# Nursery Diseases and their Management at the Forestry Commission Nursery, Perth.

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**Abstract**

*The management of five diseases which have caused or have the potential to cause serious damage in the nursery is discussed. Integrated control involving cultural manipulation, hygiene and fungicidal spraying has been developed to prevent epidemics of grey mould. Powdery mildew control relies primarily on the use of fungicides following the appearance of disease on susceptible species. Chlorination or filtration of the irrigation water gives effective control of upper stem rots caused by water-borne fungi, principally* Phytophthora cactorum. *Rigid quarantine procedures are used to prevent the establishment of two diseases,* Phytophthora cinnamomi *and* Dothistroma septospora, *which are not resident or only sporadically resident in the nursery.*

**Introduction**

The forest nursery provides a unique environment in forest pathology in terms of the diseases which affect the crop and the way those diseases can be managed. The compact areas of the nurseries and the short rotation of the crop removes many of the barriers limiting disease management in the field. Intensive management of nursery diseases is often a viable economic proposition and has many features in common with horticulture.

Some pathogens causing disease in the nursery are restricted largely to the nursery while others may also cause continuing problems when they are transferred to the field. The aim of the disease management program at the Forestry Commission's nursery at Perth is to produce healthy plants keeping damage from nursery pathogens within acceptable levels and also to produce plants free of certain pathogens which can persist into the field situation, e.g. *Phytophthora cinnamomi*. The achievement of these aims requires a multi-faceted approach including the monitoring of plant health; the use of cultural practices and chemical control which disadvantage existing pathogens; and hygiene and quarantine to keep the nursery free of new pathogens.

This paper details management practices to control three diseases which are confined solely to plants within the nursery and two diseases which can persist in infected nursery stock after planting in the field.

**1. Diseases Confined to the Nursery**

*Grey mould*

Grey mould caused by the fungus *Botrytis cinerea* is a ubiquitous disease of humid environments. At Perth the fungus has infected a wide range of plant species although it causes greatest losses in containerised eucalypts, particularly paper-potted plants growing under shade. The main damage caused by grey mould is a stem lesion usually resulting in the collapse of the stem above the lesion. Less severe stem lesions may not cause visible damage whilst in the nursery but are a point of weakness and the stem often breaks after planting in the field.

Grey mould has the potential to build up to epidemic levels in a very short time. Suppressed and dead plants or plant parts

provide the initial source of infective spores. Dead plant tissue can become abundant following 'topping', a standard procedure used to produce seedlings of uniform height, or following physical stresses particularly from early frosts in autumn. Suppressed plants, shoots and leaves in trays which become densely spaced near the end of the growing season in autumn provide both foci for infection and a source of inoculum for further infection. Epidemic disease has also occurred in the past when plants were supplied with luxury levels of nitrogenous fertilizer producing an abundance of lush, soft shoots and foliage.

Grey mould, more than any of the other nursery diseases, needs more than one approach for successful management. When conditions are optimum for infection and abundant inoculum is present the reliance solely on one approach, such as fungicides, will often fail to prevent epidemic disease. At Perth the critical time, in terms of controlling grey mould, is during the latter part of the growing season in autumn. At this time the plants are larger and hence more crowded and humid weather occurs more often.

Epidemic disease requires initial infection foci from which to spread. The early detection and removal from the nursery of such infection foci or potential foci is the first, and probably the most important, step in actively avoiding epidemic disease. Containerised

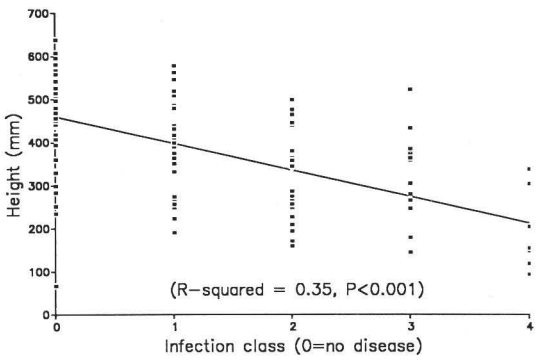


*Fig. 1. Relationship between the height of* Eucalyptus nitens *seedlings and the severity of powdery mildew infection.*

stock is frequently monitored and dead or suppressed plants rogued out particularly if *Botrytis* is sporulating on them. Similarly all debris created during 'topping' is removed from the plants or their immediate vicinity. Frost damaged plants rarely sustain high levels of *Botrytis* infection possibly because the damaged foliage is usually in the better ventilated upper shoots.

The manipulation of the environment in which the plants are grown so that conditions are made less conducive for disease (cultural control) is the first consideration for grey mould management.

