

Commercial Options for Disease and Pest Control in Plant Propagation

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INTRODUCTION

Most disease and pest problems in the nursery are our own fault. For example most races of *Pythium* are opportunistic, only a few races are aggressive. Pathogens and pests are present or lurking nearby all the time, we need to keep plants healthy so that they can cope with them.

Sprays are nasty chemicals which are residual and poison our environment. This is how many of the public perceive sprays of agricultural chemicals; it does not really matter if they are right or wrong, it is what they think

The white-spotted tussock moth eradication programme in the eastern suburbs of Auckland highlights this. The biological insecticide Bt is being used for this programme. We as horticulturalists can appreciate the very low toxicity of this product to all animal life, apart from susceptible caterpillars. However there is much concern among residents of the eastern suburbs with regard to the broadcast aerial spraying and possibility of exposure to the spray.

In my view there is a greater potential occupational health risk in the noise generated from the DC6 aircraft being used to apply the spray.

In a similar spraying programme conducted in Canada, there were 200 recorded instances within 2 days of the spraying, of people notifying medical authorities of various allergies or illnesses which they believed were caused by the spray.

More than 90% of these notifications were proven not to be related to the spraying programme. There was no substantiated proof that any of the notifications were related to the spraying programme.

This demonstrates the high level of public concern with regard to agricultural chemicals, in particular direct contact, drift, and residues both in the environment and on products.

As a consequence we must continue to strive to find more environmental and user-friendly crop-protection materials. Also we must continue to make the best use of all other methods of protecting our crops from diseases and pests.

1) Control the Soil Environment:

- Reduce the levels of pathogens, e.g. pasteurisation.
- Maximise levels of friendly or suppressive microorganisms e.g. *Trichoderma*
- Ensure good air-filled porosity (AFP) and drainage.
- Media should be in the correct pH range say 5.0 to 6.5—watch acidification.
- Media should be in the correct conductivity range—watch salt accumulation.

2) Control the Aerial Environment. To provide conditions to optimise plant growth, in particular temperature and humidity control.

3) **Check Water Quality.** Treat water if necessary.

4) **Maintain Good Nutrition and Nutritional Balance.**

5) **Manage Watering Effectively.** The two most important nutrients for plants are water and oxygen

6) **Hygiene.** It is easy to let nursery hygiene lapse with the false sense of security of soilless media, plastic pots and trays, and clean growing surfaces. Once root rot diseases strike, 20% seedling losses are common.

