

# Preventing Pests and Diseases

## Farm Management Review and Action plan

(Greenhouse Horticulture)

Property Address:

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Property Owner or Operator:

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Postal Address:

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Postcode: \_\_\_\_\_

Contact Phone:

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Reviewer:

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Date of review:

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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:

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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 *Key pests and diseases* 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 
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.  
**Page 15**

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:**

- |   |   |  |                                      |
|---|---|--|--------------------------------------|
| <input type="checkbox"/> Tunnel / igloo | <input type="checkbox"/> Gable – venlo type | <input type="checkbox"/> Gable – wide span | <input type="checkbox"/> Raised arch |
| <input type="checkbox"/> Flat arch      | <input type="checkbox"/> Off-set arch       | <input type="checkbox"/> Off-set gable     | <input type="checkbox"/> Sawtooth    |
| <input type="checkbox"/> Skillion       | <input type="checkbox"/> Other _____        |  |                                      |

**Technologies:**

- |   |   |   |   |
|---|---|---|---|
| <input type="checkbox"/> Twin roof vents                | <input type="checkbox"/> Single roof vent | <input type="checkbox"/> Wall vents     | <input type="checkbox"/> Hydronic heating |
| <input type="checkbox"/> Hot air heating                | <input type="checkbox"/> Insect screens   | <input type="checkbox"/> Thermal screen | <input type="checkbox"/> Climate control  |
| <input type="checkbox"/> Substrate culture (type _____) | <input type="checkbox"/> Water culture    | <input type="checkbox"/> Soil           |   |
| <input type="checkbox"/> Other _____                    |   |   |   |

**Cladding:**

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Single plastic film | <input type="checkbox"/> Twin plastic film | <input type="checkbox"/> Glass ( _____ mm thickness) |
| <input type="checkbox"/> UV absorbing film   | <input type="checkbox"/> Polycarbonate     | <input type="checkbox"/> Other _____                 |

Average yield (per m2):

Primary crop	( _____ ) =	_____
Secondary crop	( _____ ) =	_____
Tertiary crop	( _____ ) =	_____

crop

## Pest and disease risk assessment – complete for each greenhouse

### Key pests

- Thrips
- Whiteflies
- Broad mites
- Russet mites
- Rutherglen bug

Assessed  
Risk level  
(1, 2 or 3)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Key pests

- Aphids
- Caterpillars
- Spider Mites
- Flies (fungus gnats)
- Other .....

Assessed  
Risk level  
(1, 2 or 3)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Key diseases

- Fungal moulds and mildews
  - Botrytis (grey mould)
  - Downy mildew
  - Sclerotinia (white mould)
  - Leaf mould
  - Powdery mildew
  - Other .....

Assessed  
Risk level  
(1, 2 or 3)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Key diseases

- Bacterial leaf spots and soft rots
  - Angular leaf spot
  - Bacterial speck
  - Bacterial spot
  - Bacterial soft rot
  - Other .....

Assessed  
Risk level  
(1, 2 or 3)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Fungal leaf spots, blights and cankers

- Alternaria leaf spot
- Anthracnose leaf spot
- Grey leaf spot
- Gummy stem blight
- Other .....

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Bacterial wilts

- Bacterial canker
- Bacterial pith necrosis
- Bacterial wilt
- Other .....

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Fungal wilts and root rots

- Black root rot
- Damping off
- Fusarium
- Verticillium
- Other .....

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Viruses

- Mosaic viruses
- Cucumber yellows
- Tomato spotted wilt virus
- Other .....

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### 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**..... **Yes /No**Old crops completely removed from greenhouse at the end of the crop  Used substrate completely removed from greenhouse at the end of the crop  **Yes /No** The greenhouse always cleaned and disinfected before planting a new crop  Appropriate disinfectant used for sanitising the greenhouse, tools, shoes and other equipment  All equipment, tools, containers, bins and other items are completely removed from greenhouse before the clean up  **LIMITING THE SPREAD OF PESTS AND DISEASES****Assessing the problem**..... **Yes /No** 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   Action points are determined and pest and disease check information is used for all decision making including chemical, biological, whole-crop and hot-spot  **Plant management**..... **Yes /No**Plants are pruned and trained appropriately and sharp, clean blades are used  Pruned plant material put directly into a 'pruning' bin or bag and disposed of appropriately  Infected plants (bagged before removal) are removed from the greenhouse (roguing)  De-leafing, truss or flower pruning and thinning used to reduce pest and disease risk  **Spot treatments**..... **Yes /No**Spot treatments are used when appropriate  Chemical controls are assessed for any resistance issues or control failures and a resistance management plan is used

