

Disease management

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Developing an Integrated Disease Management (IDM) strategy for your farm



Effective disease management must be integrated with management of the whole farm. Basic strategies should be implemented regardless of whether or not a significant disease problem is evident. These basic strategies should focus on the host, the pathogen and the environment.

Host

A particular plant may be immune, resistant or susceptible. Breeders also use the term 'tolerance' to imply good performance (yield) despite the presence of the disease.

1. Plant resistant varieties

- Level of resistance to Verticilium wilt indicated by a higher V.rank.
- Levels of resistance to Fusarium wilt indicated by a higher F.rank.
- Consider seedling vigour of variety particularly when watering up or planting early. Refer to CSD variety notes for more information.
- When the Black root rot pathogen is present, use more indeterminate varieties that have the capacity to catch up later in the season.
- For back to back fields, disease risks can be higher increasing the value of planting resistant varieties and late planting.

BE AWARE OF

- Control volunteer and ratoon cotton throughout the year.
- Ensure vehicles, equipment and people have followed Come Clean Go Clean.
- Where pathogens are known to be present, plant resistant varieties as late as possible in the window.
- Monitor crops throughout the season for diseases.
- Manage crop residues and consider crop rotations based on best practice for diseases present in field.
- Utilise industry pathology services where unusual symptoms or new diseases are present.

- Bacterial blight is endemic in all cotton areas. All commercial varieties offer robust resistance to current strains of bacterial blight.

2. Grow a healthy crop

- A healthy crop is more able to express its natural resistance to disease.
- Adopt a balanced approach to crop nutrition, especially with nitrogen and potassium. Both deficiencies and excesses provide better conditions for the development of diseases such as Verticillium and Alternaria.
- Excess nitrogen greatly increases the risk of boll rot particularly in fully irrigated situations.

3. Replanting

Replanting decisions should be made on the basis of stand losses, not on the size of the seedlings. For more information refer to Chapter 7c.

Pathogen

A pathogen must be present in the area, capable of surviving the inter-crop period and adapted for effective dispersal between host plants if a disease is to occur.

4. Conduct your own field disease survey

- Know what diseases are present and where they are present by conducting a disease survey in November and February of each season. Monitor and record to see if diseases are increasing. Refer to *myBMP* for a template to assist with conducting a disease survey.
- If a suspect cotton plant/s is located, submit suspect samples and healthy comparison plant samples to a plant pathologist for diagnosis/confirmation. Refer to the Cotton Pest Management Guide for information.
- Train farm staff to recognise cotton plant diseases. 'Symptoms of diseases and disorders of cotton in Australia' is a useful reference to keep in the ute or go to the Cotton CRC website for symptoms tool.



Boll rot. (Stephen Allen, CSD)



Fusarium wilt. (Linda Smith, DEEDI)

5. Good farm hygiene is practiced

- Encourage all staff and visitors to ‘Come Clean-Go Clean’.
- Minimise the risk of moving diseases onto or off your farm or from one field to another by considering machinery movements within the farm and having a strategy for ensuring clean movement of machinery onto and around the farm.

6. Crop residues are managed to minimise carryover of pathogens into subsequent crops

- The pathogens that cause Verticillium wilt, Fusarium wilt, Black root rot, boll rots, seedling disease and Alternaria leaf spot can all survive in association with cotton and some rotation crop residues.
- Manage crop residues to minimise carryover of pathogens into subsequent crops. Incorporate cotton crop residues as soon as possible after harvest, except where Fusarium wilt is present.
- Where Fusarium is present residues should be slashed and retained on the surface for at least one month prior to incorporation.



Verticillium wilt. (Stephen Allen, CSD)



Alternaria leaf spot. (Chris Anderson, I&I NSW)

- The Fusarium wilt pathogen can also survive and multiply on the residues of non-host crops such as cereals. Currently recommendations are that residues should be buried or baled as soon as possible after harvest.

7. Crop rotations are utilised to assist in disease management

- Use rotation crops that are not hosts for the pathogens present. The Verticillium wilt pathogen has a large host range and most legume crops are hosts of the Black root rot pathogen. Legumes such as mungbeans and fababeans also increase the Fusarium wilt pathogen.
- The Rotation Crop Comparison Tool can assist with developing a rotation strategy.

