Meeting the Fusarium challenge

By Sonya Tingay, Research Program Coordinator, CRDC

The incidence of Fusarium wilt continues to increase even with current hygiene practices in place. Dealing with Fusarium (Fov) in the soil is a key challenge to researchers and growers alike.

The Cotton Research and Development Corporation, along with the Australian Cotton CRC and CSD, sponsored Dr Patrick Colyer to visit the Australian cotton industry in February. Patrick is a plant pathologist with extensive Fusarium experience. He is based at the Red River Station, Louisiana, US. Patrick’s tour of Fusarium-infected cotton growing regions included discussions with breeders, researchers, pathologists, seed companies and growers.

This visit was organised by the Fusarium wilt of cotton research and extension coordinating committee (FUSCOM). In conjunction, a Biotechnology review of Fusarium-related research projects was held. This was organised by Dr Helen McFadden of CSIRO’s Division of Plant Industry.

Biotechnology and Fusarium Review meeting

Approximately 30 participants (mostly researchers) were involved in the Biotechnology Review. Research presentations were given and the projects were discussed extensively.

Key points

Steve Allen (CSD and Australian Cotton CRC) highlighted the importance of an integrated control strategy for the management of Fusarium wilt. He outlined CSD’s current trials testing Fusarium control strategies. These trials included testing of products to induce systemic resistance, the effects of metham sodium and
fertilisers, examining pre and post plant herbicides, as well as checking the current collection of ‘snake oils’.

Joe Kochman (QDPI Toowoomba) heads a large Fusarium wilt research effort. As Fov can be found in seed, there is high importance in ensuring Fov-free seed for planting continues to be able to be produced. Joe’s group is working at understanding the diversity and distribution of Fov through work being conducted by the Fusarium testing group and by the use of molecular methods.

Trials in the area of biocontrol for this season do not appear to be promising.

Rotation trials are in progress. Field and glasshouse experiments have been set up to examine the effect of rotation crops on spore levels. These trials are in their first year and will need several years of examination to get a good understanding of how spore levels are affected.

The group continues to test disinfestation agents, though Farmcleanse still rates as the best product. Farmcleanse is still available with an altered label that removes reference to Fusarium. Glasshouse screenings test breeding lines against Fov to assess resistance levels at a preliminary stage of breeding.

David Nehl (NSW Agriculture Narrabri), suggested that the disease is more widespread than is currently recognised. Part of David’s work includes annual surveys of Fusarium wilt to examine changes in disease levels with different varieties grown.

He stressed the importance of growers waiting for adequate research to be carried out in areas such as the use of biofumigation crops. Current experiments with mustard and canola suggest that there are situations in which these crops can cause an increase in the severity of Fusarium. David spoke of the build-up of plant pathogens as a response to the continuous use of a monoculture on the soil ecosystem.

Peter Reid (CSIRO cotton breeder), stated that there has been a rapid increase in Fusarium
breeding since 1998, with over 7000 plots currently in use. Sicot 70 has consistently rated higher in its resistance compared to Sicot 189. Sicot 289i is ranked highly after three trials.

In the presence of the disease, new lines coming through show further improvements in final survival percentages and yield. Steady progress continues to be made and further sources of resistance are being sought — for example from wild cotton species.

Biotechnology

The biotechnology presentations were divided into two sessions. The first session focussed on the pathogen, while the second looked at host aspects of the disease.

Dr Bo Wang (CSIRO Plant Industry), is investigating Australian native cottons as sources of resistance and examining new pathotypes of Fusarium wilt. There is a lack of sources of resistance effective against Australian isolates of the pathogen. Bo Wang has found that Fusarium species are commonly associated with wild cottons, both in the roots and in stems.

Interestingly, Fusarium oxysporum is prevalent in wild cotton populations in the rhizosphere, but has not been detected within the stems. This may suggest a source of resistance could be identified from the wild cotton. An extensive collection of native cotton species continues to be screened.

Resistant lines will be assessed for their suitability for use in breeding programs (see box story).

Dr Patrick Colyer’s review

Some of the key points of his review included:

• Sound practices need to be developed for testing seed to ensure its pathogen-free state.

• Admiration of the industry’s efforts in promotion and use of the ‘come clean, go clean’ campaign — but he stressed that this merely slows down the spread of Fov, rather than preventing it. Pat stated that this program
should continue to be strongly encouraged because the spread of the pathogen will be much faster without it.

- Crop rotation experiments take several years of research to determine which are effective.

- Overall field fertility was given importance in creating healthy, vigorous plants better able to fight off infections.

- Physical management, such as flooding, was encouraged with the appropriate analysis of spore levels.

- Biological control is known to be variable. If used, it should be done so as part of an integrated disease management program.

- For chemical management, fumigation would be an expensive exercise, which may have a role when Fov builds up to uniform, high levels.

- Dr Colyer urged breeders to examine tolerance along with screening for resistance. But the possible downside of tolerance is the role it may have in building up spore levels.

- In order to control Fusarium wilt, an integrated approach will be required and strategies should focus on reducing spore levels within the soil.

- Areas of research should include studies of pathogenicity differences, and the infection process (both of these areas are in progress).

Overall, Dr Colyer thought there was “an excellent cooperative effort in place that should facilitate a more efficient and rapid solution to the problem”. Many of his suggestions are already in place or are starting up as new projects that have been approved for funding by the CRDC.

Future research

CRDC will establish a committee to outline a Fusarium research program that will fill in gaps based on the Fusarium review outcomes and Dr Colyer’s suggestions. As well, to assist in the area of breeding, an expert in DNA marker technologies will be brought over from the US to
CSD has recently distributed a video entitled “Fusarium: Progress and Management”, which highlights research progress, plant breeding, and management issues. It was noted that growers needed Integrated Disease Management guidelines as soon as possible. Since the review, a meeting has been held to discuss the completion and production of these guidelines. It is anticipated that the guidelines will be released at the 11th Australian Cotton Conference in August.