

Onion Growers' Biosecurity Manual

A guide to farm biosecurity measures to reduce the risks of pests, diseases and weeds impacting your production

Version 1.0 February 2018



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Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia. As a not-for-profit company, PHA services the needs of members and independently advocates on behalf of the national plant biosecurity system.

PHA's efforts help minimise plant pest impacts, enhance Australia's plant health status, assist trade, safeguard the livelihood of producers, support the sustainability and profitability of plant industries and the communities that rely upon them, and preserve environmental health and amenity.
planthealthaustralia.com.au



Onions Australia (OA) is a representative body and non-profit membership organisation that supports Australia's onion industry. OA serves as an umbrella organisation, representing and progressing the interests of everyone in the onion industry, including growers, packers, wholesalers, exporters, researchers, and retail outlets.

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The logo for Hort Innovation, featuring the text "Hort Innovation" in a bold, sans-serif font, with "Strategic levy investment" in a smaller font below it.	The logo for the Onion Fund, featuring the text "ONION FUND" in a bold, sans-serif font.
<p>This project has been funded by Hort Innovation using the onion research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au</p>	

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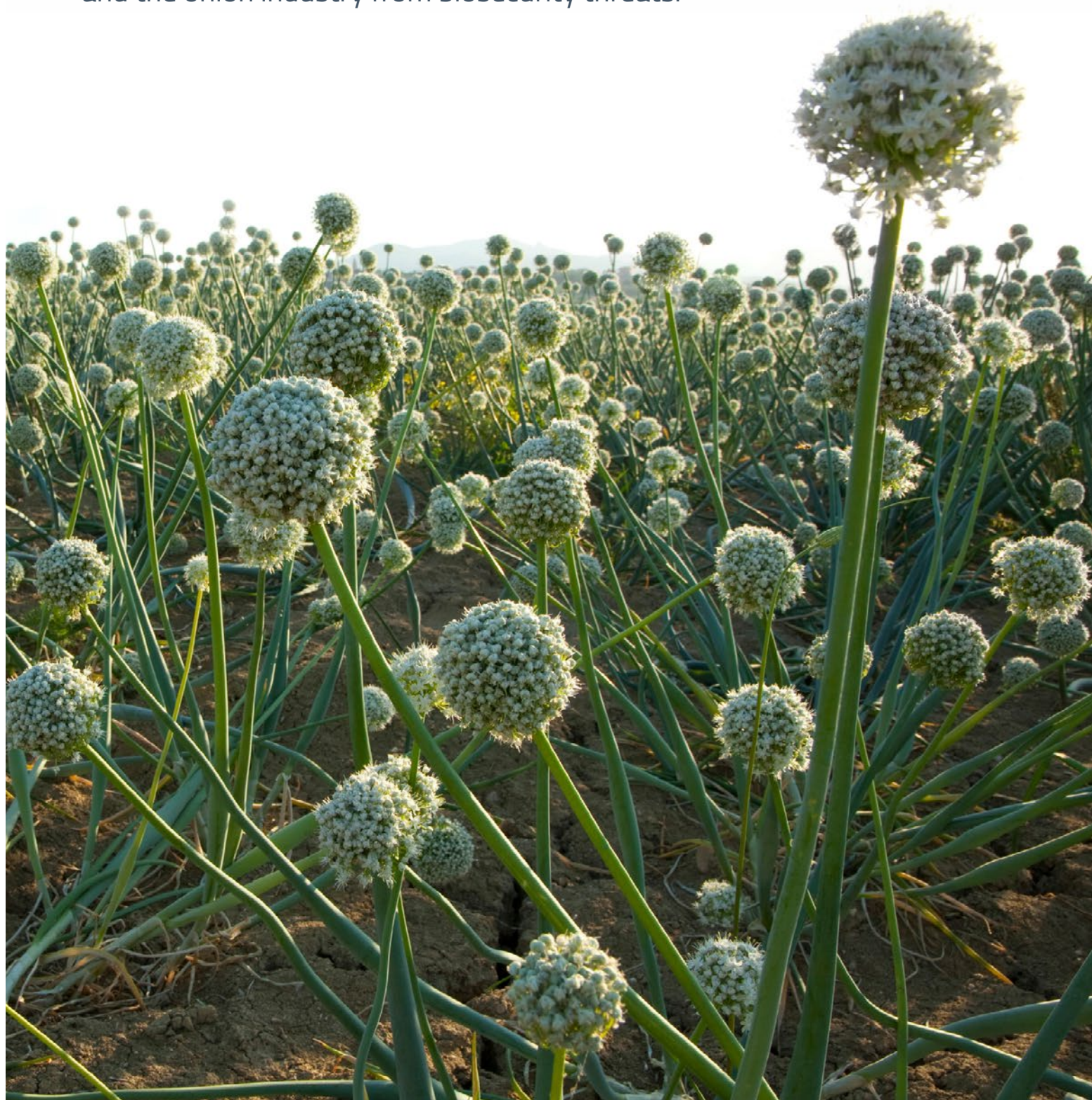
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Introduction

This manual is designed for use by onion growers and their staff, as well as contractors, researchers and consultants working in the industry. It outlines simple procedures that can be used to minimise the risk of introducing and spreading pests, diseases or weeds.

You have an important role to play in protecting your farm, your region and the onion industry from biosecurity threats.



Working together to protect your enterprise and Australia

While many people think of biosecurity as quarantine restrictions imposed by the Australian Government at international border entry points, biosecurity is actually a multi-layered activity and every Australian has a part to play.

The diagram below shows how the biosecurity system is made up of three components and many activities carried out by multiple people, including farmers. Protection from pests, diseases and weeds is only possible if everyone works together.

The Australian Government plays a key role pre-border, working with exporting nations to minimise risks before product leaves a country.

Much of the Australia Government's work is at the border, where international movements of people and goods are regulated. These activities aim to prevent entry and establishment of exotic pests and diseases.

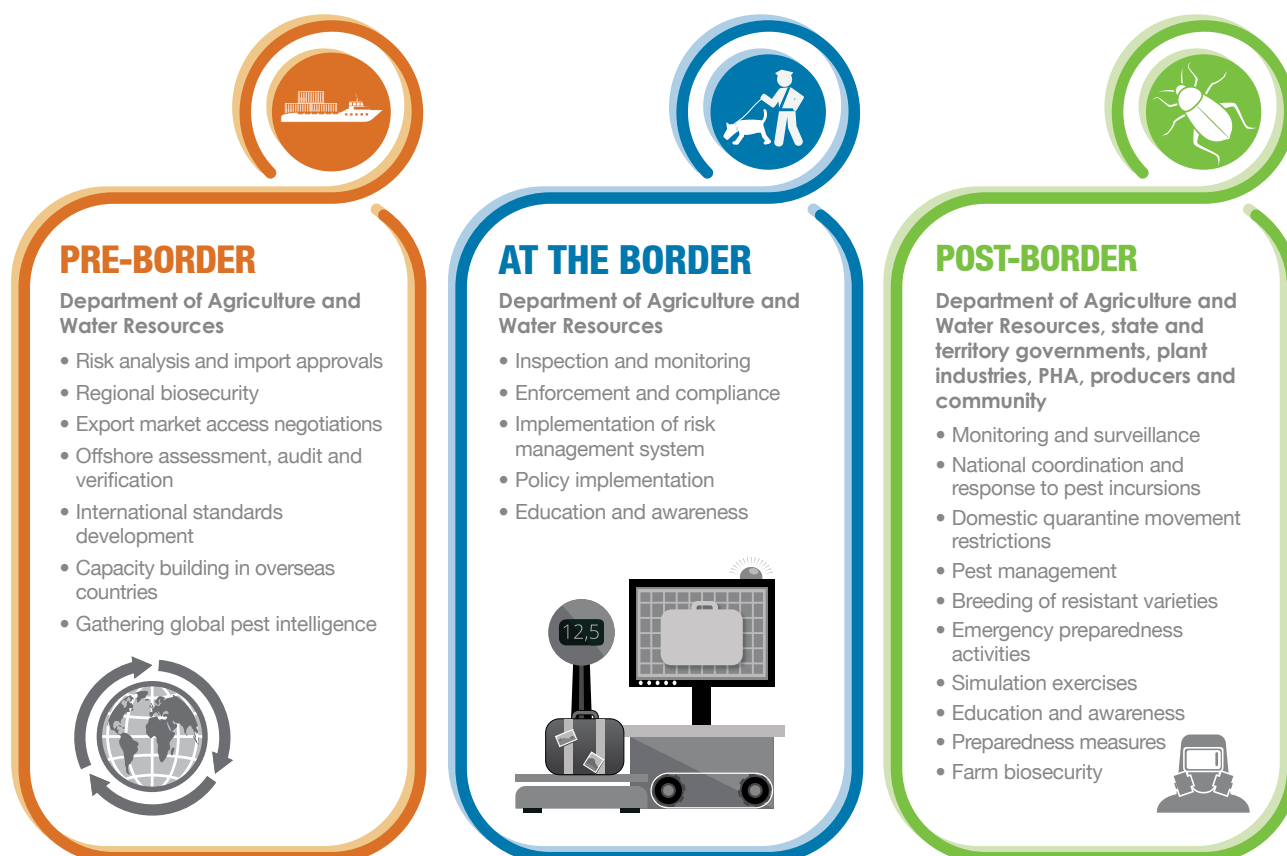
Within Australia, post-border biosecurity measures aim to prevent the spread of regionalised weeds, pests and diseases, and to contain and eradicate any new pest entries into Australia.

Post-border biosecurity relies on the activities of state governments, local governments and everyday Australians.

The roles of everyday Australians, including onion growers, are to:

- Protect areas within their control from weeds, pests and diseases.
- Obey the law, particularly those about movement restrictions.
- Report any sightings of possible exotic pests, weed and disease.

In Australia, biosecurity involves three layers of protection:





Biosecurity overview

By implementing the recommended measures in day-to-day operations, you will improve your farm's biosecurity and that of your region, minimising crop losses and additional costs.

The risk is real

Onion growers face different types of biosecurity risks:

- **Exotic pests and diseases** – that are not in Australia yet (pages 35 – 42).
- **Regionalised pests and diseases** – that are already in Australia but are restricted to particular regions or can be kept off your farm through biosecurity practices (pages 43 – 48).

On-farm biosecurity practices like those in this manual will help to protect your property from biosecurity risks.

