateman
Western Australia
6150

The main INA bacteria are:

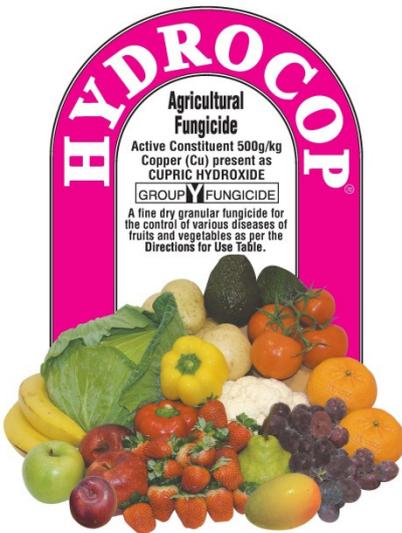
- Pseudomonas Syringae
- Pseudomonas Fluorescens
- Erwinia Herbicola

The higher the concentration of INA bacteria, the greater the probability of damage. Consequently reducing the INA bacteria concentration will reduce the likelihood and severity of freezing.

Young olive trees and branches can be killed at temperatures below -5.5°C and mature trees below -9.5°C. This is general information as there are varietal differences as well.

Citrus trees can be damaged by frost. The juice vesicles inside the fruit rupture as the ice crystals inside them form. This causes the fruit to dry out and decay quickly. The critical temperature and condition for the onset of frost damage in citrus is -1.7°C for 30 minutes or longer. Frost sensitivity varies with varieties.

In trials on Almonds, using cupric hydroxide, three weekly applications were used with the first application at bud-break. Current label recommendations would not overlap this period.



Tree/Vine Crop	Disease	State	Dilute/Spraying Rate	Critical Comments
Almonds	Shothole (<i>Stigmina carpophila</i>)	All States	105 g/100L	Apply when buds are swelling but BEFORE AND WITHIN ONE WEEK OF BUD OPENING. Apply as a dilute or concentrated spray. DO NOT use a concentration factor greater than 2.
	Leaf Curl (<i>Taphrina deformans</i>)			<p>CORRECT TIMING IS CRITICAL FOR EFFECTIVE CONTROL. Apply when buds are swelling but BEFORE AND WITHIN ONE WEEK OF BUD OPENING. Apply as a dilute or concentrated spray. DO NOT use a concentration factor greater than 2. For a given variety, the time of bud opening will vary from year to year, depending on the weather and in any year it will vary between varieties. Thus, the bud development of each variety in the orchard should be monitored each year to determine the correct time of application. Blocks containing more than 1 variety may not be treated more than once, to treat each variety at the correct time. Where leaf curl is, or is likely to be a severe problem, based on previous experience, the following program should be followed.</p> <ol style="list-style-type: none"> 1. AUTUMN – apply at leaf fall. 2. Apply at the FIRST SIGN of BUD SWELL and REPEAT ONE WEEK LATER PRIOR TO SIGNS OF BUD OPENING.

Frost Reducing Activities:

Protection methods are either passive or active and frost reducing activity using a copper based product falls into the passive protection category. Passive protection includes site selection, plant nutrition management, and the use of chemicals.

Tested bacterial ice-nucleation inhibitors with frost reducing activity which are a worthy of consideration, include:



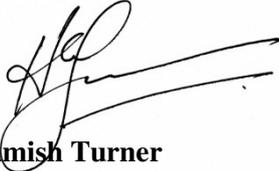
- Growth regulators, e.g. Ethephon, give protection to flowering buds by increasing bud hardiness and delays flowering.
- Copper based fungicides
- Urea or Zinc Sulphate are water soluble and can be washed off in the first rains.

There is no silver bullet for frost protection and a lot more research work is needed before any substantial claims can be made.

References:

1. *Frost Protection: Fundamentals... Vol. 1*
2. *Lindow 1983*
3. *Frost Protection – University of California – Publication 8100 – 101*

Kind regards,



Hamish Turner
Director / Technical & Product Develop

Mobile: 0420 855 500

Email: hamisht@melpat.com.au