Appropriate cultural control measures are:

- increasing interplant spacing and lifting the plants off the ground to improve ventilation;
- avoiding late-afternoon and evening watering to reduce the time that the foliage is wet; and
- adjusting fertilizer levels so that the production of large plants with lush foliage is avoided - the use of rapid release supplementary fertilizers, in particular, is avoided.

The broad-scale use of fungicides applied prophylactically for the duration of the crop in the nursery to prevent epidemic grey mould is not practised at Perth. Rather their use has been targeted to specific times and plant species. Fortnightly alternating spraying using Benlate (Ciba-Geigy) and Rovral (May & Baker) commences after plants reach a size when air circulation may be restricted (plants approximately 15 cms tall). In addition, spraying is restricted to only those plant species which from previous experience are known to be susceptible to epidemic grey mould (mainly the eucalypts).

The final consideration given to the prevention of epidemic grey mould is the prompt despatch for planting of stock which has reached specified size. Considerable

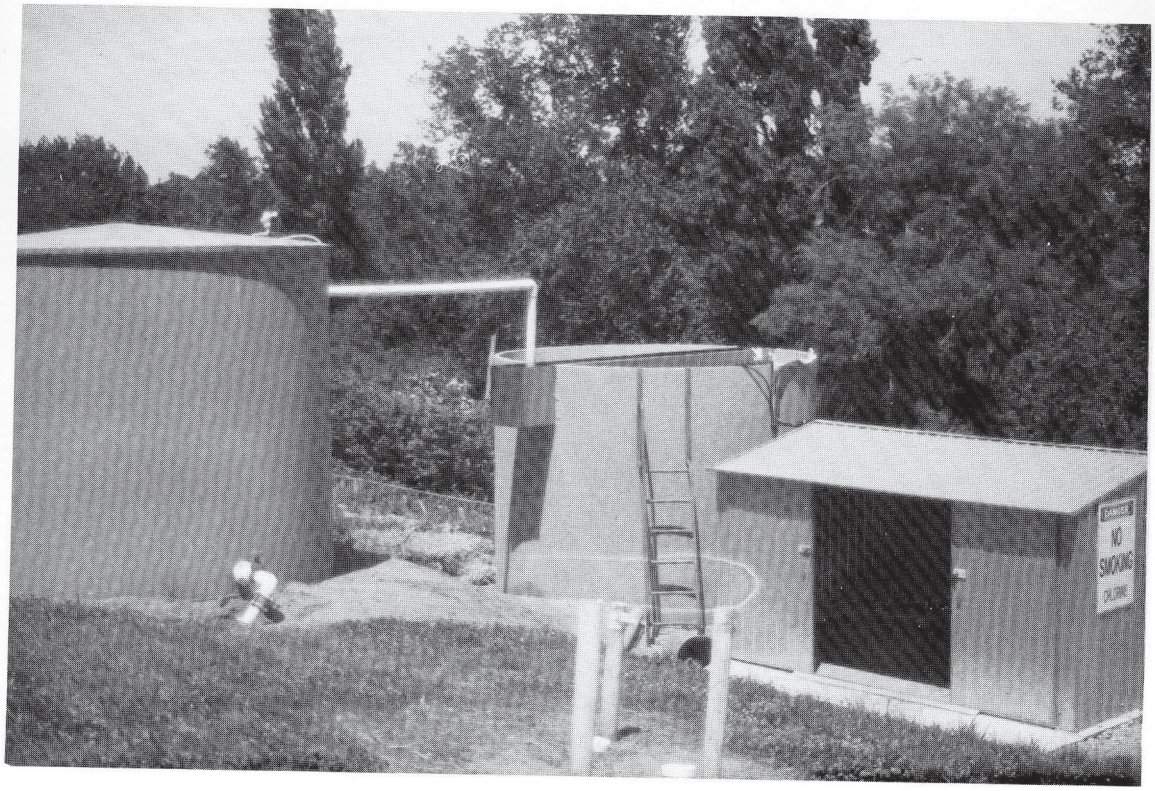


*Fig. 2. Water chlorination plant at Perth Nursery.*

difficulty in preventing epidemic disease has been experienced in the past when stock, which has reached specified size, has had to be retained for prolonged periods in the nursery. Under such circumstances damage has been reduced by removing stock from the shade house to better ventilated open areas of the nursery.

*Powdery mildew*

Powdery mildew, caused by the fungus *Oidium* sp., is endemic at Perth Nursery on the leaves and shoots of oak, hawthorn and eucalypt seedlings. It rarely kills seedlings but does result in a considerable reduction in growth (Fig. 1) and heavily infected plants are usually stunted. Infection, particularly on eucalypts, rarely persists once the plants leave the nursery for field planting.

Unlike grey mould, powdery mildew does not require extended periods of high humidity to cause epidemic levels of infection. On *Eucalyptus nitens*, the most commonly affected eucalypt, heavy infection occurs in the glasshouse and under 50 per cent shade but becomes less serious under 34 per cent shade and is undetectable in open beds.