8. Control alternative hosts and volunteers

- The pathogens that cause Verticillium wilt, Fusarium wilt, Black root rot, Tobacco Streak Virus and Alternaria leaf spot can also infect common weeds found in cotton growing areas. Control alternative hosts to prevent



Tobacco streak virus. (Murray Sharman, DEEDI)



Cotton bunched top. (Stephen Allen, CSD)

build up of inoculum and carry over of disease from one season to the next.

- Cotton volunteers and cotton ratoons significantly increase the risk of diseases such as Cotton Bunched Top carrying over between seasons.

9. Application of fungicides

- Fungicides are not a major component of disease management in Australian cotton.
- Where appropriate use seed treatments for seedling disease control and foliar sprays for the control of *Alternaria* leaf spot on Pima cotton.
- While Bion is not a fungicide it has been shown to improve seedling survival where *Fusarium* is present.

10. Biofumigation

- In addition to fixing substantial quantities of nitrogen, vetch has a biofumigation effect against Black root rot.

11. Control of insect vectors

- Diseases caused by a virus or phytoplasma can often be prevented by controlling the vector that carries the pathogen.
- Cotton Bunched Top (CBT) can be transmitted by aphids feeding on infected plants then migrating to healthy plants. Transmission of Tobacco Streak Virus (TSV) to plants relies on the virus from infected pollen entering plant cells through the feeding injury caused by thrips.
- Viruses can only survive in living plants. Control of cotton ratoons and volunteers throughout winter will reduce pathogen levels and also lowers vector insect populations, drastically reducing disease risk

Environment

Pathogens have optimum environmental requirements for infection to occur and for the disease to spread and multiply in the host plant. It may appear difficult to manipulate the environment but it can be achieved by altering row or plant spacing, irrigation method or frequency or by changing the sowing date.

12. Preparing optimal seed bed conditions

- Plant into well prepared, firm, high beds to optimise stand establishment and seedling vigour.
- Carefully position fertiliser and herbicides in the bed to prevent damage to the roots.
- Fields should have good drainage and not allow water to back-up and inundate plants.
- Tail water should also be managed to minimise the risk of disease spread.

13. Irrigation scheduling

- Applying water prior to planting provides better conditions for seedling emergence than watering after planting.
- Watch for signs of water stress early in the season if the root system has been weakened by disease (eg. Black root rot) and irrigate accordingly.
- Avoid waterlogging at all times, but especially late in the season when temperatures have cooled.
- Irrigations late in the season can result in a higher incidence of *Verticillium* wilt.

14. Agronomic management

- High planting rates can compensate for seedling mortality however a dense canopy favours development of bacterial blight, *Alternaria* leaf spot and boll rots. Avoid rank growth and a dense canopy with optimised nitrogen and water and with the use of growth regulators where required
- Manage irrigations, nutrition and insects for early maturity as many pathogens are favoured by cool conditions at the end of the season.
- Balanced crop nutrition is provided to assist the plants' natural resistance to disease.
- In fields where *Fusarium* wilt is present avoid inter row cultivations after seedling stage as mechanical damage to the roots provide a site for infection by the pathogen.

15. Sowing date

- Delay sowing as late as possible within the planting window to avoid cool, wet conditions that favour disease. Sowing when the soil temperature is above 20°C would be best for reducing cotton's susceptibility to disease, but generally this is not practical. Time planting to coincide with soil temperatures of at least 16°C and rising.

16. Soil health

- Cotton is highly VAM dependent. Bare fallow for more than one season or removal of top-soil (especially more

than 40cm) may result in a severe lack of mycorrhiza (VAM deficient); a cereal or green-manure crop may restore sufficient mycorrhizal fungi for cotton. Refer to the cotton rotation poster for more information.

Farm hygiene

Farm hygiene strategies are important in controlling the spread of diseases. This is particularly important where fusarium wilt and black root rot diseases are present in fields.

Good farm hygiene measures include:

- Ensuring machinery and vehicles that enter or leave the farm are free of dirt or crop debris.
- Keeping irrigation tail-water and run-off water on the farm.
- Controlling weeds and cotton volunteers within and around fields.
- Using a crop rotation strategy.
- Maintaining good soil nutrition levels.
- Minimising spillage and loss when transporting modules, hulls, cotton seed or gin trash.

KEY TO DISEASES AND DISORDERS OF SEEDLING COTTON

Choose your most obvious symptom from the column on the LEFT or RIGHT possible causes can be found in the centre column.

