

Preventing Pests and Diseases

Farm Management Review and Action Plan

(Greenhouse Horticulture)

Property owner or operator: _____

Property address: _____

Postal address: _____

_____ Postcode: _____

Contact phone: _____

Date of review: _____



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Keep it CLEAN – Farm management review

This farm management review has been developed to guide greenhouse vegetable growers in implementing effective preventative pest and disease management practices.

This review can be used in conjunction with the greenhouse growers' guide to preventative pest and disease management – Keep it CLEAN, Reducing the costs and losses in the management of pests and diseases in the greenhouse, published by NSW Department of Primary Industries.

The farm management review has been produced in a form to enable comprehensive and efficient assessment of a grower's particular operations. Preventative pest and disease management strategies need to be used as an integrated, whole of farm approach.

For more information or a copy of the guide, contact:

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Conducting a Farm Management Review

1. Read through the resource manual, 'Keep it Clean'

Completing the review:

2. For **each** greenhouse, complete a *Greenhouse structure* description Page 3
3. Fill in the *Pest and disease risk assessment* sheet. Using the risk assessment table in the manual, allocate a risk rating to each of your key pests and diseases Page 4
4. Draw a map of your farm (label each greenhouse) and insert map Page 5
5. Walk around your farm and make a list of the potential sources of pests and diseases on your farm (Refer to Section 1 of the manual for more information). You may want to mark or label these places on your farm map. Page 6
6. Work through the checklist and tick either 'yes' or 'no' depending on whether you are **currently** doing the practice mentioned. If you are only partly doing it, tick 'no'. Pages 8-13
7. Look at the practices for which you ticked 'no'. These are things that you can do which will improve pest and disease management on your farm. Are there any of the 10 essential practices that you are not doing? These are highlighted with a  Page 15
8. Write out action plans for how you can implement and start doing the missing practices. Start with any of the 10 essential practices that you are missing. Then look up the practices listed in the manual for any pests or diseases that you graded as high risk and try to implement any of these that are missing.

2 Keep it CLEAN – Farm management review

When writing an action plan, sometimes a couple of practices can be linked together and implemented with one action. Some practices might be done on their own. An example action plan is provided on page 14.

To write your action plans;

i. Go the *Practices to be implemented* section:

Write the 1 or 2 practices that you will be implementing into the space/s in the blank plan.

ii. Go the *Problem* section:

Describe the problem that you currently have which these practices will address. Consider the sources of pests and disease that you identified.

iii. Go the *Aim* section:

Write out what you aim to achieve with this action plan.

iv. Go the *Strategy/action* section:

Make a list of **what** you will do, **where** you will do it and **how** you will do it.

v. Go the *Resources* section:

Make a list of what you will need, what it will cost and who will do it and how long you expect it to take to implement.

vi. Go the *Schedule* section:

When do you plan to have these practices in place?

vii. After you have completely implemented the practices and they are now part of your normal farm or greenhouse management, you can sign off on your action plan as being completed.

Work through all the missing practices. You should not expect to do everything straight away, but you do need to plan what and when you will do it. A couple of practices might not be feasible for you, in which case, leave them and concentrate on practices that you can do.

Greenhouse structure (name or ID number) _____

Area (m²) = _____

Height to gutter (m) = _____

Height to peak (m) = _____

Span width (m) = _____

Single span

Multispan

Shape/features:

Tunnel/igloo

Gable – venlo type

Gable – wide span

Raised arch

Flat arch

Gothic arch

Off-set gable

Sawtooth

Skillion

Other _____

Technologies:

Twin roof vents

Single roof vent

Wall vents

Hydronic heating

Hot air heating

Insect screens

Thermal screen

Climate control

Substrate culture (type _____)

Water culture

Soil

Other _____

Cladding:

Single plastic film

Twin plastic film

Glass (_____ mm thickness)