Why on-farm biosecurity matters

On-farm biosecurity practices help to protect you from weeds, established pests and diseases and, in the event of new pest entry into Australia, from exotic pests.

These practices make good business sense since new pest entries reduce yield and increase production costs. Sometimes, new pests have devastating consequences, such as the entry of white rot (see page 13).

In addition to being best practice, increasingly, state legislation is changing to make it a legal requirement that everyone, including onion growers, reduce risks under their control. See page 6 for information on new laws already in force in Queensland and NSW. Other states and territories are expected to follow suit.

Protecting market access

Biosecurity is also crucial for protecting markets for your produce. The presence of weeds, pests and diseases can mean that certain markets will not be willing to receive products grown in particular regions.

These might be interstate buyers in regions that are free from the threat, or overseas markets. Maintaining a favourable pest status underpins the future profitability and sustainability of the Australian onion industry.

Area wide management

Since weeds, pests and diseases can spread to your property from neighbouring areas, it makes sense to work with others on regional approaches to pest management wherever possible.

Pests, diseases and weeds can be harboured in the backyards of nearby towns where onions and other allium crops are grown. Other nearby properties may also pose a risk, especially abandoned or neglected farms. Sometimes native vegetation can host pests and diseases as well.

It pays to contact others in your area to develop a shared understanding of local threats and local expertise and resources that can help.

On-farm biosecurity is most effective if all practices are of a high standard and adhered to. A single practice failure can potentially lead to the introduction of a new pest or disease.

Biosecurity is the management of risks to the economy, the environment and the community, from new pests, diseases and weeds entering, establishing and spreading.

New biosecurity laws

Everyone has a role to play in safeguarding Australia from weeds, pests and diseases. All states have legislation for biosecurity management which include requirements for reporting new pests and diseases. Queensland and NSW are examples of two states where significant and specific changes to biosecurity legislation has recently been made.

Queensland: the general biosecurity obligation

The Queensland *Biosecurity Act 2014* came into effect on 1 July 2016. Under the new Act, everyone needs to take an active role in managing biosecurity risks that are within their control.

The general biosecurity obligation in the Act means that everyone must take all reasonable steps to ensure that they do not spread a pest, disease, weed seeds or contaminants. Everyone therefore has a responsibility to report unusual events that might be related to biosecurity.

You are not expected to know everything about all biosecurity risks, but you are expected to know about risks associated with your work or day-to-day activities.

For example, farmers are expected to be aware of the pests and diseases that affect their crops and manage them appropriately, including reporting unusual symptoms or pests.

For growers in Queensland, further information is available from the Queensland Department of Agriculture and Fisheries: daf.qld.gov.au/biosecurity/about-biosecurity/Biosecurity-Act-2014



Department of Agriculture and Fisheries
Biosecurity Queensland

New biosecurity laws for Queensland

Biosecurity is the protection of the economy, the environment and the community from animal and plant pests, diseases and contaminants. It is critical to market access and the profitability and sustainability of our industries. It also safeguards Queensland's natural assets, our health and our way of life.

The *Biosecurity Act 2014* (the Act) came into effect on 1 July 2016. This brochure outlines how this new Act will affect you.

Why change Queensland's biosecurity laws?

Queensland's former biosecurity legislation consisted of many different Acts that were developed independently over the past hundred years. Because of this, there were many inconsistencies as well as laws that were not flexible enough to meet the challenges of today's biosecurity environment. Queensland is facing more biosecurity threats more often. Global travel, trade in animal and plant products, and diversity of land use—all of which increase biosecurity risk—continue to grow. Also, Queensland's environmental diversity and climatic conditions favour the establishment of many exotic pests and diseases, so we can expect more biosecurity incursions than any other state in Australia. To cope, we need

What has changed?

The new Act replaced a lot of legislation you might be familiar with. Importantly, the Act allows a consistent, modern, risk-based and less prescriptive approach to biosecurity in Queensland.

The Queensland Government will continue to take immediate action to manage biosecurity risks. In fact, under the new Act, action can be taken if there is a reasonable belief that a serious risk exists, without having to wait for scientific confirmation.

The Act deals with pests (such as wild dogs and weeds), diseases (such as foot-and-mouth disease) and contaminants (such as lead on grazing land).

Decisions made under the Act depend on the likelihood and consequences of the risk. This will mean risks are managed more appropriately.

All Queenslanders need to take an active role in managing biosecurity risks under their control. Under the Act, individuals and organisations whose activities pose a biosecurity risk have greater legal responsibility for managing them. This **general biosecurity obligation** means they must take all reasonable steps to ensure they do not spread a pest, disease or contaminant.

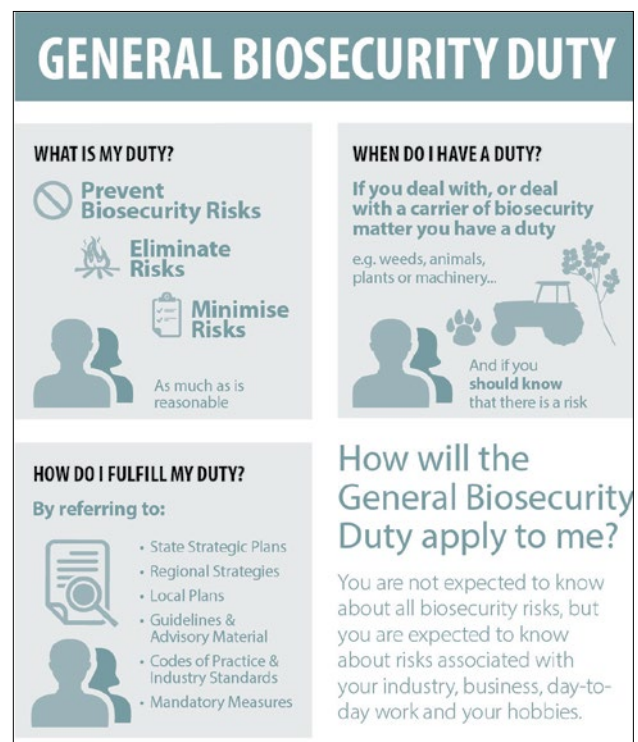
Queenslanders need to report unusual events that might be

New South Wales: the general biosecurity duty

The NSW *Biosecurity Act 2015* supports the principle that biosecurity is a shared responsibility between government, industry and the community.

The inclusion of a general biosecurity duty in the legislation means that any person who deals with a biosecurity matter and who knows, or ought to know, about the biosecurity risk has a responsibility to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.

The new legislation came into effect on 1 July 2017. More information can be obtained from the NSW Department of Primary Industries: dpi.nsw.gov.au/biosecurity/biosecurity-act-2015



GENERAL BIOSECURITY DUTY

WHAT IS MY DUTY?

- Prevent Biosecurity Risks
- Eliminate Risks
- Minimise Risks

As much as is reasonable

WHEN DO I HAVE A DUTY?

If you deal with, or deal with a carrier of biosecurity matter you have a duty

e.g. weeds, animals, plants or machinery...

And if you should know that there is a risk

HOW DO I FULFILL MY DUTY?

By referring to:

- State Strategic Plans
- Regional Strategies
- Local Plans
- Guidelines & Advisory Material
- Codes of Practice & Industry Standards
- Mandatory Measures

How will the General Biosecurity Duty apply to me?

You are not expected to know about all biosecurity risks, but you are expected to know about risks associated with your industry, business, day-to-day work and your hobbies.

The responsibility of every onion grower

The following pages suggest ways to reduce the vulnerability of your enterprise. Every farm is different, so the general principles described here will need to be tailored to your needs.

It is useful to start with a map of your property to consider risk areas, and the best places to locate biosecurity zones and checkpoints.

This could include signs at entrances to the property, parking areas near the house or site office, the location of deliveries and pick-ups in relation to storage facilities, vehicle wash-down areas, and existing roads or tracks for movement within the property. Think about what you can do to minimise the risk of introducing diseases, pests and weed seeds at each point.

The priority should be to minimise the biosecurity risks in the production areas.

On pages 26 – 33 there is a **Biosecurity Checklist** that will help you to assess the strengths and weaknesses of your current arrangements and plan improvements.

The checklist provides three levels of biosecurity activities – baseline, industry standard and above industry standard – to allow continual improvement in practices. Any legal requirements are also stipulated.

The practices you choose may vary from paddock to paddock, depending on factors such as the size and location of your property, the facilities available, and the risks that need to be addressed.

Limit access to areas known to be clean to stop them becoming infected. In particular, apply rules for vehicle and equipment movements in production areas known to be infected to stop further spread.

The **pests and weeds of greatest concern to onion growers** are described at the back of this manual, beginning with exotic pests on page 35. Each pest threat summary indicates how the weed, pest or disease threat can be managed through biosecurity practices.

Exotic pests are those not currently present in Australia. **Established** pests are already within Australia.

The biosecurity essentials

The six farm biosecurity essentials are:

1. People, vehicles and equipment
2. Farm inputs
3. Production practices
4. Farm outputs
5. Feral animals and weeds
6. Train, plan and record

The Farm Biosecurity website has a series of short videos on the six biosecurity essentials that show how easy it can be to implement simple but effective biosecurity measures on your farm. Go to **farmbiosecurity.com.au/videos**

Movement of people poses a particular risk to your farm because weeds and some plant pests and diseases can be spread in soil and plant material that can adhere to footwear, clothing and other materials brought onto the farm.

Farm biosecurity practices

This section outlines the recommended biosecurity practices for all onion growers.

Every farm is different. Assess the strengths and weaknesses of your current arrangements using the Biosecurity Checklist on pages 26 to 33.



People, vehicles and equipment

People, vehicles and equipment can inadvertently carry diseases, insects and weed seeds onto and around your farm.

Inform visitors of your biosecurity requirements

Make sure that staff, regular visitors, and anyone else entering your property knows about your biosecurity requirements.

Biosecurity signs, like those available from farmbiosecurity.com.au or onionsaustralia.org.au, help to control movement onto and around your property. Signs can be purchased or the design file downloaded for printing locally.

Signs at the main entrance to your property alert visitors to the need to comply with the measures you have in place. Other signs can show visitors where to park and where to clean down their vehicle or equipment, if needed.

Consider erecting signs in another language if regular visitors are speakers of languages other than English.

When new staff or groups of people arrive, hold an induction session to explain biosecurity measures in place on the farm. This can include workplace health and safety as well as biosecurity requirements, including specific detail relating to the areas of the farm they will access.

Make sure workers know about any biosecurity risks in the region or issues on the property. They should also be familiar with pests commonly found on the property and know how to report anything unusual.