Control of powdery mildew relies principally on the use of fungicides which are applied only after infection is seen on the seedlings, *i.e.* the fungicides are not used prophylactically. Good control is currently achieved with fortnightly applications of Bayleton (May & Baker). Benlate, although registered in Tasmania for the control of powdery mildew on ornamentals, has not been effective in controlling the disease on eucalypts.

For *E.nitens*, now an important crop, there is a dual problem of attack by powdery mildew and grey mould each of which respond to a different spectrum of fungicides. In the past

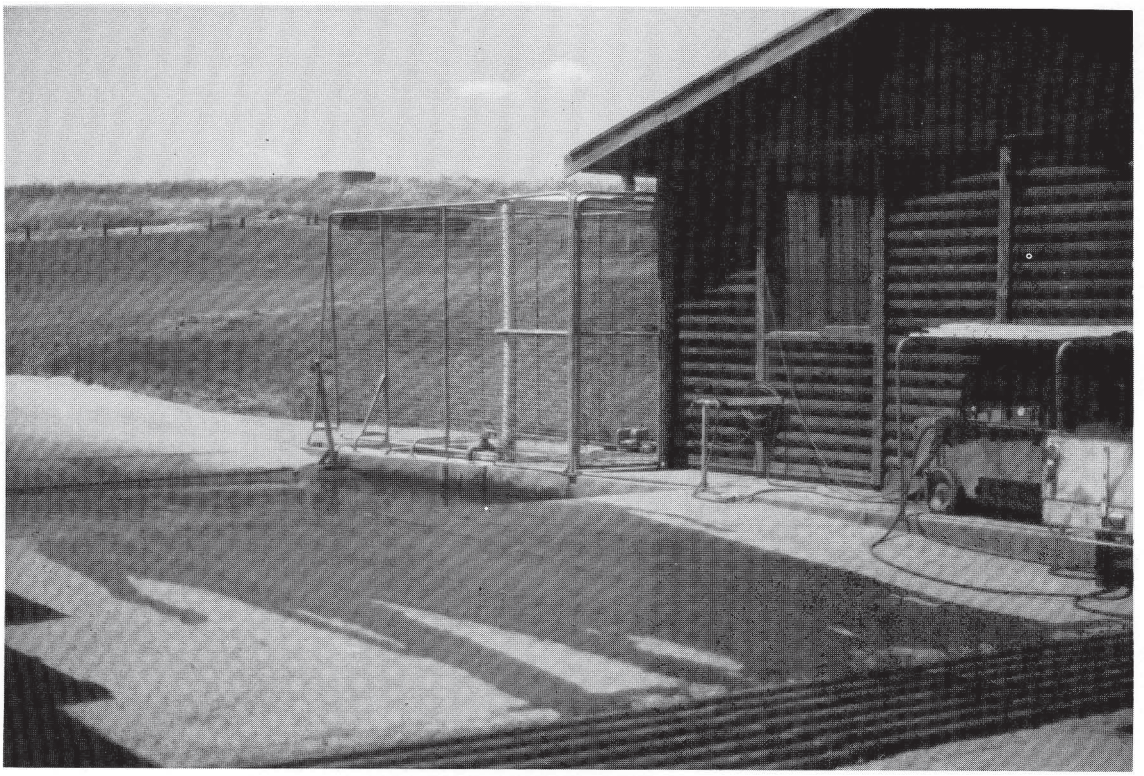

*Fig. 3. Vehicle bath, pedestrian footbath and steam cleaning unit installed at Perth Nursery (Native Point).*

this has meant the separate application of fungicides to control the two diseases - Bayleton for powdery mildew and Benlate/ Rovral alternation for grey mould. Recent trials suggest that on *E.nitens* Bayleton and either Benlate or Rovral may be mixed without phytotoxic effects, thus offering the prospect of a single fungicide application to control both diseases. The fungicide Octave (Schering) has recently been used at the Perth Nursery in alternation with Bayleton. Trials have shown that Octave gives good control of powdery mildew on *E.nitens* as well as offering the prospect of controlling grey mould.

*Upper stem rots*

Upper stem rots are caused by several fungi which infect the main stem of seedlings usually causing the collapse and rot of all leaves and shoots above the point of stem infection. *Phytophthora cactorum* is the fungus most commonly associated with the disease in eucalypts and tree lucerne (*Chamaecytisus proliferus*) with *P.citricola* and *Pythium anandrum* also causing the disease in eucalypts (Wardlaw and Palzer 1985). *Fusarium* and *Cylindrocarpon* species have been isolated from *Banksia* spp. with upper stem rot. Epidemic levels of disease have only occurred sporadically in eucalypts in the past but crops of tree lucerne and *Banksia* spp. suffered heavy losses almost every year until effective treatment measures were implemented.