7) **Common Sense.**

IMPORTANT DISEASES DURING THE PROPAGATION AND EARLY GROWTH STAGES OF NURSERY CROPS

For infection by a disease to occur, three things are necessary

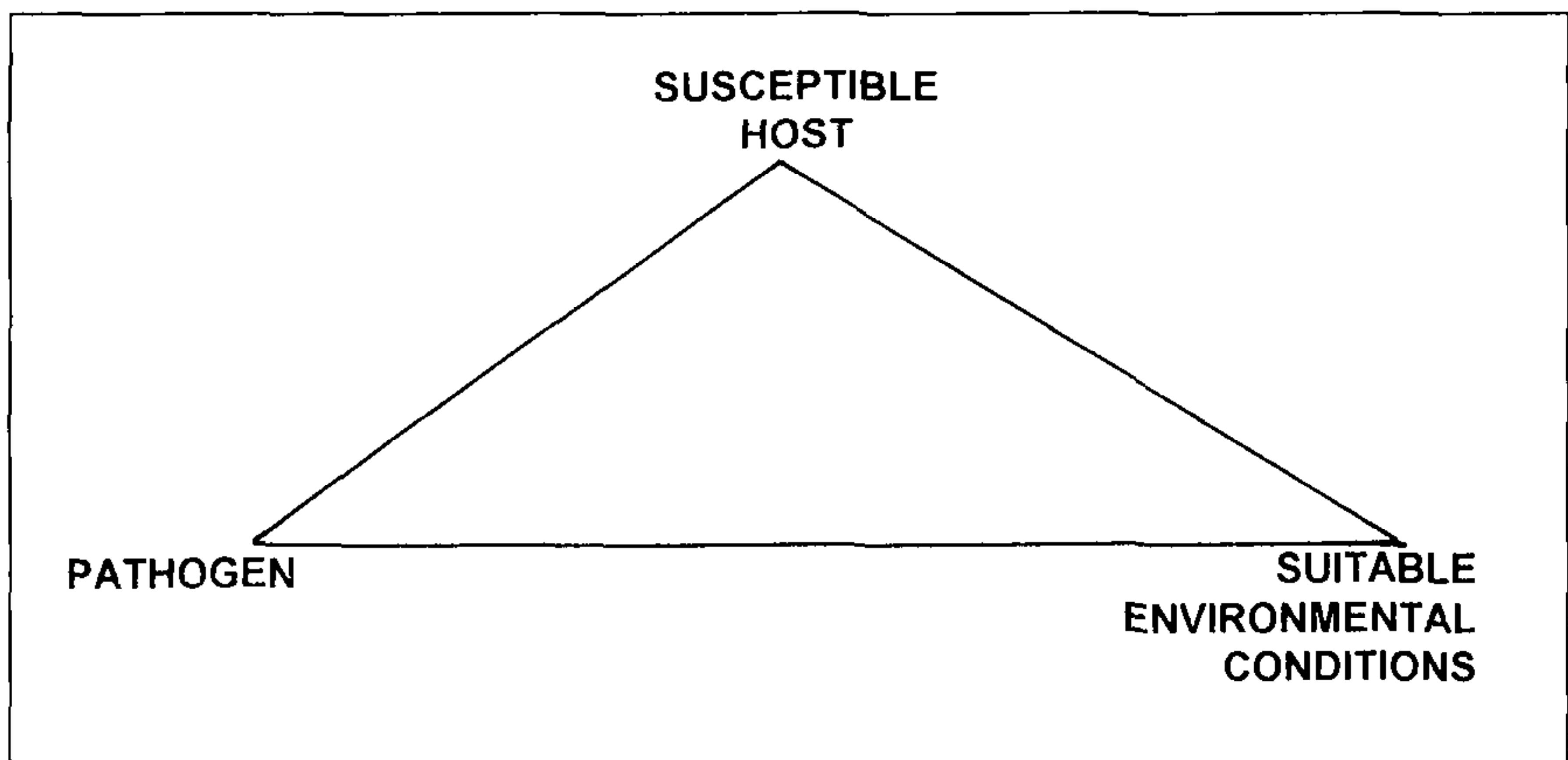


Figure 1. The disease triangle.

Remove any one of these three things and the chance of infection is negligible.

Again, an understanding of the disease triangle demonstrates the importance of environmental control, *Pythophthora* and *Pythium* spp. have a limited ability to infect healthy tissue. The most common point of entry is through damaged or dead root tissue, if conditions in the root zone do not cause damage to the roots, then the chance of infection is very much reduced.

PLANT HEALTH MANAGEMENT

Good plant health relies on the effective management of many production factors. All production decisions must fit together like a puzzle (Fig. 2).

Other pieces which may be included are quarantine, hygiene, and plant inspection.

The two main causes of root rot diseases in containers are :

- 1) Lack of aeration, e.g. insufficient AFP, waterlogging.
- 2) Death of roots due to drought or salt injury

Use well aerated media, coupled with better watering practices to reduce the possibility of root rot diseases.