If you hold events on your farm, such as field days, equipment demonstrations, or research trials, clearly indicate any entry requirements and be especially vigilant in checking for new pests and diseases afterwards.

Use a visitor register

It is good practice to maintain a visitor register to document who has been on your property, where they have come from, and where they are going on the farm, and after they leave.

Visitor or contractor records are useful tools in the event of a new pest entry into Australia or a new region within Australia because they can allow investigators to trace the origin and spread of a pest or disease.

A visitor register template can be obtained from farmbiosecurity.com.au or onionsaustralia.org.au



Control access by people

Controlling and limiting access to production areas is the best way to minimise biosecurity risks from the movement of people.

Visitors include farm contractors, consultants or agronomists, backpackers, employees of utility providers, and research personnel. Busloads of visitors such as grower groups or students might also require precautions.

Ideally, there should be only one access point to the property. This makes it easier for you to monitor and control the movement of people. Although not common in the onion industry, fencing is recommended as part of controlling access.

Providing a designated parking area away from production areas and asking all visitors to let you know when they arrive will also help you manage who is coming onto your property.

Assess the risks that each visitor poses. Get into the habit of asking visitors where they have been recently and take actions appropriate to the risk, as explained on the following pages. If you cannot reduce the risk presented by a visitor by implementing some of the suggestions outlined in this manual, you can refuse access to your property.

Take particular care with high risk visitors – anyone who has recently arrived from overseas, particularly from rural areas, people who have travelled from another onion farm, and any visitor who moves from farm-to-farm and region-to-region.

Ask all visitors to stay on paths and designated roadways as much as possible when moving around the farm.

Also consider how to manage people who come on farm to buy a bag of onions or who jump fences to collect pickling onions. Appropriate signs might be required as part of managing this risk.

Limit machinery and equipment entry to your farm

Any machinery coming onto your property poses a risk of spreading pests and weed seeds. This is particularly the case with contractors involved in harvesting, planting or fertilising who have travelled from farms where onions are grown.

You have the right to ask contractors to clean machinery before entering (and leaving) your farm.

Another alternative is to only engage contractors who are signatories to an industry-recommended hygiene protocol or program.

To ensure that your property does not become the source of new pests for others, you have a responsibility to inform visitors of any declared or notifiable pests present on your farm, so that they can take steps to avoid transferring them to the next property.

Soil and plant material that adheres to vehicles and equipment, including harvest bins, coming on to your property can spread pests such as bean and onion flies, diseases such as white rot and weed seeds.

VISITORS

**PLEASE RESPECT
FARM BIOSECURITY**

Please phone or visit the house before entering.

**Do not enter property without prior approval.
Keep to roadways and laneways.**

 Plant Health
AUSTRALIA

Use signs to direct visitors to designated parking or reception areas. Access to production fields should be limited to a restricted range of personnel only.

Limit vehicle movements in production areas

It is often impractical to stop all movements of vehicles onto and around the property, but there are steps you can take to minimise the risks that they pose.

Best practice is to make sure that all vehicles are either restricted to a designated parking area or cleaned before entering production areas. Having a parking area on the property allows you to inspect a vehicle and decide what, if any, action you need to take. Get into the habit of doing a quick and simple risk assessment for vehicles and equipment by asking the operator where it has been recently.

Wherever possible, use dedicated farm vehicles to move through production areas. A dedicated farm vehicle should never leave the farm, to minimise the risk of bringing a pest back with it. Otherwise provide a wash-down facility to clean vehicles before allowing access to production areas.

Establish zones around your farm and limit access according to the risk status of the area. Limit access to areas known to be clean to stop them becoming infected. In particular, apply rules for vehicle and equipment movements in production areas known to be infected to stop further spread.

Any equipment that moves from farm-to-farm and region-to-region is an increased biosecurity risk to your property. This could include harvesters and contract sprayers.

Non-production vehicles should stay on designated roadways as much as possible when moving around the farm.



Without signage, visitors and staff may be unaware of the biosecurity procedures enforced on your property.

Clean boots and clothes

Since weed seeds and pathogens like rusts can enter on people's footwear and clothing, it helps to have a policy of clean clothes and boots for employees and visitors.

Boots present more of a risk than clothes because they have direct contact with the soil. Provide hot soapy water, scrubbing brushes and disinfectant for people arriving with muddy boots, or give them boots to wear while in your production areas. People should also use a footbath when leaving your property.

People who have recently returned from overseas pose an increased potential risk, particularly if they have been in regions where onions are grown and exotic pests are present. Make sure that they have clean footwear and clothes before entering the farm.

Additional protective measures may be required in areas contaminated with pests or diseases to limit further spread. Provide hygiene supplies such as hand sanitiser, gloves, disinfectant foot scrubbers, disposable over boots and overalls for use where appropriate.

Foot baths are a simple way to manage biosecurity risks associated with soil-borne pests and weed seeds being carried in dirt and mud. Footbaths need to be maintained well to be effective. See farmbiosecurity.com.au/biosecurity-basics-make-your-own-footbath



Pests, disease causing organisms and weed seeds can be present on hands, clothing, footwear and personal items.

Establish wash down and disinfecting facilities

All vehicles and equipment entering production areas can be easily cleaned using high pressure water and a detergent/degreaser such as Bio-Cleanse™ or compressed air.

Locate a wash down area between the driveway and farm roads, and away from production areas. A sealed (concrete or bitumen) surface or a pad of packed gravel is ideal, with a sump to collect waste water and debris. Make sure mud, soil and plant material are kept away from crops, storage areas and waterways.

Inspect the area around the wash down facility regularly for the presence of pests or weeds, and treat or report as required.

The wash down area may be the same as that used for chemical wash down of vehicles and equipment since both require a separate waste water holding pond. If so, all occupational health and safety issues associated with chemical wash down areas must be taken into account.

Washing all planting and harvesting equipment with a detergent/degreaser such as Bio-Cleanse™ and water, and then disinfecting with a product such as Sporekill™ or Virkon™ will provide additional protection from onion diseases.

It is important to consider risks posed by equipment that has previously been used on crops elsewhere, including garlic, leek and shallot crops and even other soil based crops such as potatoes and carrots, as the same pests and weeds may be a problem.

Where onions are hand harvested, provide new gloves, snips and baskets at the start of each season. Often, snips are signed out and in each shift, providing an opportunity to wash them with hot soapy water and treat with a disinfectant such as Sporekill™ at the same time to decrease the risk of spreading bacterial and fungal diseases.

If you farm in an area where teams of harvesters move from one property to the next with their equipment, make sure that the team leader or manager understands your clean down requirements prior to bringing equipment and vehicles onto your property.

Wash down bay designs

In the wake of the entry of Panama disease tropical race 4, (a non-eradicable disease of bananas) in Northern Queensland in 2016, Biosecurity Queensland's Panama TR4 Program has developed new wash-down bay designs for growers.

The designs are ideal for use by onion growers since Panama TR4 is a soil borne fungal disease, as is rust of allium (page 45).

Go to Wash-down designs to combat Panama disease tropical race 4
farmbiosecurity.com.au/wp-content/uploads/Wash-down-designs-for-TR4.pdf

Automatic wash down areas are easy and efficient to use. Costs are higher with these systems than those which are non-automated, but the protection from soil borne diseases may be improved, if designed and maintained well due to greater contact of water underneath.

The wash down facility illustrated below is designed for vehicles with a medium to high level of soil and plant contamination. Vehicles are submerged up to the axles and some of the underbody, and a high-pressure hose is provided for specific washdown of other parts of the vehicle or machinery as required.

This type of wash down bay should be used for all vehicles and machinery entering the property, so it needs to be wide enough for a B-Double to pass through.

Use a disinfectant solution that kills the bacterial or fungal pests you're trying to keep off your farm, but that is also safe for regular use on your vehicle and machinery. Speak to your agronomist or ag-reseller to find a suitable product.



An automatic vehicle wash down bay that provides protection against soil borne diseases.

Used with permission, from Wash-down designs to combat Panama disease tropical race 4, Queensland Department of Agriculture and Fisheries, 2017

Case study - How white rot established in Australia

White rot was an exotic pest to Australia but was somehow introduced in the 1960s. The disease went unreported and, with few growers managing biosecurity risks on farm, it spread quickly.

The disease had a devastating impact on onion growers. Some onion growing areas were so badly affected by white rot that production ceased or was dramatically reduced. For example, in the late 1940s, 60,000 tonnes of what were said to be the best quality onions in Australia were produced in western Victoria around Colac and Port Fairy. Once white rot became established, soils in the region became so heavily infested that production of onions fell to less than 5,000 tonnes.

Onion growers still have to contend with white rot today. It has spread to all onion growing states except Western Australia, and strict movement controls are in place to maintain area freedom.

Options for the management of the fungal disease have been identified through research and development, but it still poses a threat to onion production.

As a soil fungal disease it can be spread on people, vehicles and machinery. It is difficult to control because it is a disease which survives in the soil for many years and the high disease pressure in many commercial fields cannot be managed by fungicides alone.

On-farm biosecurity measures will slow its spread into new areas.

The case of onion white rot demonstrates the importance of ongoing biosecurity measures on farms.

Growers should monitor crops and report anything unusual immediately on 1800 084 881. Consistent use of farm biosecurity measures will keep this threat and others out of your property.

White rot, caused by *Sclerotium cepivorum Berk.*, is considered the most severe disease of alliums. It usually affects patches of plants, rather than individuals.

It can be difficult to differentiate from other diseases above ground.

White rot will cause stunted plant growth, followed by yellowing and death of the outer leaves.

Later, remaining leaves and the central stem dies, and there will be an obvious rotting of the stem above the bulb. In severe cases the bulb will be completely rotten.

Infected plants will pull easily from the soil. The disease presents as a fluffy white (mycelia) growth on the roots and root plate, with tiny black growths like poppy seeds (sclerotia).

The sclerotia are highly resistant to adverse temperatures and conditions, and can remain alive in the soil for thirty or more years, even in the absence of a host.

A small number of sclerotia can cause significant disease, and it is very difficult to control.



White fluffy bulbs are a key sign of white rot.

Onions Australia Poster, 2017

Farm inputs

Anything moved onto your property can be a potential source of weeds, pests and diseases.

Monitor the sources of everything that comes onto your farm including deliveries and water, as these can also bring weeds, pests and diseases.