UV absorbing film

Polycarbonate

Other _____

Average yield (per m²): Primary crop (_____) = _____

Secondary crop (_____) = _____

Tertiary crop (_____) = _____
crop

Pest and disease risk assessment – complete for each greenhouse

Key pests	Assessed Risk level (1, 2 or 3)	Key pests	Assessed Risk level (1, 2 or 3)
<input type="checkbox"/> Thrips <input type="checkbox"/> Whiteflies <input type="checkbox"/> Broad mites <input type="checkbox"/> Russet mites <input type="checkbox"/> Rutherglen bug	_____ _____ _____ _____ _____	<input type="checkbox"/> Aphids <input type="checkbox"/> Caterpillars <input type="checkbox"/> Spider Mites <input type="checkbox"/> Flies (fungus gnats) <input type="checkbox"/> Other	_____ _____ _____ _____ _____
Key diseases	Assessed Risk level (1, 2 or 3)	Key diseases	Assessed Risk level (1, 2 or 3)
<input type="checkbox"/> Fungal moulds and mildews <input type="checkbox"/> Botrytis (grey mould) <input type="checkbox"/> Downy mildew <input type="checkbox"/> Sclerotinia (white mould) <input type="checkbox"/> Leaf mould <input type="checkbox"/> Powdery mildew <input type="checkbox"/> Other	_____ _____ _____ _____ _____ _____	<input type="checkbox"/> Bacterial leaf spots and soft rots <input type="checkbox"/> Angular leaf spot <input type="checkbox"/> Bacterial speck <input type="checkbox"/> Bacterial spot <input type="checkbox"/> Bacterial soft rot <input type="checkbox"/> Other	_____ _____ _____ _____ _____ _____
<input type="checkbox"/> Fungal leaf spots, blights and cankers <input type="checkbox"/> Alternaria leaf spot <input type="checkbox"/> Anthracnose leaf spot <input type="checkbox"/> Grey leaf spot <input type="checkbox"/> Gummy stem blight <input type="checkbox"/> Other	_____ _____ _____ _____ _____	<input type="checkbox"/> Bacterial wilts <input type="checkbox"/> Bacterial canker <input type="checkbox"/> Bacterial pith necrosis <input type="checkbox"/> Bacterial wilt <input type="checkbox"/> Other	_____ _____ _____ _____ _____
<input type="checkbox"/> Fungal wilts and root rots <input type="checkbox"/> Black root rot <input type="checkbox"/> Damping off <input type="checkbox"/> Fusarium <input type="checkbox"/> Verticillium <input type="checkbox"/> Other	_____ _____ _____ _____ _____	<input type="checkbox"/> Viruses <input type="checkbox"/> Mosaic viruses <input type="checkbox"/> Cucumber yellows <input type="checkbox"/> Tomato spotted wilt virus <input type="checkbox"/> Other <input type="checkbox"/> Nematodes	_____ _____ _____ _____ _____ _____

INSERT or DRAW YOUR FARM MAP

Sources of pests and diseases

Make a list of the potential sources of pests and diseases on your farm. Think about where pests and diseases can travel from and hide.

Plant sources of pests and diseases

eg *weeds growing to west of greenhouse # 3*
garden herbs growing in greenhouse

Weeds:

- _____
- _____
- _____

Other crops:

- _____
- _____
- _____

Pet plants:

- _____
- _____
- _____

Crop debris:

- _____
- _____
- _____

Seedlings:

- _____
- _____
- _____

Other:

- _____
- _____
- _____

Non plant sources of pests and diseases

eg *vehicles driving in to production area from off-site*
substrate in contact with soil and weather

People and vehicles:

- _____
- _____
- _____

Greenhouse covers and structures:

- _____
- _____
- _____

Rubbish:

- _____
- _____
- _____

Tools, equipment, containers:

- _____
- _____
- _____

Substrate (or soil):

- _____
- _____
- _____





Irrigation system and water:

- _____
- _____
- _____

Other:

