

## Diseases of vegetable brassicas

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Broccoli, cabbage, Chinese cabbage, cauliflower and Brussels sprouts are members of the brassica family. The family also includes the root vegetables such as turnips and swedes and many common weeds such as wild turnip and wild radish. This Farmnote describes the symptoms of diseases which affect vegetable brassica plants and management options for controlling vegetable brassica diseases.

### Bacterial diseases

#### Black rot (*Xanthomonas campestris*)

Black rot disease is often seen as a light brown to yellow 'V' shaped lesion on the leaf, typically starting at the leaf margins. When the leaf veins are cut in half, the veins will be black. Black rot is caused by the bacteria entering the plant through natural leaf openings or from damage caused by insects, other pathogens or mechanical damage.

The black rot bacteria can spread in water splash from rain or irrigation and under warm moist conditions can spread very rapidly throughout a crop. The black rot bacteria can also be seed borne. Black rot can persist for many seasons on common alternative hosts such as brassica weeds, wild radish and wild turnip.



Figure 1: Black rot infection causing V-shaped lesions.

#### Bacterial soft rot (*Erwinia* species and *Pseudomonas* species)

Soft rot disease is common to most plants, not just brassicas. It causes a soft mushy breakdown on leaf stalks, heads and storage roots. The decay is often foul-smelling but there is no mould associated with the rot. Infection is through damaged areas often resulting from fertiliser burn or hail injury in the field, but can be associated with harvest damage.

The soft rot bacteria may be carried on cutting knives or on residue in produce bins. Post harvest rot by this organism is common where temperature of the harvested produce is allowed to rise and cool chain is not maintained.

### Fungal diseases

#### Blackleg (*Leptosphaeria maculans*)

Blackleg fungus commonly affects the stems and leaves of vegetable brassicas. Stem damage can lead to cankering and severing of the plant at the base. The lesions of this fungus are light brown with a purplish outline which often contain pinhead-sized, black dots. The lesions tend to be linear and are irregularly distributed. The development of the disease is favoured by wet and windy conditions.

The blackleg fungus is predominantly carried over on brassica crop residues but can also be carried on seed. Once present in the crop, it can be spread by irrigation and rain water splash or wind dispersing the spores from the lesions. It can also be spread by farm machinery and equipment.

#### Clubroot (*Plasmodiophora brassicae*)

Clubroot causes galls to form on the roots of infected plants. The galls interfere with the plant's uptake of water and nutrients. Under warm conditions, plants often wilt, which is usually the first sign of a clubroot infection. Wilting plants should be removed from the ground to check for galls on the roots.

The clubroot fungus can remain in infested soil and water for many years. Care should be taken not to confuse a clubroot infection with the galls that are formed by root knot nematode. Considerable research has occurred into the management of the disease in vegetable brassica crops. For further information, see Farmnote Number 110 'Managing clubroot in vegetable brassica crops'.

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Figure 2: Galls formed after infection by the clubroot pathogen.

#### **Damping off (*Fusarium* species or *Pythium* species)**

Damping-off disease can occur before or after emergence and typically is associated with wet, cold conditions. Obvious signs are missing plants or wilting of newly-emerged seedlings. There may be a wet rot of the stem and seedling stems may become constricted. These fungi are soil borne and can survive in the soil without a host being present. The fungi have a wide host range and they can survive on alternative non-brassica hosts.

#### **Downy mildew (*Peronospora parasitica*)**

Downy mildew causes damage from the seedling (cotyledons) to the harvest stage of growth. Leaf symptoms appear as yellowish, irregular areas on the upper surface corresponding to a white fluffy growth on the underside of leaves. Older lesions become dry, brown and papery in texture and may cause the entire leaf to drop. Cool, moist conditions favour the development of the disease and the head of broccoli and cauliflower curds may be infected with black spots within or on the surface.

The peak period for spore release is in the morning after sunrise. Downy mildew is spread by the wind although leaf wetness is required for infection to occur. The fungus can survive on brassica weeds, in crop debris or in soil for several months, even in the absence of a host.