Purchase planting material from reputable sources

Infected seed can spread many pests and diseases, especially botrytis but potentially also rusts of onion, onion thrips, and fusarium basal rot (page 43).

In most cases, you will not be able to assess the quality of seed just by looking at it. It pays to always source seed from accredited suppliers and seed that has been tested or treated before delivery is recommended.

Seed certification schemes need to be recognised by a reputable organisation, especially where seed is imported from overseas. Treatment with a suitable, registered fungicide can also be a useful pre-emptive action to minimise pressures from diseases on the crop growth and yield.



Poor quality water in spray mixes is an input that can spread diseases.

Request documents that state the source and testing history of planting material and keep them on file to allow the origin of diseases, pests or weeds to be traced in case of the entry of a new pest. Record information like the variety, crop class, the purchase date, the source of seed, the area planted, and the block where the seed was planted.

Once planted, regularly monitor growing plants for signs of pests or disease and report any potential seed borne issues to the supplier for established pests (pages 43 - 48) and the plant pest hotline (page 17) for potential exotic pests (pages 35 - 42).

Never use poor quality or diseased seed as it has the potential to infect your entire crop.

Check water sources regularly

Dams, rivers and channels have the potential to be reservoirs and conduits for weeds and pests including bacterial soft rots (page 43).

Monitor the quality of water used for irrigation and the vegetation along the edges of water courses. This can provide early warning of new weeds, pests and diseases brought on to the farm in water. It can also reveal increased pest pressure on crops due to a build-up of insects or diseases in or near a water course.

If an outbreak of a water borne disease has been recorded on nearby properties, other measures can be considered. For example, testing by a state department plant health diagnostic laboratory is advised.

More care is needed where water which drains from a paddock into a dam is recycled back onto the crop. Additional measures may need to be taken to treat the water in the event of a disease outbreak on the farm.

On-farm biosecurity is not necessarily expensive or difficult. Often, reducing risk is a simple matter of adjusting the way that production activities are done.

Protect water sources from contamination as much as possible by making yourself aware of where inflows to your irrigation sources come from. Consider treating water which has flowed off a potentially contaminated onion crop. Consider aerating stagnant bodies of water such as dams to prevent outbreaks of blue-green algae, for example.



Many pest and disease-causing organisms can survive for a long time in water sources until they find a suitable host.

Use certified fertiliser

Fertilisers are another input that can potentially introduce diseases, pests and weeds to your farm. In particular, organic fertilisers such as manure and compost can be a source of pests such as root knot nematode and *Xanthomonas* leaf blight, as well as weed seeds.

Reduce the risk of purchasing contaminated or non-compliant fertiliser by ensuring that the supplier is following the Fertilizer Industry Federation of Australia (FIFA) Purchasing Code of Practice or has equivalent quality controls in place. See fertilizer.org.au for more information.

Look for compliance with the Australian Standard AS4454-2012 that applies to compost, soil conditioners and mulches.

It is best practice to ask suppliers of compost for a testing history or other assurance of quality.

When batches are used on-farm, keep a record of the source and where it was applied. Check the area for signs of new pests, diseases or weeds.

If you make your own compost, don't include source material that you know comes from diseased plants. It is also important to monitor the temperature and make sure that thresholds for pest destruction are achieved at all points in the pile of composting material.



Organic fertilisers such as manure and compost can be a source of weeds if not composted thoroughly.

Production practices

You can reduce the risk of spreading pests and diseases by including simple biosecurity measures as part of your everyday farm management practices.

Monitor crops and fallow areas for pests and diseases

Monitoring your crops and fallow areas provides the best protection against new pests, diseases and weeds. Any unusual pests or symptoms should be reported on 1800 084 881.

Monitoring the health of your crop is a fundamental part of farm management and gives the best chance of spotting a new pest soon after it arrives. You, your employees, contractors or consultants should be looking over your farm on a regular basis for established pests and exotic pests.

Pay particular attention to high risk areas where pests are most likely to enter and establish, such as loading areas (sidings or pads), near wash down areas, and along roads, creeks and channels.

Fallow areas should also be monitored for signs of new weeds, or volunteer plants of other crops, which can shelter pests between growing periods.

Finding something new to your property early gives you the best chance of controlling it.

Record the results of monitoring activities

Surveillance involves looking for pests and diseases, any symptoms, or plant health issues on your farm, and recording their presence and population levels, or their absence.

In addition to assisting with farm management, pest surveillance is important for maintaining the pest-free trading status of the Australian onion industry.

An example of a pest surveillance record sheet is provided on farmbiosecurity.com.au or onionsaustralia.org.au

Recording that a pest is absent is just as important as recording what you do see.



The optimum frequency of monitoring depends on the type of crop being managed, and the production intensity.

Learn about exotic pests

Pest surveillance increases the chances that a new pest is detected early enough to be contained and eradicated. A new pest on your farm might also be new to the region or even the country.

To increase the chances of early detection, make yourself familiar with established pests and the exotic pests that pose the greatest risk to the Australian onion industry. Display shed posters where staff will see and learn to recognise key pests or can refer to if they find something unusual.

At the back of this manual there is a series of fact sheets on exotic pests and some significant established pests, showing what they look like or the symptoms that they cause.

Prompt reporting of anything unusual is vital. Only if new problems are found early can they be contained or eradicated.

While Australia has one of the strictest border control systems in the world, there is always the chance that an exotic pest will make it into the country. The number of passenger arrivals and imported goods continues to increase so a serious exotic pest of the onion industry might only be a day's flight away.

There is also a constant risk of pests and diseases moving by natural means from Papua New Guinea and the Torres Strait south onto mainland Australia.

Farmers, contractors and consultants have an important role to play in reporting suspicious pests immediately to minimise potential damage. All reports will be investigated and treated confidentially.

Growers are often the first to notice the presence of a new biosecurity problem, so it pays to be familiar with the worst exotic and regionalised weed, pest and disease threats.

In addition to state general biosecurity obligations, onion growers have a legal responsibility to report suspect pests because the onion industry is a signatory to the Emergency Plant Pest Response Deed (see page 19).

If you find a pest that you think might be exotic, take the following precautions to contain it and protect other parts of your farm:

- Mark the site where you saw the pest.
- Do not touch, move, or transport affected plant material.
- Take a photo of the pest or disease symptoms.
- Restrict the movement of people, animals and equipment near the affected area while waiting for identification.
- Wash your hands, clothes and footwear that have been in contact with affected plant material or soil.
- Without delay, call the Exotic Plant Pest Hotline on 1800 084 881 to report it to your state department of agriculture.

Incorrect handling could spread the pest further or make the samples unfit for diagnosis so always seek advice before taking a sample.

Calls to the Exotic Plant Pest Hotline are forwarded to an experienced person in your state or territory government, who will ask some questions and arrange for an assessment of what you've found.

If the hotline in your state operates only during business hours, leave your full contact information and a brief description of the issue and your call will be followed up as soon as possible.

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

1800 084 881

Fences and property cleanliness

Secure boundary fences make it easier to control the movement of people, vehicles and equipment onto and around your property, minimising the risk of diseases, pests and weeds from entering and becoming established.

Fencing can also limit access by wild or feral animals that can carry pests, diseases and weeds. For example, feral pigs can pick up onion pests and diseases as well as weed seeds while foraging elsewhere and carry them onto your property in the soil and mud attached to their coat.

Make sure that waste is dealt with responsibly. Rubbish dumps can attract pests or wild animals that carry diseases onto your property, so remove or contain anything that is likely to act as an attractant. A waste pit away from production areas, composting, using waste for power generation, burning, deep burial or feeding to livestock are all management strategies which could be used. Records of how waste is disposed of should be maintained in case of a pest outbreak.

Monitor neglected farms

Neglected farms potentially pose a high biosecurity risk to the onion industry, as they may allow pests to multiply, become established and spread.

Monitoring of neglected farms, including hobby farms should be proactive to reduce the risk of establishment and spread of new pests.

Report any farms that you suspect are neglected to your state department of agriculture to reduce risks of biosecurity threats spreading.

Agvet chemicals

Always use chemicals in accordance with the label. In addition to problems with safety, inappropriate or persistent use of chemicals can produce resistance in insects and weeds. This can cause more widespread and ongoing biosecurity problems.

Be sure to follow the instructions and observe withholding periods. Seek training in appropriate use of agvet chemicals (eg AusChem or ChemCert™ training).

Keep a record of chemical treatments in a spray diary, specifying application rates and weather conditions.



The misuse of chemicals can lead to the development of resistance by pests.

The Emergency Plant Pest Response Deed

The Emergency Plant Pest Response Deed (EPPRD) is the formal, legally binding agreement between Plant Health Australia (PHA), the Australian government, all state and territory governments, and plant industry signatories. It sets out how pest incursions are handled in Australia, and how the cost of a response is shared between industry and governments.

Having signed the EPPRD, Onions Australia has a seat at the decision making table in the event of an emergency plant pest incursion.

If a response plan is agreed by the signatories to the EPPRD, Onions Australia will have a say in what happens. The industry may also have to contribute funds to implement an approved Response Plan.

Also under the EPPRD, the onion industry has a responsibility to report suspect pests. This is because the earlier a new pest is detected, the greater the chance an eradication response will be mounted and the more likely it will be successful.

More information on the EPPRD is at planthealthaustralia.com.au/epprd

Owner Reimbursement Costs

An underlying principle of the EPPRD is that growers are not worse off as a result of reporting an Emergency Plant Pest.

The agreement allows for payments to growers, known as Owner Reimbursement Costs (ORCs), for direct costs incurred as a result of the implementation of an approved Response Plan.

ORCs may cover direct grower costs or losses as a result of the destruction of crops, enforced fallow periods, replacement of crops and additional chemical treatments.

Calculation of ORCs is prescribed in the EPPRD, with different formulae being used depending on the type of crop grown, and a specific formula has been developed for onions. For more information, see: planthealthaustralia.com.au/owner-reimbursement-costs

It is important to remember that ORCs only apply to approved Response Plans aimed at eradication, which is more likely to occur if a pest is found and reported early.



Farm outputs

Responsibility for biosecurity does not end when a crop leaves your property. The measures in place on your farm support biosecurity in your region.

Maintain good farm hygiene

Maintaining good hygiene practices on farm can help to minimise the spread of pests around your farm.

Disposing of production waste carefully, especially where there is a suspected or known incidence of insect infestation or disease infection, can limit the spread on the farm. Composting of healthy waste can serve as a useful nutrient source but composting of diseased waste is not recommended.

