



Fusarium wilt update

March 2000

Compiled by Greg Salmond¹ and pathologists from the Cotton CRC

This season cotton growers on the Darling Downs have experienced a dramatic increase in the incidence of the disease fusarium wilt in their cotton crops. The worst affected areas are the Central and Southern Downs, with samples from other Darling Downs districts confirming that fusarium wilt has spread over a large proportion of the current production area. For the first time, this disease has been officially confirmed in several dryland cotton crops.

Other cotton districts have also had the disease confirmed for the first time from plant samples this current season. Growing districts of Warren and Moura are now no longer regarded as fusarium wilt free. At the time of writing, suspected fusarium wilt plant samples had been received from the Upper Namoi and Bourke districts and are undergoing laboratory testing. New outbreaks have also been recorded in the St George district.

Once fusarium wilt is confirmed on a farm, both seed companies **must** be informed of the farm's location. Fusarium wilt can be seed borne. Informing seed companies is **critical** for the Australian cotton industry to ensure the production of disease free seed.

MOST COMMONLY ASKED QUESTIONS ABOUT FUSARIUM WILT

What is fusarium wilt?

Fusarium wilt is a disease of cotton caused by the soil-inhabiting fungus *Fusarium oxysporum* f.sp *vasinfectum* (**Fov**). The disease was first confirmed in Australian cotton crops on the Darling Downs in March 1993.

Australian isolates of *Fov* are different to *Fov* found in other cotton producing countries around the world. Vegetative compatibility group (VCG) analysis and DNA finger printing techniques have identified two unique strains of *Fov* in Australia - VCG 01111 (formerly known as the Darling Downs Strain) and VCG 01112 (formerly known as the Boggabilla Strain). Both strains are equally capable of causing fusarium wilt disease in all currently available commercial cotton varieties.

What has caused this disease to be more severe this year?

The new occurrences of *Fov* this year are not the result of spread this year. It is more likely that *Fov* arrived several years ago and the number of spores has only now built up enough to cause noticeable disease.

Seasonal conditions during the 1999-2000 growing season have been ideal for the development of *Fov*.

- *Fov* is a stress related pathogen meaning that cotton plants will become more susceptible when stressed. The fungus is able to rapidly colonise the stressed plants.
- Temperatures experienced this past growing season have contributed to plants suffering severe stress. November 1999 on the Darling Downs was the coldest on record. Long periods of unusual cold shock conditions were experienced early in the growing period. The severe heat wave conditions experienced in January (after periods of mild temperatures) contributed to additional plant stress. After both these events, widespread plant deaths as a result of *Fov* infection were reported from many areas.



- Disease symptoms are most commonly seen in cotton crops:
 - * in the seedling phase, after flowering or during boll fill;
 - * a few days after an irrigation, or as a result of over-irrigation;
 - * after water stress (too much or too little);
 - * in plants injured from either fertiliser burn, mechanical implements, or even hail;
 - * and may be first noticed in tail drain areas of fields where plants are stressed from waterlogging.
- As a result it is critical that any unusual patches in fields should be investigated.

How long can the spores of the fungus last in the soil?

Some spores of the fungus (*Fov*) can survive in the soil for at least 10 years, even in the absence of cotton. If highly susceptible cotton varieties continue to be grown in infected fields, the *Fov* population in the soil will build up to the point where production will not be possible even with the most tolerant varieties of cotton. This has already occurred in some fields on the Darling Downs.

Are there alternative hosts?

YES! Bladder ketmia, sesbania pea & dwarf amaranth are hosts that show no external symptoms. These weeds may act as an on farm reservoir for the disease. There is evidence that the fungus can also survive on the residues of other crops and weeds.

Can the fungus be spread from one field to another or from one farm to another?

YES! The disease can spread from field to field, farm to farm and even region to region. Spores of the fungus are effectively spread over long distances in infested soil attached to boots, vehicles, farm machinery and equipment and also in water (irrigation and overland flows). It can also be transferred in infected plant material.