Symptoms	Disease or Disorder	Symptoms
Seedlings not emerging	Soil too cold	Seedlings dead or dying
	Soil crusting	
	Sowing depth	
	Rhizoctonia	
	Pithium	
	Wire worm	
	Fusarium wilt	
	Herbicide	
	Fertiliser burn	
	Soil compaction	
Spots or dead areas on leaves	Wind damage	Leaves discoloured or distorted
	Lightning	
	Bean root aphid	
	Alternaria leaf spot	
	Bacterial blight	
Seedlings stunted without obvious	Herbicide	
	Wind damage	
	Thrip	
	Mycorrhiza	
	Herbicide	
	Bacterial stunt	
	Black root rot	
Mycorrhiza		
	Soil compaction	
	Bean root aphid	

In season disease trouble shooting

Early season

- Compare number of plants established per metre with number of seeds planted per metre. Refer to section 7C for further information about crop establishment and replanting decisions.
- Walk the field and look for plants that show signs of poor vigour or unusual symptoms.
- Examine seedling roots.

During and late in season

- Walk field and look for plants that are dead, show signs of poor vigour or have unusual symptoms.
- Cut stems and examine for discoloration.

Where disease is detected in new fields, or if unsure about diagnosis, send samples of both the affected and unaffected plants to:

Cotton Pathologist
Ecosciences Precinct,
Basement 3 Loading Dock, Off Joe Baker Street,
Dutton Park Qld 4102

For more information:

Cotton Pest Management Guide

Integrated disease management manual

(www.cottoncrc.org.au) or Contact Susan Maas 0749837403

myBMP has more information on good farm hygiene including appropriate come clean go clean protocols and resources to help implement a comprehensive farm biosecurity plan.

Rotation Crop Comparison Tool, Cotton CRC website.

Booklet available from CRDC Phone 02 6792 4088.

COTTON PLANTS

Choose your most obvious symptom from the column on the LEFT or RIGHT possible causes can be found in the centre column.

Symptoms	Disease or Disorder	Symptoms
Plants completely dead	Fusarium wilt	Plants defoliating or wilting
	Sudden wilt	
	Lightning	
	Cultivation	
Leaves with discoloured spots or dead areas and spots	Verticillium wilt	
	Sunscald	
	Mites	
	Bacterial blight	
	Tropical rust	
	Nutrition	
Bolls with spots or dead areas, or completely dead	Wind damage	Leaves or shoots distorted
	Chimera	
	Alternaria leaf spot	
	Bunchy top	
	Herbicide	
	Bacterial blight	
	Boll rot	
	Boll dangle	
	Boll damage	

Are you at risk of Cotton Bunchy Top (CBT)?

The wet late winter/spring in 2010 has taken what was a very low level of CBT incidence to one that is highly visible in many cotton crops and volunteers late in the season, with some crops having severe yield impacts. Actual yield losses in 2010–11 are lower than 1998/99 (estimated at about 25% yield loss on 21% of the area equal to 5.2% loss across the whole industry and \$140/ha). However, a winter/spring conducive to volunteer/ratoon, weed, aphid & CBT survival, could affect your yield next season.

Can you afford to let CBT affect your crop?

Over-winter risk factors for CBT

Do you have any volunteer or ratoon cotton on your farm?

CBT can only survive in living plants. Host plants, especially volunteer and ratoon cotton become the bridge that allows the virus to continue season to season. Elimination of hosts, particularly over winter, is the most effective means of minimising the risk of CBT and will also remove an important over winter host for cotton aphid.

Do you have any broadleaf weeds?

Good on-farm management of broadleaf weeds is important as they can also host aphids and some may be hosts for CBT.

What is CBT?

CBT is a viral disease that is spread by cotton aphid (*Aphis gossypii*). While cotton can compensate for a proportion of plants being infected, if the proportion of CBT infected plants is too high (>15–20% plants), there can be serious yield implications.

CBT is characterised by small leaves, short internodes and small bolls. Leaves usually have pale green angular patterns around the margin with darker green centres and will have a leathery texture. Crops affected as seedlings, take on a compact, stunted, 'climbing ivy' appearance. There is a 3–5 week delay from infection to obvious symptoms. Symptoms are difficult to distinguish in older volunteer cotton and late crops (post cut out) where there has been insufficient new growth to show symptoms.

For more information refer to the CBT tech note available from www.cottoncrc.org.au