In addition to cleaning machinery before it is used on your property, it is also important to clean machinery before it leaves your property.

Vehicles that transport onions after harvest and sorting are likely to move from farm-to-farm, posing a significant biosecurity risk which should be managed appropriately.

Product should be collected from the field in harvest bins or trailers and taken to a shed for sorting, not picked up directly from the field by trucks that move from farm to farm. Instead have trucks come onto the property via a single road and take produce from a loading dock or shed.

Post harvest risks

There is a risk of spreading weeds, pests and diseases after harvest so make sure that harvesters moved between blocks and farms are cleaned and disinfected.

Bins used for collecting onions in the field pose a significant risk and it is essential that they are free of plant material and disinfected between crops. Also make sure that trucks carrying onions to another property for packing are cleaned.

Other post harvest and farm output considerations

When aggregation of produce from multiple farms takes place to meet consignment quantities, special care should be taken to manage waste to avoid introducing a new pest to your farm.

Onion skins and other waste that is fed to sheep, as is common in some areas, might pose a risk for the spread of diseases such as onion rust, leaf rot and neck rot to crops on nearby properties if not managed well as these diseases are spread by spores that can be blown off a passing truck.



Ensure plant products are fit to travel, your records are up to date and that the transport vehicle is clean.

Case study - A biosecurity success story: onion smut eradication

In 1979 the exotic pest onion smut was detected in South Australia. The detection sparked an eradication program that continued for almost four decades.

Australia is once again free from this disease, but ongoing surveillance is required to provide evidence that our produce is onion smut free.

The eradication program has been long and involved. The affected crops were destroyed, infected paddocks disinfected, equipment cleaned, and strict on-farm biosecurity measures were implemented. Then there was a long wait.

Fifteen years of quarantine was required to make sure that no spores remained in the soil, so no onions or other Allium crops could be grown for that period.

The South Australian government undertook annual inspections from 1979 until 2010 to ensure area freedom. On average, 111 properties per year were inspected – over 90 per cent of the South Australian onion industry – and crops checked included leeks, shallots, spring onions, garlic and chives. Growers were required to establish that their property was free from smut so that they could access interstate markets.

The cost for surveillance, approximately \$50,000 per year, was recovered from growers. There were positive detections of onion smut during this time, each of which was dealt with by crop destruction, disinfection, tightened on-farm biosecurity measures and a long wait.

The disease was last detected in 2002, and quarantine restrictions ended in October 2017.

The eradication program was long and expensive and highly stressful for affected growers, but it was effective and provided benefits for the entire industry. It relied on consistent use of on-farm biosecurity practices to prevent onion smut spreading further.

It could happen again. Onion smut is spread in contaminated soil: in this case shared harvest bins were linked to spread of the disease between growers and packing sheds.

To protect yourself from a future incursion make sure bins are free from contaminants or remove bins from your production system and harvest directly into trailers which are cleaned down between paddocks. Also maintain biosecurity practices around people, vehicle and equipment movements.

There is no evidence of transmission by seed, but the disease could be transferred as a contaminant on the seed coat or loose plant material in a consignment if the crop was grown in an infected area so seek clean seed certification where possible.

Onion smut (*Urocystis cepulae*) is a damaging fungal disease which weakens plants and causes seedling death.

Seedlings usually die within a few weeks. Those that survive are often distorted and remain stunted.

It can persist in soil for many years, making eradication difficult.



Onions Australia website, 2018

Feral animals and weeds

Feral animals pose a risk to your property through direct impact on production but can also carry diseases, pests and weed seeds onto and around your property.

Vermin such as rats can damage crops, spread animal diseases and contaminate water sources. Weeds too, are a significant problem in their own right, reducing yields.

In addition to their direct effects, feral animals and weeds can spread and harbour plant pests and diseases, providing additional reasons for management.

Wild and feral animal access

To protect the health of your crops, and to prevent damage to cropping land, it is important to minimise the risks associated with feral animals.

Feral pigs and wild animals pose a particular threat to onion production because many diseases are spread in soil, which animals take with them when they move to other properties.

Fencing that prevents animal movements will provide some protection. It is therefore important to check and mend broken boundary fences.

Develop and implement an integrated wild and feral animal control program. For best results, work with neighbours and other growers in your local area to implement a coordinated approach to feral animal control.

Ensure farm buildings are in good repair and remove any sources of feed for animals. Dispose of any animal carcasses properly and promptly.

Volunteer plants and weeds

Weeds and volunteer plants of other crops that have escaped from production areas can create a 'green bridge' that can harbour pests or diseases between seasons. Pests then have the potential to cause early re-infection of the next crop.

Ensure that crop destruction and follow-up controls remove all volunteers in paddocks. Where necessary, control volunteers and weeds external to the paddock, such as along roadways and boundary fence lines.

Establish a weed management plan for your property, including plans to eradicate, contain or manage current weeds on your property, and to prevent the introduction of new ones.

You are likely to need a combination of practices to manage existing weeds, including herbicides and cultural practices like strategic tillage and farm hygiene.

Property and land damage

Fires, floods and storms can provide an opportunity for pests and weeds to become established, and for feral animals to enter.

Make regular inspections of your property for the presence of diseases, pests, weeds and feral animals. Pay particular attention to areas that have been recently excavated such as new roads or dams and anywhere that has been damaged in storms or flooding. Keep an eye out for new weeds in the areas where flood waters may have run across your land from neighbouring properties and treat them before they flower and produce seeds.





Train, plan and record

Make sure that biosecurity procedures and threats are included in staff training and that biosecurity is part of farm planning activities. Record keeping is also an important part of managing your business, which provides the ability to trace where planting material and other inputs came from and where produce goes.

Train staff

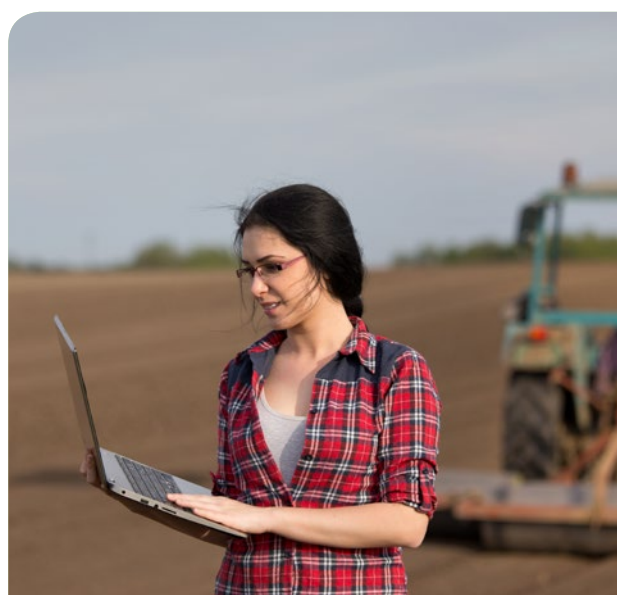
Since many people are not aware of how easily diseases, pests and weeds can spread, anyone coming onto your property, particularly into your production areas, needs to be informed. It's important that everyone who comes onto the property, including staff, friends, family and contractors, are aware of the risks, and know about your procedures to prevent the spread of biosecurity risks.

Inform staff of the biosecurity standards they need to adhere to, and provide formal training or instruction if required. Staff can help monitor crops and keep an eye open for any problems but education is important in preparing them to do this well.

Make sure workers keep a lookout for unusual pests. In particular, make sure that they can recognise established and key exotic pests, and that they know how to report them.

Posters in sheds featuring established and exotic pests, such as those available from Onions Australia can build awareness and serve as a reminder.

If you build your farm biosecurity measures around daily, monthly or yearly farm routines, then it should become a habit which is easily maintained.



Planning is an essential part of integrating biosecurity into your everyday farm activities.

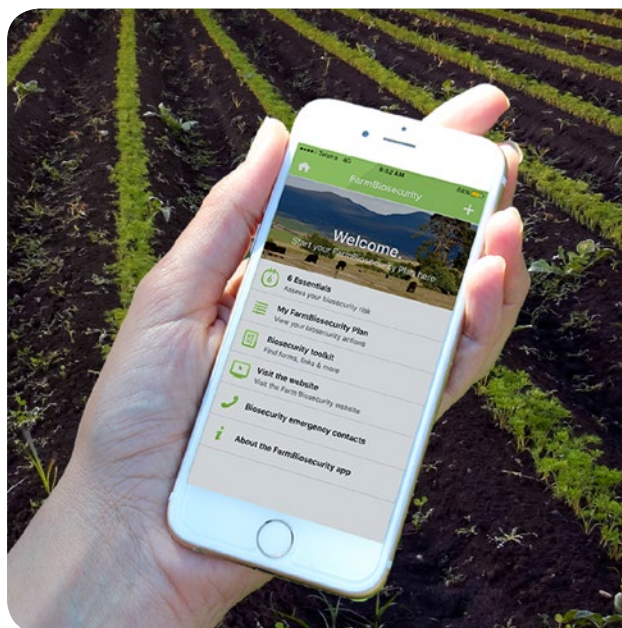
Make a biosecurity plan for your property

Quick and simple measures built into everyday practice will help protect your farm and your future and an on-farm biosecurity plan will help you prioritise the implementation of biosecurity practices relevant to your property. Use the checklist on pages 28 to 33. Alternatively, The Farm Biosecurity Action Planner is a free booklet to help you create your own tailor-made plan. It is based on the six biosecurity essentials used in this manual.

Copies of the Farm Biosecurity Action Planner are available from the Farm Biosecurity Toolkit at **farmbiosecurity.com.au/toolkit**.

There is also an app based on the planner. To make your biosecurity plan using the FarmBiosecurity app, simply select the actions that apply to you from the suggestions, or type in your own actions. Your selections become a to-do list that you can share with others. You can attach photos as reminders or to let others know what needs to be done. If you have multiple properties or sites, that's not a problem. You can add as many as you like.

The FarmBiosecurity app is available for free from the App Store or Google Play.



Keep records

It is good practice to maintain records as a matter of course. This includes a visitor register to trace people movements.

In the event of a new pest entry that prompts an emergency response, valuable time can be lost trying to determine how far the disease or pest may have spread. Sound record keeping can speed up this process and prevent further spread.

Templates for record keeping that you can download, print and use are available from **farmbiosecurity.com.au** or **onionsaustralia.org.au**

It is important to keep records of the sources of all inputs. In addition to fertiliser and seeds, records of the movements of contractor machinery as well as where products and other material, such as waste for sheep feed, are shipped to.