- _____
- _____
- _____

General Farm Management

Establish a 'clean zone'	Yes	No
 The greenhouse is within a 'clean' zone which is quarantined from the 'outside' zone of the farm	<input type="checkbox"/>	<input type="checkbox"/>
 Check and control points are used to control movement of people, vehicles, plants and materials into the 'clean' zone	<input type="checkbox"/>	<input type="checkbox"/>
 A 5-10 metre wide clean buffer area is maintained around every greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
 The greenhouse and farm surrounds are kept weed free	<input type="checkbox"/>	<input type="checkbox"/>
Work procedures for all jobs that need to be done in and around the greenhouse are written and explained to all workers	<input type="checkbox"/>	<input type="checkbox"/>
Crop work is done in cleanest, youngest crops first and dirty tasks are completed last in the day	<input type="checkbox"/>	<input type="checkbox"/>
A parking area for employee and visitor vehicles is in the 'outside' zone of the farm	<input type="checkbox"/>	<input type="checkbox"/>
All vehicles in the 'clean' zone are kept free from soil, plant debris and rubbish	<input type="checkbox"/>	<input type="checkbox"/>
All vehicles that travel off-farm ('outside' zone) are always cleaned before entering the 'clean' zone	<input type="checkbox"/>	<input type="checkbox"/>
Windbreaks are established around the farm or greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
There is a neighbourhood agreement for managing weeds	<input type="checkbox"/>	<input type="checkbox"/>

Maintain clean surfaces**Yes****No**

Roadways and pathways in the 'clean' zone are sealed or covered

Roadways and pathways in the 'clean' zone are free from soil and mud, weeds, plant debris and rubbish

Floors and other surfaces of sheds in the 'clean' zone are sealed or covered for easy cleaning and are regularly cleaned

The greenhouse floor and other surfaces kept covered for easy cleaning

Water and drainage**Yes****No**

All water used in the 'clean' zone is disinfected and disinfected water is stored so that it can not be contaminated

Drainage ensures that there are no puddles or wet areas in the 'clean' zone and surface run-off does not wash into the greenhouse

Manage rubbish**Yes****No**

 Crop debris is removed and stored/disposed of outside 'clean' zone and away from greenhouse

A waste bin is located away from the greenhouse for management of bulk waste and is emptied regularly

Rubbish removed and stored/disposed of outside of 'clean' zone and away from greenhouse

Small 'day' and 'pruning' bins are located conveniently in or near the greenhouse and are emptied frequently

Greenhouse Sanitation

Greenhouse clean out

Old crops completely removed from greenhouse at the end of the crop

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Used substrate completely removed from greenhouse at the end of the crop

<input type="checkbox"/>	<input type="checkbox"/>
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Greenhouse clean up

☛ The greenhouse always cleaned and disinfected before planting a new crop

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Appropriate disinfectant used for sanitising the greenhouse, tools, shoes and other equipment

<input type="checkbox"/>	<input type="checkbox"/>
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All equipment, tools, containers, bins and other items are completely removed from greenhouse before the clean up

<input type="checkbox"/>	<input type="checkbox"/>
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Limiting the Spread of Pests and Diseases

Assessing the problem

☛ Be able to correctly identify pests and diseases (or have them identified for you) and routinely conduct a pest and disease check to ensure early detection, and correct identification of problems

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

☛ Action points are determined and pest and disease check information is used for all decision making including chemical, biological, whole-crop and hot-spot treatments

<input type="checkbox"/>	<input type="checkbox"/>
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Plant management

Plants are pruned and trained appropriately and sharp, clean blades are used

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Pruned plant material put directly into a 'pruning' bin or bag and disposed of appropriately

<input type="checkbox"/>	<input type="checkbox"/>
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Infected plants (bagged before removal) are removed from the greenhouse (roguing)

<input type="checkbox"/>	<input type="checkbox"/>
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De-leafing, truss or flower pruning and thinning used to reduce pest and disease risk

<input type="checkbox"/>	<input type="checkbox"/>
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Spot treatments

Spot treatments are used when appropriate


Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Chemical controls are assessed for any resistance issues or control failures and a resistance management plan is used

<input type="checkbox"/>	<input type="checkbox"/>
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Quarantine and Exclusion