However, conditions conducive to infection do occur at times, problems in opera-

Table 1. Products used to control-media borne pathogens in nursery crops

Product (Active ingredient)	Label claims	Mode of action	Recommended uses
<ul style="list-style-type: none"> ■ <i>Phytophthora-Pythium</i> Fongarid 25 WP (25% furalaxyl) Terrazole 35 WP Terrazole 25 EC (etrizazole) 	<p><i>Phytophthora</i> <i>Pythium</i></p> <p>Soil-borne diseases</p> <p><i>Phytophthora</i> <i>Pythium</i></p>	<p>Systemic Protectant (absorbed by roots and moves up in xylem)</p> <p>Protectant (prevents disease spread)</p>	<p>Soil Mixes</p> <p>Cutting beds/boxes</p> <p>Potted plants</p> <p>Soil mixes</p> <p>Vegetable seedlings</p> <p>Bedding plants</p> <p>Potted plants</p> <p>Foliage plants</p> <p>Turf</p> <p>Foliar Spray</p> <p>Soil drench</p> <p>Tree injection</p>
<ul style="list-style-type: none"> Foschek (40% phosphorus acid) EUP-LS ■ <i>Phytophthora</i> Alliete (80% fosetyl-aluminum) 	<p><i>Phytophthora</i> and <i>Pythium</i> root rots</p> <p><i>Phytophthora</i></p>	<p>Systemic - rapidly absorbed by roots and foliage</p> <p>Preventatives</p> <p>Systemic Rapidly absorbed by roots and foliage</p> <p>Preferably use as a preventative</p>	<p>Foliar Spray</p> <p>Soil drench</p> <p>Tree injection</p> <p>Foliar Spray</p> <p>Use at 2.5 g l⁻¹ every 28 days as preventative</p> <p>Use at 5 g l⁻¹ every 14 days as a curative or under high disease pressure</p>

Table 1. (continued). Products used to control-media borne pathogens in nursery crops

Ridomil MZ 72WP (8% Metalaxyl and 64% Mancozeb)	<i>Phytophthora</i> tree nurseries	Systemic - upwards Protectant	Seedbeds Drench around trees
■ <i>Pythium</i> Previcur N (60% Propamocarb)	Damping off caused by <i>Pythium</i> spp	Systemic- taken up by roots Preferably use as a preventative	Soil Mixes Seedbeds Seedlings Cuttings Pot plants
■ <i>Growth Enhancement</i> Trichopel G (<i>Trichoderma</i> spp. in a nutritive pellet)	Growth enhancement Colonisation of media by "friendly" micro-organisms	Protectant Colonises soil and is antagonistic to soil-borne pathogens	Seed planting Seedlings Established plants Bulbs and tubers
■ <i>Rhizoctonia and Fusarium</i> Spp. Terrachlor 75 (75% quintozone)	<i>Rhizoctonia</i> and <i>Fusarium</i>	Protectant - direct activity against susceptible fungi	Disinfecting seed boxes Pre-sowing soil treatment Postplant drench Turf
■ <i>Rhizoctonia</i> Rizolex (10% tolclofosmethyl)	NR ornamentals <i>Rhizoctonia</i>	Protectant Curative	Soil Mixes

Table 1 (Continued). Products used to control-media borne pathogens in nursery crops

Product (Active ingredient)	Label claims	Mode of action	Recommended uses
■ Other Fungicides			
Octave (46 2% prochloraz)	<i>Colletotricum</i> spp	Protectant	Spray twice weekly or as required
Benlate (50% benomyl)	<i>Monochaeta</i> spp Activity against a range of fungal pathogens	Curative Protectant Systemic - upwards movement	Dip Drench to seedbeds Spray Dip
Topsin M4A (40% thiphanate methyl)			
Rovral WP (50% Iprodione)	<i>Botrytis</i> <i>Fusarium</i>	Protectant through contact action Some curative action	Seed dressing Drench Spray
Thiram (Various thiram formulations)	Broad spectrum; multi-site active fungicide	Protectant	Seedbeds damping off Bulbs & tubers - botrytis Turf - brown patch Damping off
■ Crown Gall			
Dygal Biological fungicide (pure culture containing approx 5 billion viable <i>Agrobacterium radiobacter</i> bacteria per gram)	Prevents plants becoming infected with organisms which cause crown gall	Preventative	Dip