Additionally, if you have problems with a supplier of seed or fertiliser you will be able to show how their product has impacted upon your production system.



You should be able to 'track back' and 'trace forward' if there is a disease, pest or weed entry on your property.

Biosecurity checklist

The following checklist can be used to identify the strengths and weaknesses of your farm biosecurity activities.



The checklist provides options to assess yourself and your business against different levels of a set of biosecurity practices, from baseline activities to above industry standard. This level system allows for you to incrementally improve your biosecurity preparedness over time as necessary, practical and affordable.

By completing this self-assessment checklist you can quickly establish where current practices are working well to keep weeds, pests and diseases off your farm, and where improvements are needed.

The checklist will also help you to prioritise areas for improvement and can be used to plan and implement your on-farm biosecurity activities.

It should be revisited and updated as part of your annual farm planning activities to ensure that your day to day farm activities reflect the highest practical level of biosecurity preparedness.

Completion of this checklist is not compulsory and, except where stated, is not a legal requirement. Completion is therefore for the benefit of you as a grower in self-assessing your biosecurity preparedness activities.

Consider including the checklist as part of your QA reporting to demonstrate your compliance with good farm management principles.

Levels of biosecurity practice

In collaboration with Onions Australia, four levels of biosecurity practice have been developed:

L1. Baseline – minimal biosecurity practices are used and are below industry standard. Improvements should be made to minimise risks.

L2. Industry standard – biosecurity practices that reduce the risk of introducing new pests and diseases to a property are in use, however improvements could be made.

L3. Above industry standard – high level biosecurity practices that are consistently applied to minimise the risk of introducing new pests to, or spreading pests within, a property.

LR Legal requirement – in some cases there are legal requirements which must be met before best practice management is considered. Any legal requirements must be met.

Copies of this checklist can be downloaded from onionsaustralia.org.au

People, vehicles and equipment				
Biosecurity awareness				
L1 - Signs at entry and control points				
L2 - Farm biosecurity information sheet signed by visitors on entry				
L3 - Training of all permanent and casual staff, and management of visitors - i.e. supervised access to the property				
LR - N/A				
Biosecurity signs				
L1 - Signs at gate sites				
L2 - Signs at gates and critical points on farm				
L3 - Signs as above in other languages to cater for non-English speaking people who visit regularly - e.g. English + Vietnamese/Korean				
LR - N/A				
People and vehicle access				
L1 - Single point of entry. Gate sign. Requirement to report to office or house				
L2 - Visitor register used				
L3 - Visitor register includes recent (the previous 48 hours to 1 week) visits to other farms or nurseries				
LR - N/A				
Clothes and shoes				
L1 - Clothes and shoes checked and cleaned				
L2 - In addition to L1, boot covers used in higher risk areas				
L3 - Clothes and boots provided to visitors and employees for use on farm				
LR - N/A				

Equipment access (harvesters, contract sprayers, bins, utility providers, etc.)					
L1 - Incoming equipment visually inspected and entry to farm stopped if there are signs of soil or plant material					
L2 - Dedicated wash down area on the farm, using a product suitable for pest and disease risks. e.g. Bio-Cleanse™					
L3 - External equipment not brought onto farm					
LR - N/A					
Farm inputs					
Propagation material (seeds)					
L1 - Seeds sourced from a known supplier. Visually inspected and treated with an appropriate fungicide and/or insecticide before delivery					
L2 - In addition to L1, seed retreated with an appropriate fungicide and/or insecticide treatment on delivery					
L3 - In addition to L2, material supplied by a certified producer of clean or resistant varieties					
LR - N/A					
Organic fertilisers					
L1 - Sourced from reputable provider					
L2 - Sourced from reputable provider and visually inspected for contaminants					
L3 - Sourced from a provider of certified fertiliser meeting AS4454 (2012)					
LR - N/A					
Water (surface - dams and channels - and ground water used for irrigation) and natural weather events					
L1 - Water courses mapped and checked for weeds and feral plants which could harbour pests and diseases. Weather events recorded					
L2 - In addition to L1, active monitoring of paddocks and water courses undertaken after major weather events					
L3 - Structured surveillance undertaken around water courses or after significant weather events and records made of the details of the weather event such as wind direction, speed and anything different noticed in the days, weeks and months after					
LR - N/A					

Production practices				
Insect and disease plant pests				
L1 - Crop monitoring undertaken and observations of pest presence and absence recorded in order to control pests at critical points or thresholds				
L2 - Pest levels recorded for established pests. Management programs implemented on property boundaries for regionally established pests and diseases				
L3 - Crop monitoring (including pest levels) and treatment activities recorded. Absence of exotic pests recorded				
LR - Report anything unusual				
Volunteer plants of Alliaceae crops				
L1 - Property boundaries are occasionally monitored				
L2 - Alliaceae crops close to property boundaries are monitored regularly and records kept				
L3 - Regional approach to management of volunteer plants and weeds is undertaken				
LR - N/A				
Effective use of chemicals				
L1 - Growers are aware of resistance issues and rotate chemical modes of action accordingly				
L2 - Resistance management strategy in place for herbicides, pesticides and fungicides. Records kept of pest populations before and after treatments				
L3 - Integrated pest management program and suitable resistance strategy in place				
LR - Chemicals applied according to the label				
Biosafety zones				
L1 - Discrete blocks or paddocks identified on farm map				
L2 - Movement plan developed and restrictions on movement from high risk areas of the property (or between linked properties)				
L3 - Clean down of equipment between blocks - as appropriate, based on a risk assessment				
LR - N/A				

Farm outputs				
Waste management				
L1 - Waste bulbs and plant material are mulched in the field				
L2 - Waste bulbs and plant material are removed from the field to a designated on-farm disposal site				
L3 - All bulb and plant waste is removed from the field and destroyed by composting, burial or burning, or taken off-farm				
LR - N/A				
Harvest management				
L1 - Visual inspection of harvest equipment before entry into each paddock (including own equipment)				
L2 - Wash down of harvest equipment before movement between blocks or paddocks				
L3 - Wash down machinery between blocks followed by use of a suitable disinfectant. Blocks suspected of infection with disease harvested last. Records kept of all treatments and movements of equipment and machinery				
LR - N/A				
Packing shed management				
L1 - Packing shed cleaned daily and waste disposed of in a pit and sprayed				
L2 - Packing shed cleaned regularly and waste effectively composted or deep buried				
L3 - Packing shed cleaned regularly according to schedule with records kept. Waste disposed of away from the field or off farm				
LR - N/A				
Waste management for packing shed processing other people's bulbs				
L1 - Waste bulbs buried				
L2 - Waste bulbs piled and covered in black plastic (solarised) for an appropriate length of time				
L3 - Full destruction (e.g. burning) or deep burial and records kept on all waste removals and treatments				
LR - N/A				

Feral animals and weeds				
Weeding or spraying				
L1 - Weeding or spraying equipment is cleaned with high pressure water and visually checked before each use				
L2 - Weeding or spraying equipment is cleaned with a suitable detergent/degreaser and treated with a suitable disinfectant between blocks				
L3 - Weeding or spraying equipment is cleaned with a suitable detergent/degreaser and treated with a suitable disinfectant between blocks. Records of movement and cleaning kept				
LR - N/A				
Wild and feral animals management				
L1 - Pests are identified				
L2 - Some pest management activities conducted (e.g. baiting, trapping and shooting). Risks for disease or insect pest introduction assessed				
L3 - Regional vertebrate management plan developed and implemented with neighbours or wider farming community				
LR - N/A				
Abandoned farms				
L1 - Aware of risks in area				
L2 - Regular monitoring of crops near fence lines				
L3 - Regional pest management strategies in place with monitoring and reporting to stop pests or disease build up				
LR - State biosecurity obligations - control endemic pests and report suspected exotic pests				

Train, plan and record				
Biosecurity planning				
L1 - The <i>Farm Biosecurity Action Planner</i> or the <i>FarmBiosecurity</i> app is used as part of annual farm planning activities				
L2 - In addition to L1, a farm map and biosecurity plan has been developed and is referred to when undertaking annual farm planning activities				
L3 - A farm map has been developed. A biosecurity plan is developed in consultation with an agronomist or consultant as part of annual farm planning				
LR - N/A				
Staff training				
L1 - Shed posters are displayed to draw staff attention to potential pest risks				
L2 - Biosecurity training included as part of induction of all staff and family				
L3 - External training is provided to staff on biosecurity management, including risk minimisation, exotic pest ID and reporting				
LR - N/A				
Record keeping				
L1 - General records are kept about the timing of farm management activities including the arrival of new inputs, staff and equipment				
L2 - Specific records of all movements on and off the property are kept. Records kept of pest presence				
L3 - In addition to general farm management activities, records are made of surveillance activities including pest absence.				
LR - Spray records are maintained in line with state requirements for AgVet chemical use				

Pests and disease threats

Exotic pests

Onion growers need to be familiar with the most serious exotic pests and diseases because there's always a chance that a disease could make its way past border controls into Australia.

The most serious exotic threats to the onion industry – High Priority Pests – are described here.

Note that this list may change in time, as the High Priority Pest list is reviewed annually by an onion industry biosecurity reference panel. For the most up to date information visit the Onions Australia website.

Information on exotic pests of the onion industry described here has come from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- published literature
- local and overseas research
- specialist and expert judgement.

Established pests

Established pests of biosecurity significance are pests that are contained within one or more regions, have market access implications, and a significant impact on production, but can be kept off a property through on-farm biosecurity practices.

How pests are assessed

Each pest is assessed on the following criteria and given an overall risk rating. Pests rated a high risk are designated High Priority Pests, which have been agreed by the onion industry and governments so that biosecurity efforts can be coordinated.

For High Priority Pests

Entry potential: There is a risk of introduction through a number of possible pathways including the legal importation of plant material as well as illegal pathways, contamination and through natural means such as wind.

Spread: The natural spread of the pest to most production areas would be largely unhindered or as a contaminant would be difficult to manage hitchhiking.

Establishment: The pest would be able to survive (establish) in environment conditions that prevail in Australia in the majority of regions where the host is grown.

Economic impact: The pest would severely impact on production, including host mortality or significant impacts on either crop quality or storage losses, or severe impacts on market access.

Unless attributed otherwise all information is taken from Version 3 of the Biosecurity Plan for the Onion Industry.

Onion fly

(*Delia antiqua*)



Plant Health
AUSTRALIA

What crops does it affect?

