

Common diseases of cotton

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Seedling diseases

There have been over 30 species of fungi isolated from dying cotton seedlings. Death of seedlings is often referred to as 'damping off' but is mainly caused by *Rhizoctonia solani*; *Pythium spp.* and *Fusarium spp.* (not Fusarium wilt)

Symptoms

Pre-emergent seed rots. Post emergent wilting, collapse and death (damping off). Slow early season growth, small cotyledons and reddened hypocotyls, lesions on roots.

Favoured by

Anything that slows down germination and seedling growth favours infection by seedling disease. This includes cool and/or wet weather, poorly formed beds, compaction, waterlogging, incorrect planting depth, fertiliser under the plant line, excessive rates of planting herbicide, movement of herbicide into root zone (ie by rain) and infection by other pathogens.

Host range

These pathogens have wide host ranges and can survive on residues of many crops and weeds.

IDM tactics

- Delay sowing if possible, until soil temperature is 16°C and rising.
- Use a variety with good seedling vigour.
- Use effective seed treatment fungicides.
- Avoid freshly incorporated rotation crop residues.
- Plant into well prepared, high, firm beds.
- Carefully position fertiliser away from the plant line.
- Pre-irrigate and/or plant into moisture.
- Take care with use of herbicides at planting.



Rhizoctonia seedling disease. (Alison Seyb, formerly DPI NSW)

Black root rot

Thielaviopsis basicola

Symptoms

Affected crops may be slow growing or stunted, especially during the early part of the season. The disease causes destruction of the root cortex (outer layer), seen as blackening of the roots. Some roots may die but *T. basicola* does not kill seedlings by itself. Severe black root rot opens the root up for infection by *Pythium* or *Rhizoctonia*. Plants that are badly affected early in the season may not continue to show symptoms later in the season as the dead cells of the root cortex are sloughed off when growth resumes in warmer weather.

Host range

The host range of *T. basicola* includes all varieties of cotton, most legumes including faba bean, soybean, cowpea, field pea, chickpea, mung bean, lablab and lucerne. *Datura* weeds (thornapple, castor oil) are also hosts, but little is known about other weeds. Non hosts include all the cereal crops, sunflower, canola and vetch.

IDM tactics

- Choose varieties that can 'catch up'.
- Use Bion seed treatment.
- Prepare beds well ('high and firm' not 'low and loose')!
- Pre-irrigate and/or plant into moisture.
- Delay sowing if possible, until soil temperature are 16°C and rising.
- Rotate with biofumigation crops such as vetch or mustard.
- Avoid legumes and control weeds.
- Minimize your tailwater.
- Always practice good farm hygiene.
- Summer flooding if possible.



Black root rot. (Stephen Allen, CSD)

Verticillium wilt*Verticillium dahliae***Symptoms**

Leaf mottle – yellowing between the veins and around the leaf margins, vascular discolouration or browning extending throughout the stem and into the petioles, root system otherwise healthy, some defoliation may occur if cool.

Internal symptoms can be checked by cutting the stem. The vascular tissue of an infected plant will reveal flecking brown discolouration extending throughout the stem and into the petioles. Under Australian conditions with Australian strains of the pathogen, all plants with vascular symptoms will also display foliar symptoms,

The discolouration is similar to that of *Fusarium* wilt but usually appears as flecking rather than continuous browning. Severe cases often need to be tested by a pathologist to determine whether the pathogen is *Fusarium* or *Verticillium*. The root system appears otherwise healthy.

Favoured by

Resistance to the disease is temperature sensitive. Varieties that are resistant at 25°–27°C are susceptible at 20°–22°C. The disease is most severe during extended wet weather and/or waterlogging and in late maturing crops. The disease is favoured by excessive use of nitrogen which results in late season growth and also by potassium deficiency.

Host range

V. dahliae has a large host range which includes sunflower, soybean, noogoora and bathurst burr, saffron thistle, thornapple, caustic weed, bladder ketmia, burr medic, black bindweed, pigweed, devils claw, turnip weed, mintweed, blackberry nightshade and others.

Non-host crops include sorghum and cereals.

IDM tactics

- Select varieties with a high V.rank.
- Manage for earliness, including optimizing nutrition and water inputs.
- Avoid late season irrigations.
- Incorporate cotton residues soon after harvest.
- Rotate with non-hosts such as cereals or sorghum.
- Control alternative weed hosts.
- Minimize your tailwater.
- Always practice good farm hygiene.



Verticillium wilt. (Stephen Allen, CSD)

Fusarium wilt*Fusarium oxysporum* var. *vasinfectum* (FOV)**Symptoms**

External symptoms include stunted growth and dull and wilted leaves followed by yellowing or browning of the leaves and eventual death from the top of the plant. Some affected plants may reshoot from the base of the stem. External symptoms can appear in the crop at any stage. Most commonly they become apparent in the seedling phase when plants are beginning to develop true leaves, or after flowering during boll fill. Symptoms can appear as only a few, individual plants or as a small patch, often but not always in the tail drain or low-lying areas of the field.