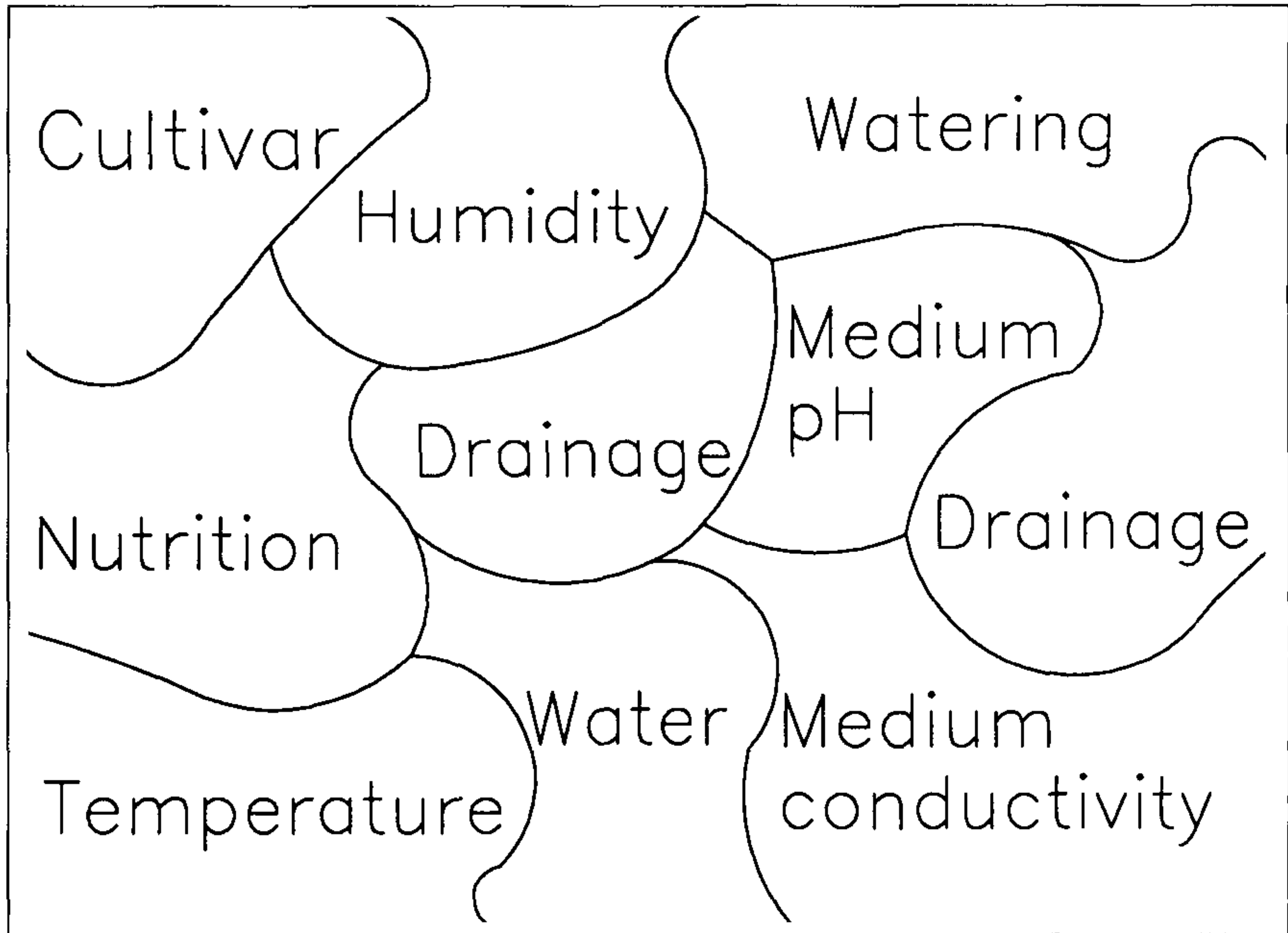


Figure 2. Good plant health relies on the effective management of many production factors which must fit together like a puzzle.

tion of automatic watering or misting equipment may cause propagation media to dry out. Also, some plants at the propagation stage are particularly susceptible to infection, especially through young root hairs.