Onions, shallots, leeks, garlic, chives, Japanese bunching onions and Welsh onions.

What does it look like?

Adults: About 7mm long, yellowish grey with five dark stripes on the thorax, yellowish wings, black legs and antennae, similar in appearance to a domestic fly.

Eggs: Dull white, long white stripes

Larvae: A white maggot which reaches 8mm when its development is complete.

Which part of the plant will be damaged?

Bulbs, leaves, roots, seedling.

What should I look for?

Yellowing and wilting of the host's outer leaves. Green and apparently healthy leaves will become floppy, and the whole plant may collapse. Later generations of larvae tunnel into the onion bulbs as well as attack the roots.

How does it spread?

Infested soil and plant material.



Adult *Delia antiqua* (dorsal view).

Simon Hinkley & Ken Walker, Museum Victoria, Pest & Diseases Image Library (PaDIL), www.padil.gov.au



Adult *Delia antiqua* (lateral view).

Simon Hinkley & Ken Walker, Museum Victoria, Pest & Diseases Image Library (PaDIL), www.padil.gov.au

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

1800 084 881

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

Bean fly

(*Delia florilega*)



Plant Health
AUSTRALIA

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

What crops does it affect?

Onions, leeks, garlic, *Brassicaceae* species, tomatoes, potatoes and corn.

What does it look like?

Adults: The adults are long and thin with grey bodies. They are about 6mm in length, with black legs and clear wings. Their eyes are large and reddish purple.

Eggs: Enclosed within a hardened, darkened larval skin, that are oval, red-brown and 8mm long.

Larvae: Creamy yellow to white 8mm long when fully grown. The body tapers toward the head end but lacks a distinct head and legs.

Which part of the plant will be damaged?

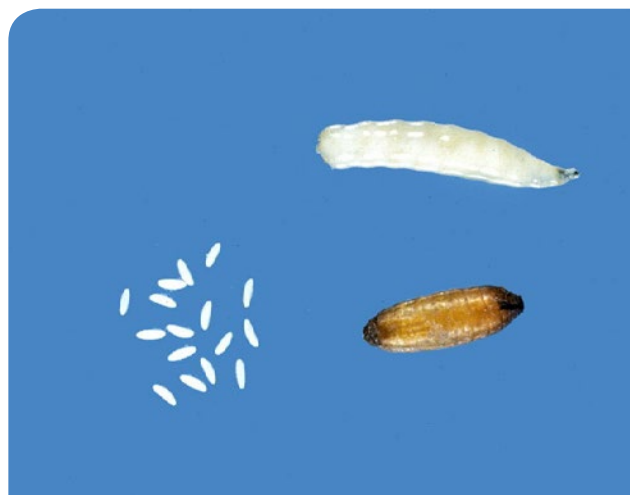
Bulbs, seedlings.

What should I look for?

Primarily a borer in the lower leaf, but the larvae can make corridor-like excursions into the upper leaf. The mines may be distinguished from other similar flies because the mines of bean fly harbour several larvae.

How does it spread?

Infested soil and plant material.



Bean fly at various life stages – eggs on left and larvae on right.

Onions Australia Poster, 2018



Adult bean flies.

Onions Australia Poster, 2018

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

☎ 1800 084 881

Vegetable leafminer

(*Liriomyza sativae*)



Plant Health
AUSTRALIA

What crops does it affect?

Wide range of vegetable and flower crops including onions, eggplant, beans, celery, peas, potatoes and tomatoes.

What does it look like?

Adults: Body length <2mm and wingspan <2mm. The head (including the antenna and face) is bright yellow. The rear margin of the eye is black. The fore-legs are brownish-yellow and the back legs are brownish-black. The abdomen is largely black with yellow sides. Vegetable leafminers don't often fly, and in crops showing active mining many flies may be seen walking rapidly over the leaves with only short jerky flights to adjacent leaves.

Eggs: Eggs are very small (<0.5mm long and <0.2mm wide), off-white and slightly translucent.

Larvae: Maggots have no separate head capsule and are transparent when newly hatched. They colour-up to a yellow-orange in later growth stages and are up to 3mm long.

Which part of the plant will be damaged?

Leaves, bulbs, flowers.

What should I look for?

Mines are usually white with moist black and dried brown areas. They are typically snake-like, tightly coiled. In larger leaves, the mines often form an irregular 'U' shape. The frass is deposited in black strips alternately at either side of the mine.

How does it spread?

Infested planting material.



Adult vegetable leaf miners.

Pest and Diseases Image Library, Bugwood.org



Larvae tunnel in onion leaf.

Whitney Cranshaw, Colorado State University, Bugwood.org

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

1800 084 881

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

Onion thrips

(*Thrips tabaci* (exotic biotypes))



Plant Health
AUSTRALIA

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

What crops does it affect?

Wide host range including onions, garlic, leeks, shallots, horseradish, daisies, cotton and *Cucurbitaceae* species.

What does it look like?

A complete generation requires 3-4 weeks during the summer months. Five to eight generations may occur each year.

Adults: Yellow and brown body (<2mm long) with two pairs of hairy wings. They spend the winter in protected sites under plants and debris in onion fields and fly readily when disturbed.

Eggs: White to yellow; kidney-bean shaped; microscopic in size. Develop within leaf tissue with one end near the leaf surface.

Larvae: Growth stages 1 and 2 are <1mm in length and are the active, feeding stages. They are white to pale yellow; long and thin body. They resemble adults without wings.

Which part of the plant will be damaged?

Leaves, bulbs, flowers.

What should I look for?

Water loss through the damaged leaf surface may cause stress and reduced plant growth. Onions are most sensitive to thrips injury during the rapid bulb enlargement phase. Fast plant maturity due to thrips injury may shortened the bulb growth period. Following harvest and during storage, thrips may continue to feed on onion bulbs, causing scars that reduce quality and visual appearance of bulbs.

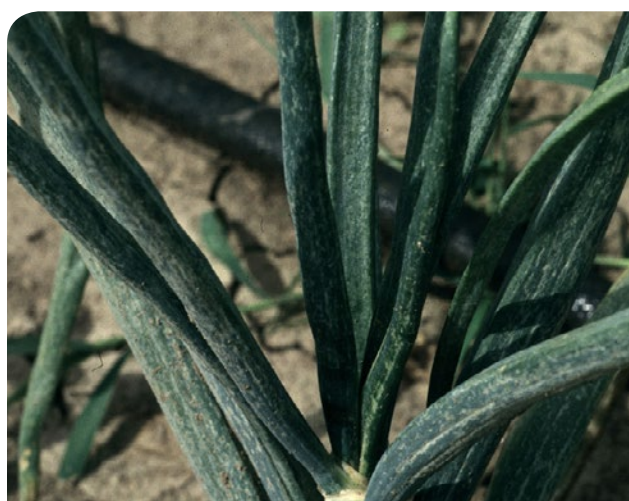
How does it spread?

Infested plant material. Adults are capable of flight.



Larvae at base of onion leaf.

Whitney Cranshaw, Colorado State University, Bugwood.org



Leaf scarring injury to onion.

Whitney Cranshaw, Colorado State University, Bugwood.org

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

1800 084 881

Xanthomonas leaf blight

(*Xanthomonas axonopodis* pv. *allii*)



Plant Health
AUSTRALIA

What crops does it affect?

Onions, garlic, leeks, chives, shallots and Welsh onions.

Which part of the plant will be damaged?

Leaves.

What should I look for?

White to tan flecks, light-coloured spots and/or deep wound in the leaf surrounded by 'water-soaking'. Wounds quickly get bigger, turning tan to brown with extensive water-soaking. As the disease progresses, wounds merge into dry dead areas of tip dieback. Typically, infection of outer, older leaves leads to plant stunting and undersized bulbs. When conditions are favourable for the disease, all leaves may become infected and plant death may follow.

How does it spread?

Infested soil and plant material, seed.



Onion plant showing symptoms of xanthomonas leaf blight.

Howard F. Schwartz, Colorado State University, Bugwood.org

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

☎ 1800 084 881

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

Leaf rot and neck rot

(synonym onion leaf blight (*Botrytis squamosa*)
synonym *Sclerotinia squamosa*))



Plant Health
AUSTRALIA

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

What crops does it affect?

Onions, Japanese bunching onions, Welsh onions, leeks and garlic.

Which part of the plant will be damaged?

Leaves, seeds.

What should I look for?

The first symptoms appear as small white wounds on the leaf surrounded by a greenish halo. This early symptom can easily be confused with insect or mechanical damage, or herbicide injury. In later stages, however, the wounds expand and many new wounds appear that cause premature die-back of leaves. Severely affected onion fields develop a withered appearance and small onion bulbs.

How does it spread?

Infested soil, plant material, wind, and rain.



Onion showing symptoms of leaf and neck rot.

Lindsey du Toit, Washington State University, Bugwood.org



Onion showing symptoms of leaf and neck rot.

Lindsey du Toit, Washington State University, Bugwood.org

**IF YOU SEE ANYTHING UNUSUAL,
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☎ 1800 084 881

Leaf blotch

(*Cladosporium allii* (synonym *Heterosporium allii*))



Plant Health
AUSTRALIA

What crops does it affect?

Onions, shallots, chives, garlic and leeks.

Which part of the plant will be damaged?

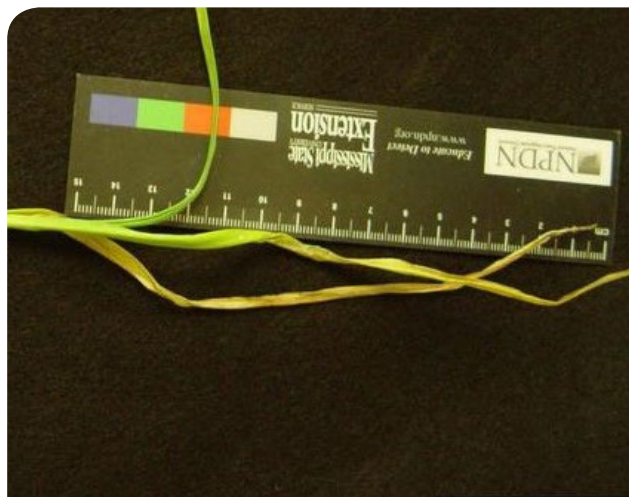
Leaves.

What should I look for?