#### **Leaf spot / target spot (*Alternaria* species)**

Two closely related species of the *Alternaria* fungus (*A. brassicae* and *A. brassicicola*) can cause this disease. The circular leaf spots vary from mid to dark brown to black. The leaf spots often have a target-like appearance as a yellow halo surrounds the sunken centre of the spot. As well as affecting the leaf, the disease can cause a blackening of cauliflower curds and subsequent rejection. The disease occurs when conditions are moist and the fungus can be carried over on crop residues and brassica weeds.

#### **Powdery mildew (*Erysiphe cruciferarum*)**

Powdery mildew is a fungus that produces a white powdery mould on the top surface of leaves. The disease can occur through to crop maturity and its development is favoured by warm dry weather. The powdery mildew fungus, which is spread by the wind, survives on living tissue and Brussels sprouts, swedes and cabbages are mainly affected.

#### **Ring spot (*Mycosphaerella brassicicola*)**

Leaf spots caused by the ring spot fungus look similar to those caused by *Alternaria* species. The main difference is that ring spot lesions are grey and contain black, pinhead dots in concentric rings. This spot does not damage cauliflower curds or broccoli heads but can render cabbage heads unsaleable unless heavily trimmed. Severe ring spot symptoms on leaves can reduce the growth of vegetable brassicas, delaying harvesting and causing damage to crops that are harvested in leaf.

Cool moist conditions are favourable for the development of ring spot. The fungus is spread by wind and water splash and survives on crop residues in the soil when a host is absent.



Figure 3: Ring spot infection on cauliflower leaves.

#### **White blister (*Albugo candida*)**

White blister has several strains which can infect different vegetable brassica crops. The disease mainly affects the green material in plants although systemic infections can produce symptoms throughout the plant. White blisters form on the underside of leaves, with a corresponding yellow patch on the upper surface of the



leaf. The blisters contain white spores, which can be spread by infected produce, crop debris and by wind and water splash. Systemic infections of white blister can cause distortion of the plant stem as well as the formation of galls on leaves. Distortion of broccoli heads can also occur, making them unmarketable. White blister can survive on brassica weeds and on crop residue in the soil.

Further information on white blister is available in Farmnote 112 'White blister control in vegetable brassica crops'.



Figure 4: White blisters formed on the underside of a broccoli leaf due to infection by *Albugo candida*.

#### **White leafspot (*Pseudocercospora capsellae*)**

White leafspot disease is relatively common on Chinese cabbage and mustard-type brassica vegetables but has also been detected on cauliflower leaves. The spots on the older leaves are usually circular, about 2 mm and larger in diameter and are pale brown to white with a papery texture. Lesions on cabbage tend to be less regular in shape and are larger and darker with well defined margins. Spores of the fungus can be spread by wind and water splash. The fungus can survive on brassica weeds which can be a source of infection in newly planted crops.

#### **White mould (*Sclerotinia* species)**

White mould fungus attacks a wide range of crops and weeds. There are two species of the disease, *Sclerotinia sclerotiorum* and *Sclerotinia minor*. First signs of the disease are water-soaked areas which later become covered by a fluffy white mould. At the late stage of *S. sclerotiorum* infection, black sclerotes about the size of rice grains may be seen in the white mould or inside the stem of the plant. *Sclerotinia minor* infection produces smaller black sclerotes (0.5 mm -2 mm) that are more rounded in shape. Above ground parts of the plants can be affected and *Sclerotinia* can survive in soil for several years without a host being present.



Figure 5: *Sclerotinia* infection in cauliflower.

#### **Wirestem (*Rhizoctonia solani*)**

*Rhizoctonia* is a fungus which can also cause damping-off of seedlings. In the paddock, the disease is commonly known as wirestem due to a constriction at the base of the stem on the seedling which progresses upwards giving the plant a wire-like appearance. Affected plants remain stunted or may break off at ground level. Plants that are affected soon after transplanting usually die. This disease can be distinguished from blackleg by the absence of pinhead-sized spots in the lesions. Seedlings that have suffered mechanical injury from transplanting operations, wind damage or insect attack are vulnerable to infection by *Rhizoctonia*. The fungus survives between crops in the soil or on crop residue.