What should growers do if they suspect fusarium wilt in their cotton crops?

Early detection and containment of new outbreaks are key strategies for managing *Fov*. All farm staff and contractors should be advised of the symptoms and be encouraged to be on the lookout.

Growers are encouraged to send stem sections from suspect plants for examination at the DPI

Farming Systems Institute Plant Pathology Laboratories in either Toowoomba or Indooroopilly. Early detection of outbreaks on properties in St George and Theodore in past seasons enabled management strategies to be implemented quickly. Management of *Fov* will be most effective if the whole district agrees to implement a strategy to minimise its spread.

It is essential that specimens from new outbreaks be analysed to detect any new strains of *Fov* and to monitor the stability of current strains.

What are the current recommendations to manage this disease?

In regions or fields where the disease has only just been found it is extremely important to detect all outbreaks as soon as possible and to maximise efforts to contain the spread.

With small patches

- Pull out affected plants and burn them on the spot. Consider soil solarisation (see below). Raking and burning the whole field at this stage is NOT an option as raking is likely to spread the disease.

With large patches

- Kill affected plants, preferably by spraying with herbicide and leaving them to die in place (this includes regrowth and volunteer plants)
- Sow a persistent ground cover in the fallow (eg. a legume) to stabilise the soil in the affected area and to prevent erosion after the cotton plants have died. Clean down any gear used for establishment and maintenance of the crop and do not allow tail water to leave the strip. Such areas may be suitable for the establishment of lucerne strips for IPM as long as traffic in and out of the area is minimised and not conducted under wet conditions.

With any patch

- Destroy one to two metres of plants in the "healthy" area surrounding the patch, taking particular care to minimise the transfer of affected soil from the area
- Reduce traffic to zero in the affected patches. Minimise traffic in adjacent areas and restrict it to dry conditions only.
- Stop irrigating affected patches. Use bunding to divert rainwater around the affected patch and, if possible, to contain rainwater that falls on it.
- Collect the trash from the tailwater of infested fields and burn it on-site. This is to minimise movement of infested trash to other fields.

Growers can reduce the impact of this disease, especially in areas where it has a restricted distribution by:

- Only growing tolerant varieties. Tolerant varieties will slow the build-up of *Fov* in the soil, in contrast to susceptible varieties. In some seasons disease incidence may increase substantially in tolerant varieties when weather conditions are particularly conducive to disease development. **Delta Emerald** and **Sicot 189** are the most tolerant commercial varieties at present. Both breeding programs are making major efforts to develop more tolerant lines. Field observations in recent seasons indicate that some Bt transformed varieties appear more susceptible to *Fov* than their conventional counterparts. Research work is continuing in an effort to understand and confirm this observation
- Field inspection for early detection and containment of isolated outbreaks
- Avoiding stresses in-crop such as over-irrigation, over application of nitrogen etc.
- Practising good farm hygiene to keep farms disease free (vehicle washing facilities/footbaths); Washdown with Castrol Farmcleanse is recommended to minimise disease spread. (refer to Cotton CRC information sheets *Farm Hygiene for Disease and Weed Control* & *Detergent based degreaser for disinfecting machinery to reduce the spread of Fusarium wilt of cotton*). The Castrol product Farmcleanse has been shown to have far greater activity against *Fov* spores in soil than Benlate (see article in Australian Cottongrower magazine April 1999). The temporary registration for use of Benlate on vehicles lapsed in May 1999.
- Ensuring all traffic including contractors

Come Clean! Go Clean!

- Changing stubble management: Early trial trends suggest that mulching infected cotton stubble and leaving it on the soil surface for a month before incorporation may be the best treatment to reduce in-field *Fov* spore levels. This is probably due to the effect of sunlight on the infected plant material. Most mulchers leave a proportion of the infected stem in the ground. However, machines are now available that will pull the whole plant and mulch in one pass (the "Excel puller-mulcher" is one model). Puller-mulchers should be better because more of the infected plant will be left on the surface.