In these instances we need to support environmental control with other methods such as crop-protection materials. A range of different types of crop-protection materials, both organic and chemical, are available. However, there are relatively few materials available especially for use in the plant propagation phase.

COMMENTS

Fongarid

- Resistant strains of fungi may develop.
- Injury to some spp of *Banksia*, *Grevillea*, ornamental stonefruit and Chinese fire fern has occurred
- 6 -10 weeks activity.

Terrazole

- Do not use on vegetable seedlings after transplanting.
- 25 EC formulation contains xylene.
- 6-10 weeks activity

Foschek

- Synthetic build-up of a natural compound.
- Stimulates natural defence mechanism of plant.
- Stimulates plant growth.

Alliete

- Aluminum complex which also breaks down to phosphoric acid.
- Stimulates natural defence mechanism of the plant.
- Can also be used as drench.

Ridomil MZ 72WP

- Resistant strains of fungi may develop.
- Preferably apply to moist ground followed by rainfall or irrigation.

Previcur N

- Soil residual life 3 to 4 weeks - shorter in alkaline soils.
- High margin of safety. Caution with repeat applications at short intervals.

Trichopel G

- Broadspectrum.
- Apply after soil sterilisation / pasteurisation.
- Best results when conditions after application are conducive to rapid colonisation—adequate moisture and pH 4.0 to 6.0.

Terrachlor 75

- 4 - 6 weeks activity.

Rizolex

- Not registered for ornamentals.
- Fungicidal dust - use in soil mixes only.

Octave WP

- Resistance to this DMI fungicide can occur. Do not make more than three applications in any 12-months period.

Benlate / Topsin M4A

- Resistance to benzimidazole (MBC) fungicides has developed in some disease situations e.g. botrytis. Use in conjunction with a fungicide from a different fungicide group.

Rovral WP

- Resistance to this dicarboximide fungicide could develop in some disease situations from repeated use. When used for botrytis control, make no more than three applications per season.

Thiram

- Short persistence.
- Thiram suppresses germination and stunts seedlings of *Nemesia*, *Phlox drummondii*, *Petunia*, French marigold (*Tagetes patula*), and *Celosia argentea* var. *cristata* Plumosa Group
- Thiram stunts the growth of *Salvia*, African marigold (*T. erecta*), carnations (*Dianthus caryophyllus* and hybrids), and *Lobelia*.

Dygal

- Treatment is normally made prior to planting.
- Treatments should be made away from direct sunlight.
- Keep treated cuttings/seedlings away from direct sunlight until planted.

IMPORTANT PESTS DURING THE PROPAGATION AND EARLY GROWTH STAGES OF NURSERY CROPS

Pest damage during the propagation and early stages of growth of nursery crops is not as common as soil-borne disease problems.

In fact the pests which I will discuss, tend to be a problem in specific crops only, or once crops have established in the nursery or production house.

The key considerations regarding pest damage and control in nursery crops are:

- 1) The relatively little range of crop protection agents available or with a label claim for nursery crops
- 2) The toxicity of many crop protection products to the user and limitations on re-entry times with some products.
- 3) Potential of pest resistance to some insecticides. Common examples in New Zealand are. mites to miticides, grass grub to DDT, leaf-rollers to organophosphates, and whitefly to organophosphates and Applaud. We need to be wary of the potential for resistance to insecticides by targeting and timing applications accurately, applying thoroughly and rotating insecticides if possible

Table 2. Products used to control media borne pests in nursery crops.

