The Nursery Papers

ESSENTIAL INFORMATION FOR AUSTRALIAN PROFESSIONAL NURSERY OPERATORS

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NIAA

HRDC

ISSUE NUMBER: 2000/03

Hygiene and sanitation of working surfaces in the nursery

General nursery hygiene procedures in the past have been based on information derived from scattered sources and were generally not tested on the range of pests and diseases relevant for the Australian nursery industry. A research project commissioned by NIAA and HRDC has defined the disinfection methods that will ensure clean working surfaces in the nursery. These procedures will also be used for NIASA accreditation

Golden rules for good hygiene practices

1 Remove all dirt and organic matter (including roots and sap) from surfaces
2 Thoroughly wash the surface (benches, tools, equipment, trays, pots)
3 Treat surface with a disinfectant at the concentration and for the time recommended (Table1)
4 Keep all treated objects/surfaces in a clean area or away from dirt and other contamination until required
5 Use only freshly made disinfectant solutions when required (used disinfectant solutions may not work)

Which pests and diseases to target

Phytophthora species are the most important root pathogens of a wide range of plants in nurseries. Protocols developed for their control should

Table 1. Treatments found to disinfect surfaces from plant pathogens

Pathogen	Steel	Plastic
Phytophthora cinnamomi	2000 ppm chlorine/1 minute 2000 ppm QAT/1 minute 40000 ppm copper oxychloride/air dry*	2000 ppm chlorine/1 minute 2000 ppm QAT/1 minute 20000 ppm copper oxychloride/air dry*
Chalara elegans	2000 ppm chlorine/20 minutes 4000 ppm chlorine/1 minute QAT: Only partial control at 4000 ppm 20000 ppm copper oxychloride/air dry*	4000 ppm chlorine/20 minutes QAT: Only partial control at 4000 ppm 20000 ppm copper oxychloride/air dry*
Xanthomonas campestris	2000 ppm chlorine/1 minute 2000 ppm QAT/1 minute Copper: Only partial control at 1033 ppm	2000 ppm chlorine/1 minute 2000 ppm QAT/1 minute Copper: Only partial control at 1033 ppm

*Air dry indicates a contact time of a least 5 hours

QAT test was a product called PHYTOCLEAN™ which contains 100g/litre benzalkonium chloride (a quarternary ammonium compound). Some QAT products may not have the same performance.

Copper tested was copper oxychloride for fungi and copper as an ethanolamine complex of copper salts (Brunnings Algae & Moss Destroyer™) for bacteria.

Chlorine concentrations are for active ppm not product ppm as the concentration of active varies between products.

Table 2. How to convert % active ingredient (a.i.) or g a.i./L to ppm (mg/L) and how to calculate the dilution of product to the required strength

Product strength (units)	**What is the product strength in ppm? Multiply by the figure below to convert to ppm**	**To make up 1L of X ppm active ingredient add Y ml of *product* to Z ml of water**	
		Rule to find Y	Rule to find Z
% active ingredient (a.i.)	10,000	X / 10 x % a.i. = Y ml product	Z = 1,000 - Y
Example 12.5% available chlorine	12.5 x 10,000 = 125000 ppm available chlorine in undiluted product	*Example, you need a 2,000ppm solution* 2,000 / 10 x 12.5 = 16 ml product	Z = 1,000 - 16 = 984 ml water
g/L	1,000	X / g/L a.i. = Y ml product	Z = 1,000 - Y
Example 125g available chlorine /L	125 x 1,000 = 125,000 ppm available chlorine in undiluted product	*Example, you need a 4,000ppm solution* 4,000 / 125 = 32 ml product	Z = 1,000 - 32 = 968 ml water

NB mg/L is equivalent to ppm

therefore be the minimum standard for hygiene practices. *Chalara elegans* (which is also called *Thielaviopsis basicola*) is not as common or widespread in nurseries although it is becoming increasingly important in pansy and viola crops which are highly susceptible. As *Chalara* is more resistant to disinfestation, hygiene protocols that control it should be followed in nurseries where a wide range of fungal pathogens require control.

Tests were also conducted on the bacterial pathogen *Xanthomonas campestris* and *Meloidogyne sp.* nematodes. Both bacteria and nematodes can be spread on infested surfaces and cause significant losses in some crops.

Making up disinfectant solutions

Only use freshly prepared disinfectant solutions because old diluted solutions may have deteriorated or been 'used up' by previous dipping of equipment or pots and trays. Diluted chlorine solutions are particularly unstable and should be made up fresh daily, however QAT (quarternary ammonium) and copper solutions are more stable. Undiluted chlorine should be stored in a cool room, preferable at 4°C. Use *Table 2* as guide to calculating dilution rates of disinfectant to achieve the desired concentrations where specific dilutions are not indicated on labels.

Table 3. Control of juvenile root knot nematodes in drainage water from potting mix

Disinfectant treatment	Exposure time (mins)
2000 ppm chlorine	40
2000 ppm QAT	40
533 ppm copper	80

Acknowledgements

The research project (NY96032) was funded by the Nursery Industry Association of Australia, the HRDC, NSW Agriculture and partners. We thank Gordon Stovold, Steven Muldoon and Suzanne Hayward, all from the Tropical Fruit Research Station, Alstonville NSW, and their Victorian colleagues for conducting this research project.

A further Nursery Paper will examine hygiene protocols for irrigation mats, sand beds, gravel and concrete. The final report on this project should be available from HRDC, (02) 9418 2200, in April 2000.

Nursery Industry Association of Australia

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