



VEGEnotes

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Management of Carrot Diseases

Common leaf diseases

Leaf blight

Leaf blight is an extremely common, quickly spreading fungal disease that initially occurs as patches within crops. The symptoms of leaf blight are small brown, dead spots on the leaves and petioles (leaf stalks). These spots grow rapidly and eventually join so that the leaf yellows and dies. The petioles also break during harvesting.

There are two types of leaf blight, *Alternaria* and *Cercospora*. *Alternaria* leaf blight is caused by *Alternaria dauci* and/or *A. radicina* and usually first appears on the oldest leaves. *Cercospora* leaf blight is caused by *Cercospora carotae* and appears on the youngest leaves first.

Disease cycle

Both *Alternaria* and *Cercospora* can be carried on carrot seeds and once introduced into an area will survive on carrot debris. They can spread easily during rain or irrigation and can also be carried on machinery.

Control

- Disease control is difficult on farms where carrots are planted sequentially
- Some carrot varieties are more tolerant of leaf blight than others



Symptoms of leaf blight.

- Use seed that has been treated with fungicide
- Use fungicide sprays, such as chlorothalonil, copper, difenoconazole, mancozeb, metiram and zineb. Start the spraying program when the first sign of blight appears

Common root diseases

Sclerotinia or cottony rot

Sclerotinia is a common fungal disease that affects many vegetables. It affects carrots both in the field and in storage and is caused by the fungus *Sclerotinia sclerotiorum*.

In the field, the first symptoms are water-soaked spots at the base of the petioles and at the crown. The outer leaves redden and wilt. There is often a white, cottony fungal growth in the surrounding soil. Eventually the top of the carrot becomes soft and slimy.



Symptoms of sclerotinia.

The Bottom Line

- Fungal, nematode, viral and bacterial diseases can affect carrots at any stage of the crop, from seedlings to cold storage
- Root and post-harvest diseases affect marketability of carrots, while foliar diseases affect the yield of crops
- For export, growers should ensure that chemical use complies with the maximum residue limits of the importing country

If slightly infected carrots are harvested the rot continues to develop during storage and can spread to adjacent carrots.

These carrots then develop a soft, watery, slimy rot at the crown. A white cottony fungus develops from this rot; it often contains small black sclerotes that look like mouse droppings.

Disease cycle

Sclerotinia is a common and widespread soil borne pathogen, with a host range that includes both commercial crops and weeds. Black, hard sclerotes form on infected plant debris and these persist in the soil for up to five years.

Sclerotes close to the soil surface infect old leaves and petioles. The infection spreads down the petioles to the crown, resulting in rotting at the top of the roots.

Control

- Deep ploughing buries sclerotes formed on the soil surface
- Check at www.apvma.gov.au to determine which fungicides are registered for controlling sclerotinia
- Post harvest losses are minimised by reducing mechanical damage during harvesting, by rapid cooling and storing carrots at 0°C

Cavity spot, damping off and root forking

Cavity spot is a widespread problem in Australia. It is particularly severe when carrots are grown with limited rotation. Affected carrots have small brown spots (usually less than 10mm in diameter) on the surface. Cavity spot develops rapidly on carrots that are close to harvest or over mature.

Cavity spot is a fungal disease caused by either *Pythium sulcatum* or *Pythium violae*. *Pythium sulcatum* occurs throughout all carrot growing regions of Australia. *Pythium violae* only occurs along the River Murray and in South Australia.

Seedling infection by pythium is a common cause of damping off.

Tap root infection is a cause of root forking.



Symptoms of cavity spot.

Disease cycle

Pythium spp. are soil borne pathogens that persist as resting spores between crops.

Pythium sulcatum only infects carrots and closely related plants, it can survive for at least two years between carrot crops. *Pythium violae* has a much wider host range and can survive for at least five years between carrot crops.

Cavity spot caused by *Pythium sulcatum* is most severe in summer and autumn harvested crops, while cavity spot caused by *Pythium violae* is most severe in winter harvested crops.

Control

- Cavity spot control is difficult on farms with limited rotation
- Grow varieties such as Stefano and Navarre that are tolerant to cavity spot
- Do not allow carrots to become over mature
- Metalaxyl will reduce pythium diseases when used at, or shortly after, seeding. If used frequently, metalaxyl may become ineffective due to enhanced microbial degradation
- High soil pH can suppress cavity spot, however enhanced microbial degradation develops more rapidly on soils with high pH. Maintain soil pH in the range 6.5-7 in water (5.8-6.3 in CaCl₂)
- When *P. sulcatum* is present, rotate carrots with unrelated crops e.g. broccoli, lettuce and onions. Where *P. violae* is present rotate carrots with non-hosts e.g. onions, maize, potatoes and beans

Root knot nematode

Carrots are very susceptible to root knot nematode. This is a serious soil borne disease that is difficult to control and symptoms include root forking and galling. Infection is usually patchy within a crop; plants are uneven and wilt easily.