Product (Active ingredient)	Label claim	Mode of action	Recommended uses
Broad-spectrum			
Suscon Green (10% Chlopyrifos in a controlled release granule)	Black vine weevil (Fungus gnat) (Mealy bug)	Contact vapour Stomach poison	Incorporated 0.75 kg/m ³ 1.0 kg/m ³ > 20% bark
Thimet 20 g Phorate (20% Phorate in a pellet)	Aphids, mites, weevils Black beetle Root lesion nematode	Contact fumigant Strongly systemic in plants	0.8 kg per 100 m ² or 30 g per plant
Black vine weevil			
Otinem	Black vine weevil	Direct feeding	Container plants, field grown stock
Bio Insecticide (a parasitic nematode in the form of a wetable powder)	Larvae		Apply on first appearance of larvae when soil temps 12 to 20C
Fungus gnat			
Dimilin 25W Insect growth regulator (25% diflubenzuron)	An insect growth regulator which prevents molting Not registered for ornamentals	No contact action Must be eaten by insects Interferes with chitin deposition in the skin	Mushrooms incorporation in compost/media at 40 g/m ³ Drench 4 g/m ²

Table 2. (Continued). Products used to control media borne pests in nursery crops.

Nematodes			
Nemacur 400 EC	Roses	Systemic - translocates to all parts of the plant	Roses - soak roots prior to planting
Nematicide/aphicide	Root knot nematode	Direct effect on nervous system of insects	
(40% of fenamiphos)		Systemic	Ornamentals
Vydate L	Ornamentals	Moves up and down in the plant	Foliar spray
Insecticide nematocide	Root knot	Mainly upward movement from foliar sprays	Use higher rates for root nematodes
(24% oxamyl)	Lesion		
	Foliar nematodes		
OTHERS			
Diazinon	Various	Contact	Vegetables
(Diazinon as various formulations)	Not registered for ornamentals	Stomach poison	

COMMENTS

Suscon Green

- Formulated as a controlled-release granule
- Relatively low user toxicity—harmful substance
- Provides control for up to 2 years

Thimet 20 G / Phorate

- Dangerous poison, can be absorbed through skin
- Do not use in container growing
- Provides 4 to 6 weeks plant and soil life

Otinem

- Parasitic nematode, use within 2 days after refrigeration
- Apply to moist soil and follow with light watering
- Use when spring temperature reaches 12C and until autumn temperature drops below 12C
- If media contains more than 50% bark, contact distributor for advice

Dimilin 25 W

- Slow acting - some plant damage can occur between treatment and death
- Treat early against young larvae

Nemacur 400 EC

- Dangerous poison.
- Residual activity for several months
- Contact re-entry time 7 days

Vydate L

- Dangerous poison
- Contact re-entry time 24 h
- Toxic to bees

CONCLUSION

Several soil-borne pathogens can cause root rot diseases of nursery crops. Plants at the propagation stage are particularly susceptible. Also, certain plants are susceptible in the early growing period or at other times, e.g. when there is additional stress on the plant during flowering.

A number of crop-protection strategies should be used including environmental control of both the growing medium and aerial environment, nutritional balance, watering management, and general hygiene.

Crop-protection products may be needed at the propagation stage and during the growth period of susceptible plants. Several types of crop-protection products, both organic and inorganic, are available. However, there are relatively few materials available within each type, therefore use judiciously, especially products for which pathogen resistance has been known to occur. Use in conjunction with other forms of disease management especially environmental control, hygiene, and common sense.

Pests are a more sporadic problem during propagation and mainly related to growing in soil rather than soilless media and specific crops, e.g. bulb and tuber crops, fungus gnat; carnations and poinsettias, black vine weevil.

Again, only a small number of crop protection agents are available to manage these pests. I recommend using those that are of low toxicity to the user and non-target organisms, have good residual effect and are not prone to development of pest resistance.

Make the Most Use of: Healthy plant material, high quality growing media, nutritional balance, good watering management, environmental control, hygiene, and commonsense. If required, select the right crop protection agent.