Plants

	Yes	No
 All seedlings are checked and found free from pests and diseases before they are planted out	<input type="checkbox"/>	<input type="checkbox"/>
Only a single crop is grown at a time in the greenhouse and the greenhouse is kept free of non-crop plants including “pet” plants	<input type="checkbox"/>	<input type="checkbox"/>
Hydroponic set up prevents plant to plant contact of run-off water	<input type="checkbox"/>	<input type="checkbox"/>

Substrate, plant containers and soil

	Yes	No
Only clean, pest and disease free substrate (new or sterilised) is used for each new crop	<input type="checkbox"/>	<input type="checkbox"/>
Soil has appropriate biological, chemical and physical properties for the crop being grown	<input type="checkbox"/>	<input type="checkbox"/>
Soil is solarised or fumigated with an appropriate and registered product between crops	<input type="checkbox"/>	<input type="checkbox"/>


Clean tools and equipment

	Yes	No
A cleaning station is set up at the greenhouse entry or other convenient location for sanitising tools before taking them into the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
All containers (bins, boxes, tubs, buckets and trays) and other materials (eg twine and crop supports) to be used in the greenhouse are cleaned and disinfected before being taken into the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
All tools and equipment (eg knives, secateurs, brooms and trolleys) to be used in the greenhouse are cleaned and disinfected before being taken into the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Pruning tools are regularly disinfected during the pruning task and when used in a diseased area of a crop are cleaned and disinfected before being taken into a healthy area of a crop	<input type="checkbox"/>	<input type="checkbox"/>
The crop support twine is new or cleaned and disinfected before use in the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>

Greenhouse structures and surrounds

	Yes	No
The number of greenhouse entry points has been minimised	<input type="checkbox"/>	<input type="checkbox"/>
Foot baths (or wheel baths) and doormats installed and used correctly at every entry point	<input type="checkbox"/>	<input type="checkbox"/>
Double entry doors (and fan) or a double curtain installed at all entry points	<input type="checkbox"/>	<input type="checkbox"/>
The greenhouse covering materials are kept clean and well maintained	<input type="checkbox"/>	<input type="checkbox"/>
Splash skirts are installed on all opening walls of greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Furrows or trenches (such as a gutter or drain) used to stop crawling pests	<input type="checkbox"/>	<input type="checkbox"/>
Insect screens are installed on opening sides	<input type="checkbox"/>	<input type="checkbox"/>
Insect screens are installed on roof vents	<input type="checkbox"/>	<input type="checkbox"/>
Windward vent opening restricted during warm windy conditions if feasible	<input type="checkbox"/>	<input type="checkbox"/>
Potential insect vectors are excluded or appropriately managed	<input type="checkbox"/>	<input type="checkbox"/>

Worker and visitor hygiene

	Yes	No
 Employees and visitors do not visit another greenhouse before entering your greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Disposable gloves are worn when in the greenhouse and are changed frequently	<input type="checkbox"/>	<input type="checkbox"/>
Employees have a clean change of clothes/overalls everyday for greenhouse work and clothes/overalls are changed after working in a 'dirty' greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Dedicated footwear or disposable shoe covers are used when working in or entering the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Employees wash hands and disinfect personal items (eg mobile telephone) after working in a 'dirty' greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Employees and visitors who smoke wash their hands after smoking before entering the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Bright yellow, mid-blue and white coloured clothing is avoided when working in or entering the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>