There are several species of root knot nematode that infect carrots in Australia. The most common species is *Meloidogyne javanica*, which occurs in South Australia, Victoria and Western Australia. Other species include *M. hapla* which is found in Victoria and Western Australia, while *M. fallax* occurs in Tasmania.

Disease cycle

Root knot nematodes are difficult to control because they have wide host ranges. They are more usually a problem in sandy soil. Root knot nematodes survive between crops on alternate hosts and in egg masses in the soil.

When conditions are suitable, the eggs hatch and juvenile nematodes penetrate root tips. Female nematodes mature within the roots and a gall develops around the nematode. These females lay eggs into a gelatinous matrix on the root surface. The eggs either hatch immediately or become dormant.

Control

- Soil sampling to assess nematode numbers before seeding is not always a reliable indicator of whether a nematicide needs to be applied
- Preplant fumigation with 1,3-dichloropropene, 1,3-dichloropropene + chloropicrin, fenamiphos or metham sodium. If these chemicals are used frequently they may become ineffective because of enhanced microbial degradation
- Use a bare fallow between susceptible crops
- Rotate carrots with a non-host crop. The choice of non-host will depend on which *Meloidogyne* sp. is present
- Where *Meloidogyne javanica* is present, seed carrots in winter



Symptoms of root knot nematode.

Root lesion nematode

Root lesion nematode causes reddish and brown patches on tap and lateral roots. The mature carrots are stunted.



Symptoms of root lesion nematode: the two seedlings on the left have reddish patches caused by nematode infection, the two seedlings on the right have healthy roots.

The four species of root lesion nematode in Australia that infect carrots are: *Pratylenchus crenatus*, *P. neglectus*, *P. penetrans* and *P. thornei*.

Disease cycle

Like root knot nematodes, *Pratylenchus* are difficult to control because they have wide host ranges, including cereal nurse crops. They are a problem in sandy soils and survive between crops either on alternate hosts or as eggs in the soil.

When conditions are suitable, the eggs hatch and juvenile nematodes penetrate carrot roots. The nematodes migrate and multiply within the roots.

Control

- Sample soil to assess nematode numbers before seeding to determine whether a nematicide needs to be applied
- Preplant fumigation with 1,3-dichloropropene, 1,3-dichloropropene + chloropicrin, fenamiphos or metham sodium. Minimise use due to the potential for enhanced microbial degradation

Carrot virus Y (CarVY)

CarVY is a serious disease, spread by aphids and occurring throughout Australia. It infects carrots at any stage and is most severe where carrots are grown all-year-round.

The leaves of infected plants develop a mild feathery mottle. The most severe symptoms are stunted and distorted roots, which occur when young plants are infected.



Symptoms of carrot virus Y.

Disease cycle

CarVY is difficult to control on farms where carrots are planted sequentially all year because infected volunteer carrots and adjacent crops provide inoculum sources for new crops.

CarVY is spread non-persistently by aphids, i.e. the aphids acquire the virus rapidly when feeding on infected leaves, but rapidly lose it when feeding on healthy plants.

CarVY only infects carrots and closely related plants e.g. parsnip, coriander and chervil.

Control

- Avoid planting sequential side-by-side crops and separate crops by planting non-hosts, such as brassicas, between them
- Remove volunteer carrots and harvested carrot crops promptly
- Use a fallow period to break the infection cycle

Common post-harvest diseases

Bacterial soft rot

This is a soft, slimy, orange rot that can occur on any part of the carrot, although it is often associated with the eyes. The rot can penetrate deeply. It does not usually smell unpleasant unless there is secondary infection caused by other bacteria.

Soft rot is caused by either *Erwinia carotovora* subspecies *carotovora* or *E. carotovora* subspecies *atroseptica*.

Disease cycle

Erwinia spp. are common soil bacteria that survive on crop residues. Carrots are likely to be contaminated with soft rot bacteria in the field before harvest. However, these bacteria are readily spread in washing water during post-harvest handling.

Soft rot bacteria enter carrots through wounds, but they can also be forced into the eyes if warm carrots are dumped into deep cold water tanks. Once the bacteria are in the carrot root they cannot be killed by sanitisers such as chlorine.

Control

- Losses caused by soft rot bacteria can be minimised by cooling carrots as soon as possible after harvest and then storing them at 0°C
- Minimise mechanical damage during harvesting and in the packing shed



Symptoms of bacterial soft rot.

Black root rot

Two fungi cause black root rot: *Thielaviopsis basicola* (*Chalara elegans*) and *Chalaropsis thielavioides*. Roots affected by black root rot have large black superficial patches on them. These patches are often circular and sometimes surrounded by a matt white halo.

Disease cycle

The fungi that cause black root rot have a wide host range and occur in soil. Carrots are likely to be contaminated with these fungi in the field before harvest.

After harvest the fungi infect carrots through wounds or abrasions. They develop rapidly on carrots stored at 25°C and in high humidity.

Control

- Losses caused by black root rot can be minimised by rapid cooling of harvested carrots and storing them at 0°C
- Minimise mechanical damage during harvesting and in the packing shed



Symptoms of black root rot.

Sclerotinia rot or cottony rot

See Sclerotinia above.

Further Information

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