**QUARANTINE AND EXCLUSION****Plants.....****Yes /No**

All seedlings are checked and found free from pests and diseases before they are planted out

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

  **Substrate, plant containers and soil.....****Yes /No**

Only clean, pest and disease free substrate (new or sterilised) is used for each new crop

Soil has appropriate biological, chemical and physical properties for the crop being grown

Soil is solarised or fumigated with an appropriate and registered product between crops

 **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

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

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

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


The crop support twine is new or cleaned and disinfected before use in the greenhouse

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

**Worker and visitor hygiene.....**

Yes /No

 Employees and visitors do not visit another greenhouse before entering your greenhouse

Disposable gloves are worn when in the greenhouse and are changed frequently

Employees have a clean change of clothes/overalls everyday for greenhouse work and clothes/overalls are changed after working in a 'dirty' greenhouse

Dedicated footwear or disposable shoe covers are used when working in or entering the greenhouse

Employees wash hands and disinfect personal items (eg mobile telephone) after working in a 'dirty' greenhouse

Employees and visitors who smoke wash their hands after smoking before entering the greenhouse

Bright yellow, mid-blue and white coloured clothing is avoided when working in or entering the greenhouse

**CULTURAL MANAGEMENT**

<b>Monitor and manage greenhouse environment.....</b>	<b>Yes /No</b>
Temperature and humidity in the greenhouse is properly managed (including monitoring) and temperature and humidity extremes in the greenhouse are	<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"/>
<b>Nutrition.....</b>	<b>Yes /No</b>
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"/>
	<b>Yes /No</b>
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"/>
	<input type="checkbox"/> <input type="checkbox"/>
<b>Reduce planting and other risks.....</b>	<b>Yes /No</b>
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><b>Problem:</b> (what is the problem that is causing a pest and/or disease risk?)  <i>No records of pests and diseases available for effective decision making</i></p>	
<p><b>Aim:</b> (what will you aim to do to fix the problem?)  <i>Implement a routine pest and disease check procedure for all greenhouses</i></p>	
<p><b>Practices to be implemented:</b> (select practices from checklist)</p> <ul style="list-style-type: none"> <li>● <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></li> <li>● <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></li> <li>●</li> </ul>	
<p><b>Strategy/action:</b> (what action will you take? where? and how will you do it?)</p> <ol style="list-style-type: none"> <li>1. <i>A preferred recording system is decided upon including where records will be kept and in what form. Record sheets obtained.</i></li> <li>2. <i>Days of week that P&amp;D check be done are decided.</i></li> <li>3. <i>Middle two rows will be purple zone for each greenhouse (2 purple zones per tunnel)</i></li> <li>4. <i>Each greenhouse is marked for P&amp;D check with 3 orange crosses in each of 2 rows (6 orange zones per tunnel)</i></li> <li>5. <i>Sticky traps installed (2 per tunnel)</i></li> <li>6. <i>Initial action points defined for each key pest and disease</i></li> </ol>	
<p><b>Resources:</b> (what do you need? how much does it cost? and who will do the work?)</p> <ul style="list-style-type: none"> <li>• <i>P&amp;D check records</i></li> <li>• <i>Sticky traps (22 needed per week in summer)</i></li> <li>• <i>Hand lens</i></li> <li>• <i>ID guide and posters</i></li> </ul>	
<p><b>Schedule:</b> (by when?)  <i>End of March 09</i></p>	<p><b>Completed:</b> (is it done?)  <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

<b>Problem:</b> (what is the problem that is causing a pest and/or disease risk?)	
<b>Aim:</b> (what will you aim to do to fix the problem?)	
<b>Practices to be implemented:</b> (select practices from checklist)	
●	
●	
●	
<b>Strategy/action:</b> (what action will you take? where? and how will you do it?)	
<b>Resources:</b> ( what do you need? how much does it cost? and who will do the work?)	
<b>Schedule:</b> (by when?)	<b>Completed:</b> (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)

●

●

●

**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?)