Cultural Management

Monitor and manage greenhouse environment	Yes	No
Temperature and humidity in the greenhouse is properly managed (including monitoring) and temperature and humidity extremes in the greenhouse are avoided	<input type="checkbox"/>	<input type="checkbox"/>
The greenhouse has adequate and adjustable venting capacity	<input type="checkbox"/>	<input type="checkbox"/>
The greenhouse has adequate heating capacity	<input type="checkbox"/>	<input type="checkbox"/>
Overhead sprinkler/misting/fogging used (if appropriate and feasible) to maintain humidity levels	<input type="checkbox"/>	<input type="checkbox"/>
Air circulation fans are installed and air movement is managed in the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Vibrating pollinators used in preference to blowers if pollinating crops	<input type="checkbox"/>	<input type="checkbox"/>
The number of whole crop foliar sprays is minimised	<input type="checkbox"/>	<input type="checkbox"/>
UV blocking covering material used (if appropriate and feasible) to disrupt pest behaviour	<input type="checkbox"/>	<input type="checkbox"/>
Nutrition	Yes	No
A balanced and appropriate nutrient regime is provided to the crop	<input type="checkbox"/>	<input type="checkbox"/>
Feed and drain EC and pH is managed (including monitored and recorded) at least daily	<input type="checkbox"/>	<input type="checkbox"/>
Irrigation	Yes	No
Irrigation uniformity test is completed before planting new crop	<input type="checkbox"/>	<input type="checkbox"/>
Feed and drain irrigation volume is managed (including monitored and recorded) at least daily	<input type="checkbox"/>	<input type="checkbox"/>
Good root zone drainage is maintained	<input type="checkbox"/>	<input type="checkbox"/>
Reduce planting and other risks	Yes	No
A crop break or rotation plan is used for the greenhouse	<input type="checkbox"/>	<input type="checkbox"/>
Resistant or tolerant varieties are used when feasible	<input type="checkbox"/>	<input type="checkbox"/>

Example Action plan

<p>Problem: (what is the problem that is causing a pest and/or disease risk?)</p> <p><i>No records of pests and diseases available for effective decision making</i></p>	
<p>Aim: (what will you aim to do to fix the problem?)</p> <p><i>Implement a routine pest and disease check procedure for all greenhouses</i></p>	
<p>Practices to be implemented: (select practices from checklist)</p> <ul style="list-style-type: none"> ▪ <i>Be able to correctly identify pests and diseases (or have them identified for you) and routinely conduct a pest and disease check to ensure early detection and correct identification of problems</i> ▪ <i>Action points are determined and pest and disease check information is used for all decision making including chemical, biological, whole-crop and hot-spot treatments</i> ▪ 	
<p>Strategy/action: (what action will you take? where? and how will you do it?)</p> <ol style="list-style-type: none"> 1. <i>A preferred recording system is decided upon including where records will be kept and in what form. Record sheets obtained.</i> 2. <i>Days of week that P&D check be done are decided.</i> 3. <i>Middle two rows will be purple zone for each greenhouse (2 purple zones per tunnel)</i> 4. <i>Each greenhouse is marked for P&D check with 3 orange crosses in each of 2 rows (6 orange zones per tunnel)</i> 5. <i>Sticky traps installed (2 per tunnel)</i> 6. <i>Initial action points defined for each key pest and disease</i> 	
<p>Resources: (what do you need? how much does it cost? and who will do the work?)</p> <ul style="list-style-type: none"> • <i>P&D check records</i> • <i>Sticky traps (22 needed per week in summer)</i> • <i>Hand lens</i> • <i>ID guide and posters</i> 	
<p>Schedule: (by when?)</p> <p><i>End of March 09</i></p>	<p>Completed: (is it done?)</p> <p><i>yes</i></p>

Action plan template

Problem: (what is the problem that is causing a pest and/or disease risk?)

Aim: (what will you aim to do to fix the problem?)

Practices to be implemented: (select practices from checklist)

▪

▪

▪

Strategy/action: (what action will you take? where? and how will you do it?)

Resources: (what do you need? how much does it cost? and who will do the work?)

Schedule: (by when?)

Completed: (is it done?)

Action plan template

Problem: (what is the problem that is causing a pest and/or disease risk?)

Aim: (what will you aim to do to fix the problem?)

Practices to be implemented: (select practices from checklist)

▪

▪

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Strategy/action: (what action will you take? where? and how will you do it?)

Resources: (what do you need? how much does it cost? and who will do the work?)

Schedule: (by when?)

Completed: (is it done?)

Action plan template

Problem: (what is the problem that is causing a pest and/or disease risk?)

Aim: (what will you aim to do to fix the problem?)

Practices to be implemented: (select practices from checklist)

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▪

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Strategy/action: (what action will you take? where? and how will you do it?)

Resources: (what do you need? how much does it cost? and who will do the work?)

Schedule: (by when?)

Completed: (is it done?)