Internal symptoms can be checked by cutting the stem. An affected plant will reveal continuous brown discolouration of the stem tissues running from the main root up into the stem. The discolouration is similar to that of *Verticillium* wilt but usually appears as continuous browning rather than flecking.

Favoured by

Use of susceptible varieties. Stresses in the crop such as waterlogging, root damage through cultivation and cool, wet growing conditions. Spores surviving in soil and on crop residues can be spread by overland flows, in irrigation water and attached to people and machinery.

Host range

The FOV pathogen is specific to cotton but can live on the residues of most non-host crops. Known alternative weed hosts include bladder ketmia, sesbania pea, dwarf amaranth, bellvine and wild melon.

IDM tactics

- Select varieties with a high Frank
- Delay planting if possible until soil temperatures are 16°C and rising.
- Ideally root pull, with crop residues slashed and retained on the surface for at least one month prior to incorporation.
- Rotate with non-hosts for up to 3 years. Hosts such as legumes can potentially increase disease. A summer sorghum/maize-fallow-cotton rotation can increase cotton plant survival, reduce disease incidence and increase yield in the third year compared to continuous cotton.
- *Fusarium* can survive on non-host crop residues, so residues should be buried or baled as soon as possible after harvest. Avoid green manure crops.
- Avoid inter-row cultivation



Fusarium wilt. (Linda Smith, Qld DAFF)

Alternaria leaf spot

Alternaria macrospora

Alternaria alternata

Most commercial varieties of cotton are relatively resistant to *Alternaria* and the impact of the disease on yield is insignificant, unless the crop is severely affected with premature senescence associated with potassium deficiency. Pima cotton is very susceptible.

Symptoms – *A. macrospora*

Brown, grey brown or tan lesions 3–10 mm in diameter on lower leaves, sometimes with dark or purple margins. Circular dry brown lesions on bolls.

Pima varieties can defoliate rapidly when the environment favours the disease.

Symptoms – *A. alternata*

Purple specks or small lesions with purple margins on bolls and leaves.

Favoured by

Heavy dews or extended periods of wet weather resulting in long periods of free moisture on the leaf. Suppressed by hot dry weather. Nutritional stress can favour development. Pima varieties are quite susceptible.

Host range

Cotton, bladder ketmia, sida and anoda weed.

IDM tactics

- Manage crop to avoid extremely rank growth.
- Foliar fungicide sprays are available for the control of *Alternaria* leaf spot on Pima cotton.



Alternaria leaf spot. (Chris Anderson, NSW DPI)

Boll rot and Tight rock

Boll rots are caused by a number of pathogens including fungi and bacteria. Tight lock refers to a type of boll rot, where the lock remains hard and fails to fluff out.

Symptoms

Bolls infected by *Phytophthora nicotianae* var *parasitica* appear dark brown to black, sometimes with areas of white mould on the surface. *Phytophthora* boll rot usually occurs when soil is splashed up onto low bolls that are beginning to crack open or when low bolls are subject to inundation. *Fusarium* boll rot (not *Fusarium* wilt) causes similar boll rots, with mould sometimes having a pink discolouration. *Diplodia* boll rot starts as dark brown lesions which rapidly expand to cover the whole boll as rot progresses. In the later stages of development, bolls become

covered in a black smut-like fungal growth which can easily be rubbed off the boll surface.

Sclerotinia boll rot characteristically has black sclerotia (2 to 10mm diameter) within and/or on the surface of the rotted bolls. A white cottony fungal growth may be present and the branch adjacent to the bolls may be affected. The sclerotia germinate to produce apothecia (small cream coloured 'golf tees' – not to be mistaken for bird's nest fungi) which release clouds of microscopic spores that can only infect the plant through dead or dying tissue. The fungus then grows into healthy plant tissue such as the developing boll and down the fruiting branch towards the main stem. Several other fungi can cause secondary boll rots in cotton, taking advantage of wounds in boll wall.

Favoured by

Boll rots are favoured by wet and humid conditions especially from a thick rank canopy and high moisture from rains and dews.

Rainfall on exposed soil that splashes soil up onto low bolls enables infection for some boll rots. Low mature bolls and lodged plants are at high risk of infection.

Boll rots and tight locks can also develop when bolls that are opening are exposed to wet weather.

Host range

There are a broad range of fungi and bacteria involved in boll rots and host range varies between species.

IDM tactics

- Manage crop to avoid extremely rank growth.