Earlier outbreaks of upper stem rots on eucalypt seedlings were effectively controlled by application of the fungicide Thiram. More recently, Ridomil (Lane/Ciba-Geigy), applied following the appearance of the disease, has given good control on eucalypts. Fungicidal control of upper stem rots, however, has not been successful on tree lucerne or *Banksia*.

Fungi closely related to those responsible for upper stem rots were previously isolated from the South Esk River in the vicinity of the uptake for the nursery irrigation by Palzer

(1980). This, together with the ability to reproduce the disease on seedlings using water containing inoculum of several of the fungi responsible for the disease, prompted us (Wardlaw and Palzer 1985) to believe that the use of untreated irrigation water contaminated with the fungi was the primary cause for the outbreaks of upper stem rots. Irrigation with water filtered through a 5 micron cartridge filter proved to be very effective in controlling the disease on a small scale and saw the virtual disappearance of the disease on tree lucerne and *Banksia*. Subsequently a water chlorination plant (Fig. 2) was installed to treat the water on a larger scale for use on all of the containerised stock. This has given good control of upper stem rots except in one instance (1988-89 season) when the disease reappeared following late summer and autumn flooding in the South Esk River. It was suspected in this case that heavy silt loads in the water were reducing the biocidal activity of the chlorine.

**2. Diseases which persist after transfer to the field**

*Phytophthora cinnamomi*

This soil-borne pathogen attacks and rots the roots and lower stems of a wide range of native and introduced plants which are grown both in the nursery and in the field. The Forestry Commission has a policy of releasing from the nursery only plants which are free from infection by this fungus.

At Perth *P.cinnamomi* outbreaks have occurred sporadically in the past in raised seed beds containing sterilized soil/washed sand. Such outbreaks have been treated by destroying all infected plants, removing contaminated soil from the nursery and sterilizing the walls of the affected raised beds. The current system for the management of raised beds involves sterilizing the soil in the beds with Basamid (BASF) prior to sowing and to date no outbreaks of *P.cinnamomi* have occurred under this system. *P.cinnamomi* has not been isolated from the permanent field beds of the nursery.

Because of its absence from permanent nursery beds, stringent quarantine measures are used to prevent the entry of *P.cinnamomi* into the nursery. At Native Point, the part of the nursery used for the production of open-rooted *P.radiata* and *Eucalyptus* spp. stock, a quarantine area has been established with security fencing restricting both vehicular and pedestrian access into the area. Vehicle movement into and out of the quarantine area is kept to a minimum and required to pass through a vehicle bath containing disinfectant (Fig. 3). A steam cleaning unit is also installed at the entry point to clean vehicles prior to their entry into the quarantine area.

The importation of contaminated soil poses the greatest risk of accidentally introducing *P.cinnamomi* into the nursery. There is a policy of restricting the entry into the nursery of plants which have been dug-up from the field. As a general rule plant material entering the nursery is either in the form of cuttings or seeds. On the rare occasions where special consignments of plants dug-up from the field are stored in the nursery they are housed in an area where the risk of contamination of the main nursery area is minimised. Any imported gravel or sand used for road surfacing in the nursery is tested beforehand for the presence of *P.cinnamomi*.

*Dothistroma septospora*

This fungus which causes a needle blight in *Pinus* spp. has not been found at Perth Nursery. Although climatically the conditions at Perth are sub-optimal for the sustained presence of the fungus, it is not known to what extent cultural practices, particularly summer irrigation, would affect the ability of the fungus to infect *P.radiata* seedlings.

Quarantine is used to minimise the chance of accidental introduction of the fungus into the nursery. The importation of vegetative material of the host species (*Pinus*, *Pseudotsuga*) is avoided but if necessary the material must first be stored in isolation away from the nursery and inspected for any evidence of infection. No vegetative material

originating from areas infected by *D.septospora* is allowed into the nursery. The extraction of seed from cones originating from seed orchards outside the nursery has recently been discontinued due to the possibility of contamination of the cones with infected needle fragments.

## Conclusion

The disease management program at Perth Nursery has evolved to match the specific requirements of each pathogen for infection, its means of dissemination and its range of suitable host plants. This has resulted in the avoidance of a broadly-based regime of fungicides used prophylactically to prevent epidemic disease in favour of an integrated approach. There are many benefits to such an approach foremost amongst which is a sharpened awareness by nursery staff of potential disease problems, when they are likely to occur and how best to respond to them to avoid epidemic disease. The success of such an approach relies chiefly on thorough and regular monitoring of plant health which allows early recognition of potential disease problems and action before the problem escalates to epidemic proportions.

## References

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