Can the fusarium wilt fungus be eradicated from fields?

NO! However, some treatments may reduce the number of fungal spores....

Solarisation: In fields where small patches of fusarium wilt have been identified, solarisation under clear plastic for a minimum of 5-6 weeks during warm weather over moist soil has been shown to reduce the amount of fungus in the soil. If UV resistant plastic is used, leaving it down for a longer period of time would also help prevent soil movement off site. NB black plastic is ineffective. Following solarisation it is important to grow tolerant varieties in that field.

Flooding of fields: In some circumstances, and where appropriate, summer flooding of fields could be a management option.

Fumigation: The use of soil sterilants (eg. methyl bromide) is **not** recommended as it has been shown to increase the disease in some other crops. As well as killing many beneficial fungi and bacteria, such treatments rarely kill all the *Fov* spores. Spores then germinate and rapidly colonise the sterilised soil eventually leading to higher spore levels in the long term. Fumigants are in general less effective in heavy clay soils than in lighter soils.

What other research is currently being conducted to find answers for this serious problem?

- Identification of tolerant germplasm is being undertaken, both in the field and in the glasshouse, in collaboration with both CSIRO and Deltapine breeding programs.
- *Crop rotations:* Crop rotation studies are yet to be completed. Dr Stephen Allen (CSD, Narrabri) has trials underway in northern NSW (eg. wheat, barley and bare fallow). A PhD student working with Dr Joe Kochman found that *Fov* populations under sorghum and maize did not decrease significantly (in small pot trials). The effects of incorporating non-host crop residues will be investigated. Crop rotation trials are to be expanded on the Darling Downs. Initial research trends have to be verified over several seasons.
- *Biofumigation studies:* Dr David Nehl (NSW Ag, Narrabri) has used biofumigation crops (brassicacae or hairy vetch) to reduce the severity of black root rot in cotton. Dr Ian Rochester (CSIRO,

Narrabri) has shown that vetch also delivers a nitrogen bonus to the soil. Trials are underway to test the effect of hairy vetch against *Fov* and Verticillium.

- *Biocontrol*: Dr Subbu Putcha (NSW Ag Narrabri) is investigating the use of biocontrol (friendly bacteria) and to enhance resistance when using tolerant varieties. A combination of agents

appears to be achieving improved resistance in trials on *Fov* affected farms on the Darling Downs this season.

- *Irrigation*: Several irrigation treatments have recently come to our attention. Future research efforts will investigate the efficacy of these agents against *Fov* spores in irrigation water.

For further information please contact:

Dr Joe Kochman or Mr Neale Obst, DPI Farming Systems Institute, 203 Tor St, Toowoomba Q 4350

Ph: 07-4688 1245

Fax: 07-4688 1199

Email: kochmaj@dpi.qld.gov.au

Dr Natalie Moore or Mr Wayne O'Neill, DPI Farming Systems Institute, 80 Meiers Rd, Indooroopilly Q 4068

Ph: 07-3896 9337 or 3896 9436

Fax: 07-3896 9533

Email: mooren@dpi.qld.gov.au or oneillw@dpi.qld.gov.au

Dr Stephen Allen, CSD, Australian Cotton Research Institute, Wee Waa Rd, Narrabri 2390

Ph 02-67991500

Fax: 02-67931186

Email stephena@mv.pi.csiro.au

Dr David Nehl, NSW Agriculture, Australian Cotton Research Institute, Wee Waa Rd, Narrabri 2390

Ph 02-6799 1500

Fax: 02-6793 1186

Email davidn@mv.pi.csiro.au

Mr Greg Salmond, Senior Development Extension Officer- Cotton, DPI Farming Systems Institute, Cnr Drayton and Cunningham Sts, Dalby Q 4405

Ph: 07-4669 0815

Fax: 07-4669 4966

Email: salmong@dpi.qld.gov.au

Fusarium information on the Cotton CRC website has recently been updated including vehicle cleaning procedures and photographs of symptoms. Website: <http://www.cotton.pi.csiro.au>