Cotton bunchy top (CBT)

It has been reported from the Macquarie Valley (south) to the Emerald region (north). CBT, a viral disease, is spread by the cotton aphid (*Aphis gossypii*, Glover).

Symptoms

Symptoms include reduced plant height, leaf size, petiole length, internode length and boll size. Leaf symptoms are usually an angular pattern of pale green leaf margins with darker green centres. The angular patches turn red as leaves age. Leaves are leathery and brittle compared to leaves on



CBT has a distinctive leaf mottling. (Stephen Allen, CSD)

healthy plants. Usually a period of 3–8 weeks lapses between infection and when symptoms first appear. Affected plants often occur in patches or crop edges and are associated with areas of highest aphid activity. When plants become infected very early, the growth of the whole plant is affected taking on a compact, stunted, 'climbing ivy' appearance. Early infection has the greatest potential to reduce yield. The extent to which yield is affected also depends on the proportion of plants infected. If the proportion infected is high (>50%), yield may be reduced.

Favoured by

CBT can only survive in living plants. Fields at highest risk of CBT are those with high aphid populations, in close proximity to ratoon cotton. Ratoons act as both a preferred host for the aphids and a reservoir for the disease, creating a source of infection in the new season. Disease spread is favoured by climatic conditions suitable for aphid reproduction, feeding and spread. The risk from CBT is probably higher after wet winters and lower after dry winters. Cotton aphid has a broad host range, including many weeds. The presence of weed hosts allow cotton aphid populations to persist overwinter, increasing the likelihood of aphids moving into cotton early in the season.

Host range

The most critical alternative host plant is ratoon volunteer cotton. They survive between seasons, retaining leaves through winter and supporting infected aphid populations from one season to the next. Seven natural field hosts and one experimental host CBT have been identified. These include cotton, *Malva parviflora* (Marshmallow weed), *Abutilon theophrasti* (Velvetleaf), *Anoda cristata* (Spurred anoda), *Hibiscus sabdariffa* (Rosella), *Sida rhombifolia* (Paddy's lucerne), *Chamaesyce hirta* (Asthma plant) and *Gossypium australe*. These are currently the only known hosts of CBT. However the virus may have a wider host range than originally thought and include further non-Malvaceae species like asthma plant (family Euphorbiaceae).

IDM tactics

1. Avoid the problem

- Break the green bridge. Elimination of hosts, particularly over winter, is the most effective means of minimising recycling CBT risk.
- Good crop destruction and control of ratoons and volunteers is critical for controlling CBT and cotton aphid.
- Good farm hygiene to control broad leaf weeds will reduce the risk of cotton aphid.

2. Manage the risk

- Don't over-react to aphids. Excessive use of aphicides will select resistance and restrict control options.
- If aphid populations are unhealthy (many beneficials present, high mortality and little spread) then keep monitoring. If healthy then consider selective control so that beneficials can provide ongoing mortality.
- If a high influx of aphids is experienced consider a quick selective control to reduce the risk of CBT infection.
- Maintain the beneficial complex to help control aphids.

Reniform Nematode

Reniform nematodes (*Rotylenchulus reniformis*) have been confirmed as affecting cotton in some fields in Central Qld.

Symptoms

Feeding causes damage to the plant resulting in stunting and generally poor plant growth. Populations can be quite uniform in their distribution across a field, making detection of early plant symptoms difficult.

Presence/absence sampling

Growers and consultants across the industry are asked to monitor for patches of unexplained unthrifty or stunted plants and send a sample of soil if concerned.

1. Mark patches with GPS or on a map so that they can be monitored next season.
2. Scrape off the dry top soil and sample 10-15cm deep using a small trowel or soil corer.
3. If there is more than one patch in a field, collect multiple samples from these areas in a bucket, and mix through.
4. Place approximately 400g in a clearly labelled plastic bag.
5. Postage and handling - The extraction process relies on live nematodes so please keep cool in an esky without an ice brick, and do not store samples in the fridge. Never send a sample on a Thursday or a Friday. Label samples with permanent marker towards the bottom of the bag. Include a sample sheet with:
 - Sample site (farm/field name and GPS references);
 - Date and time sampled; and,
 - Contact name, number and email address.

Contact Linda Smith, DAFF Qld, 07 32554356 for details.

IDM tactics

- Rotating with non-host crops such as wheat or sorghum reduces nematode levels.
- Management of cotton stubble is important. Cotton stalks should be cut and soil tilled through the stubble zone immediately after harvest (or as soon as is feasibly possible) to destroy these breeding sites.
- Ensure root-cutting is successful and there is no re-growth.
- Bare fallows are a very good management option. However success depends on having no host plants in the fallow (cotton or weedy hosts), and the length of the fallow because the longer the better.
- Plant into good conditions including optimum soil temperature, no water stress and well formed beds.