Leaf infection results in long wounds that develop parallel to leaf veins. At first, wounds appear as yellow areas but later turn brown. Weak, old leaves are more likely to be colonised by this fungus than healthy leaves. An abundance of brown to olive-brown spores are produced giving affected tissues a dark, velvety appearance. As the disease progresses onion plants begin to die.

How does it spread?

Infected debris, soil and seed.



Onion leaf showing signs of leaf blotch.

Clarissa Balbalian, Mississippi State University, Bugwood.org



Onion leaf showing signs of leaf blotch.

Clarissa Balbalian, Mississippi State University, Bugwood.org

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

☎ 1800 084 881

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

Onion smut

(*Urocystis cepulae*)



Plant Health
AUSTRALIA

EXOTIC PEST – CALL THE EXOTIC PLANT PEST HOTLINE IF SUSPECTED

What crops does it affect?

Onions, spring onions, leeks and garlic.

Which part of the plant will be damaged?

Whole plant.

What should I look for?

Occurs as distinctive narrow long dark streaks, usually on the cotyledon or first true leaf, which become thickened. The streaks are evidence of an infection that initially affects the inside of the leaf and later bursts through the leaf surface and releases masses of dark-brown powdery spores. Onion seedlings usually die within a few weeks and plant populations are reduced. Diseased plants that survive are often distorted, develop blisters on green leaves and remain stunted. Yields are reduced. Mature bulbs may, less commonly, have dark pustules.

How does it spread?

Seedlings, soil, bulbs and as a contaminant on seed.



Onion plants with symptoms of the onion smut disease caused by onion smut in the field.

Howard F. Schwartz, Colorado State University, Bugwood.org



Onion smut on bulbs.

R.B. Maude, Horticulture Research International

**IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE**

☎ 1800 084 881

Fusarium basal rot

(synonym Damping-off) (*Fusarium oxysporum* f. *sp. cepae*)



Plant Health
AUSTRALIA

What crops does it affect?

Onions, leeks, garlic, and others.

Which part of the plant will be damaged?

Leaves, whole plant.

What should I look for?

Fusarium basal rot symptoms appear as a pinkish brown rot that becomes covered with a whitish, fluffy fungal growths. Leaf tips yellow, entire leaves wilt beginning with the older outer leaves, scattered plants are stunted, and eventually die. A semi-watery decay progresses from the basal plate upward and secondary invaders (bacteria) cause a watery, foul-smelling breakdown. Symptoms may not be visible in the field, but may develop during storage. Bulbs will become spongy or sunken, and will appear brown and watery when cut open. White, light pink or reddish fungal growth may appear on bulbs or within rot cavities.

Distribution in Australia

All states except Northern Territory and Tasmania.

State movement controls or impacted markets

No movement controls but can be prevented from entering your farm through biosecurity measures.

How does it spread?

Soil, water, transplanted plants and seedlings.



Fusarium basal rot of onion bulbs.

Onions Australia Poster, 2017



Old onion bulbs showing symptoms of fusarium wilt, *fusarium oxysporum* f.sp.*cepae* in the field.

Howard F. Schwartz, Colorado State University, Bugwood.org

There are also a number of rots which are caused by bacteria which are not yet in Australia. These include Bacterial soft rot ((*Dickeya* species (exotic onion infecting strains) (synonym *Erwinia chrysanthemi*)). **If you observe rot symptoms on your onions which appear more severe than usual or are not as responsive to normal management strategies you should report this on 1800 084 881.**

White rot

(*Sclerotium cepivorum*, synonym *Athelia rolfsii*)



Plant Health
AUSTRALIA

ESTABLISHED PEST

What crops does it affect?

Onions, beans, beetroot, capsicum, carrots, *Cucurbitaceae* species, sweet potato, potatoes and tomatoes.

Which part of the plant will be damaged?

Leaves, especially near the soil line.

What should I look for?

Brown to black rot of the stem near the soil line. Plants may be stunted or there will be yellowing and wilting of the leaves. Eventually the leaves will die, beginning with the oldest leaves. During cool weather there may be white, fluffy growth at the base of the stem plate when the leaves are yellowing. On these mats of fluffy fungus, black spores will form that will be about the size of a poppy seed. This disease usually appears on groups of plants in the field that are widely spaced. However, large groups of plants may die suddenly when the fungus is abundant in the soil and conditions are favourable for disease.

Distribution in Australia

All states except Western Australia.

State movement controls or impacted markets

Restrictions for produce entering Western Australia.

How does it spread?

Infected plants/material, soil and water.



White fluffy bulbs are a key sign of white rot.

Onions Australia Poster, 2017



The affect of white rot on onion growth in the field.

Onions Australia Poster, 2017

Onion rust

(*Puccinia allii*)



Plant Health
AUSTRALIA

What crops does it affect?

Allium species including onions, garlic and chives.

Which part of the plant will be damaged?

Leaves.

What should I look for?

Rust on leaves appears as bright-orange or somewhat brownish, circular to long bumps along the veins, followed by the formation of blackish spores. When rust infection is severe the leaves may die.

Distribution in Australia

All states except Western Australia.

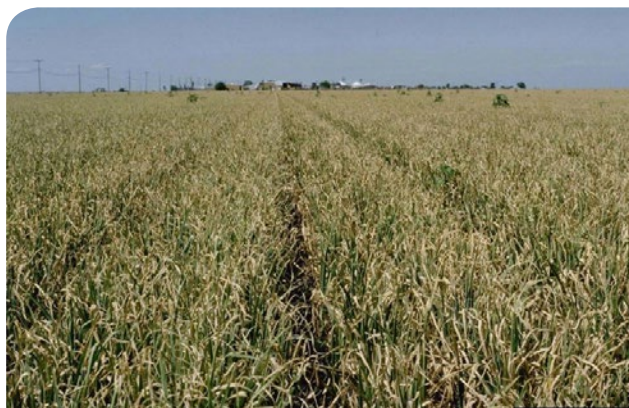
State movement controls or impacted markets

Restrictions for produce entering Western Australia.

How does it spread?

Wind dispersal. Infected plant material such as seed and mother bulbs. Garlic imported for human consumption but planted in backyard gardens.

Several species of rust which can affect onions, garlic and chives are not found in Australia.
Any rust symptoms that appear to have greater impact on your onion crop or don't respond as expected to management activities such as fungicide applications should be reported on 1800 084 881.



A cultivated garlic crop with a rust infection caused by *Puccinia porri*.

Howard F. Schwartz, Colorado State University, Bugwood.org



Telia (brown) and uredinia (yellow) on diseased leaf.

Bruce Watt, University of Maine, Bugwood.org



A cultivated garlic leaf with a rust infection caused by *Puccinia porri*.

Howard F. Schwartz, Colorado State University, Bugwood.org

ESTABLISHED PEST

Iris yellow spot virus

(*Iris yellow spot virus*)



Plant Health
AUSTRALIA

ESTABLISHED PEST

What crops does it affect?

Onion, shallot, leek, garlic, roses, and *Rubus* species.

Which part of the plant will be damaged?

Leaves, roots, whole plant, bulbs.

What should I look for?

Symptoms of iris yellow spot virus (IYSV) consist of eyespot to diamond-shaped, yellow, light-green or straw-coloured wounds (sometimes dead-looking) on the leaves, scape and bulb leaves of onion and other *Allium* host species. In the early stages of infection, lesions appear as oval, concentric rings. Some green islands can be observed within the necrotic lesions. They usually originate around a thrips feeding point. Infected leaves eventually fall over at the point of infection during the latter part of the growing season. Severely infected fields will age prematurely, and entire areas will turn brown before they collapse. Symptom severity is dependent on host cultivar, timing of infection, overall health of the host at the time of infection, and environmental conditions. IYSV does not always kill its host, however, the virus reduces plant vigour, disturbs photosynthesis and reduces bulb size. IYSV infection weakens the plants making them more susceptible to other diseases and pests. IYSV-infected onions grown for seed have reduced seed yield and quality.

Distribution in Australia

New South Wales, Victoria, Western Australia and South Australia.

State movement controls or impacted markets

Restrictions for produce entering Tasmania.

How does it spread?

Vectored by *Thrips tabaci*.



Iris yellow spot virus on onion leaf.

Ronald D. Gitaitis, University of Georgia, Bugwood.org



Extensive leaf lesions on heavily affected plant.

Whitney Cranshaw, Colorado State University, Bugwood.org

Onion stunt (Mallee stunt)

(*Rhizoctonia solani* AG 8)



Plant Health
AUSTRALIA

What crops does it affect?

Allium species and cereal crops.

Which part of the plant will be damaged?

Whole plant.

What should I look for?

Infection develops as circular to irregular patches varying in size from 1m to 25m or more in diameter. The patches usually have distinct borders between stunted and adjacent healthy plants. Stunted onions are most obvious 6 to 12 weeks after sowing when diseased plants are less than 60 per cent the size of healthy plants. The fungus attacks the roots of young plants, pruning roots and causing rotted root tips ("spear tipping") and cortex. Brown melanised mycelium typical of *Rhizoctonia* can be seen microscopically on the roots and around the basal areas of stunted plants. However, stunted onion seedlings can often appear otherwise healthy, without obvious rotted roots or root lesions.

Distribution in Australia

South Australia, Western Australia and Tasmania.

State movement controls or impacted markets

No movement controls but can be prevented from entering your farm through biosecurity measures.

How does it spread?

Infected plants/material, soil and water.



Irregular patches of stunting in the field.

Image courtesy of Sue Pederick, SARDI



Normal and stunted onions of the same age.

Image courtesy of Sue Pederick, SARDI

ESTABLISHED PEST

Bulb eelworm

(*Ditylenchus dipsaci*)



Plant Health
AUSTRALIA

ESTABLISHED PEST

What crops does it affect?

Broad host range including *Allium* species, cereal crops, ornamental bubs and potatoes.

Which part of the plant will be damaged?

Roots and vegetative organs.

What should I look for?

Penetration of onion leaves by bulb eelworm causes leaf deformation and leaf swellings or blister-like areas on the surface. The leaves grow in a disorderly fashion, often hang as if wilted and become yellow. Young plants can be killed by high infestations. The inner scales of the bulb are usually more severely attacked than the outer scales. As the season advances bulbs become soft and when cut open show browning of the scales in concentric circles.

Distribution in Australia

Present in all states and territories except Western Australia.

State movement controls or impacted markets

No movement controls but can be prevented from entering your farm through biosecurity measures.

How does it spread?

Seed and soil.



Onion attacked by bulb eelworm.



Close up of onion attacked by bulb eelworm.





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