Figure 6: *Rhizoctonia* infection on cauliflower stems.

## Nematode diseases

### Rootknot nematode (*Meloidogyne* species)

With rootknot nematode, root growth is restricted, clubbed or galled. The galling can look similar to a clubroot infection, however, galls from root knot nematodes tend to be smaller and more isolated (not joining up with other galls). Infection is more usual in warm weather, so that summer and autumn crops are more often affected, especially on sandy soils. Root knot nematodes have a very wide host range. Nematodes can be spread in contaminated soil, equipment and machinery and on infected seedlings (where symptoms may not be obvious).

### Disease control measures

The identification of a disease is necessary to ensure the correct management method is used. Advice on disease identification can be obtained from your farm agronomic advisor or from AGWEST Plant Laboratories at the Department of Agriculture and Food. A fee for service applies for samples sent to AGWEST Plant Laboratories.

Hygiene on the farm is very important for controlling many plant diseases. Access to cropping areas should be controlled. Erect signs asking visitors to respect your farm hygiene. Visitors and workers should report to a designated area (e.g. the office) prior to entering the farm and they should be aware of your farm hygiene protocols. Where possible, visitors should wear disposable covers over their shoes when entering paddocks. This is particularly important if visitors are visiting several farms.

Soil borne diseases (e.g. clubroot) can be transported to non-infested areas in soil that is on machinery, farm implements, peoples' footwear or vehicles. All equipment that both enters and leaves a farm should be thoroughly cleaned using high pressure washing, to ensure that soil is not being transported on or off the farm. Infected irrigation water can also spread some soil borne diseases. Care should be taken to avoid dams that are fed from infected paddocks. Where this is not practical, water should be drawn from the stillest part of the dam near the surface. Avoid the mud and debris at the bottom of the dam as some spores will settle over time to the bottom of a dam.

Diseases borne on crop residue such as blackleg can be managed by not transplanting seedlings or sowing seed into or close to previous year's residues. In case of a severe blackleg outbreak, a rotation of 3 to 4 years with a non-brassica crop is recommended.

Seed borne infections (eg: black rot) can be managed by hot water treatment. Most vegetable brassica seed supplied by commercial seed companies has been treated for seed borne infections but this should be confirmed by nurseries prior to seeding.

Other cultural practices which can be used to control brassica diseases include managing irrigation times and plant nutrition. Crops which are subjected to water stress or poor nutrition tend to be more prone to disease infection. Avoid having crops wet overnight as this can promote leaf diseases (e.g. white blister). The management of irrigation application times can also help to reduce some diseases (e.g. downy mildew requires leaf wetness for infection so irrigation should be avoided in the morning after sunrise as this is the peak period of spore release).

Crops should be regularly inspected for signs of disease and where practical infected plants should be removed and disposed of in a non - cropping area. Work from the least infested areas of the farm to those that are the most infested.

Seedlings should be of high quality and from a reputable source. Inspect seedlings prior to transplanting to ensure they are disease free. Seedling trays should be kept in the racks as long as possible. Avoid placing racks and trays on the ground.

Registered chemicals are available which can help to manage many vegetable brassica diseases. Consult your agronomic advisor or the APVMA website ([www.apvma.gov.au](http://www.apvma.gov.au)) for currently registered products and current permits. It is essential that chemical labels and any relevant permits are read prior to use and the instructions closely followed. Many fungicides are subject to resistance management strategies. Care should be taken to rotate between different fungicide groups and not exceed the maximum number of applications in order to reduce the risk of fungicide resistance developing.

### Acknowledgements

This farmnote has been updated from Farmnote 39/1990, originally prepared by Dr Robert Floyd.

### Further Information

Farmnote 110 'Managing clubroot in vegetable brassica crops'

Farmnote 112 'White blister control in vegetable brassica crops'

Field Guide to Pests, Diseases and Disorders of vegetable brassicas produced by Department of Primary Industries, Victoria.