Fusarium wilt in cotton on the Darling Downs in Queensland

J.K. Kochman[1], K.G. Pegg[2], R.D. Davis[2], N.Y. Moore[3] and S. Bentley[4]

1. Department of Primary Industries, P.O. Box 102, Toowoomba Q 4350
2. Department of Primary Industries, Meiers Rd, Indooroopilly Q 4068
3. Department of Botany, University of Queensland, ST. Lucia Q 4072
4. Cooperative Research Centre for Tropical Plant Pathology, University of Queensland, ST. Lucia Q 4072

Introduction:

During the past two seasons, cotton crops growing in Queensland have been surveyed for diseases. In March 1993 specimens of wilted cotton were collected from the Brookstead area of the Darling Downs. Specimens from the same area were also supplied by local cotton consultants. Verticillium wilt is common in this area but the symptoms shown by these plants were not typical of that disease.

The symptoms were: wilting; extensive dark brown discolouration of the vascular system and; leaf and stem death often from the top down. Some affected plants were re-shooting from the base. Hence these specimens were examined in the laboratory to determine the cause of these symptoms.

The fungus *Fusarium* was consistently isolated from the vascular systems of these specimens. When this fungus was used to inoculate cotton seedlings they started to wilt after about two weeks. The fungus was re-isolated from the apical region of the wilted seedlings, indicating that it was a true vascular wilt pathogen.

In culture, the fungus exhibited the characteristics of *Fusarium oxysporum* and this identification was confirmed by Dr Lester Burgess (Sydney University). As the fungus was able to cause a vascular wilt in cotton it was likely to be *Fusarium oxysporum* f.sp. *vasinfectum* (*F.o.v.*).

Fusarium wilt in cotton overseas

Hillocks (1992) has published a very good review of Fusarium wilt in cotton in his book "Cotton Diseases". The disease was first described in the USA in 1892. It has since been identified in all the main cotton growing areas of the world except west Africa, Turkey and Australia (until now). Symptoms of the disease can appear at any stage of crop growth but more usually they occur in the adult plant during boll formation and filling.

Estimates of yield loss vary from 0.2% to 40% with national losses usually being very small. However, losses on individual farms have been high and the disease has discouraged farmers from growing cotton in areas where the disease has become prevalent.

Six races of *F.o.v.* have been identified to date. Races 1 and 2 occur in the USA, Race 3 in Egypt, Race 4 in India, Race 5 in Sudan and Race 6 in Brazil. The optimum temperature for disease development is about 30^0C. Infection is encouraged by warm moist conditions but symptoms are most obvious in hot dry conditions. There is also some evidence that high nitrogen and low potassium levels in soil increase the incidence of Fusarium wilt.

The fungus can survive in the soil for several years. Some weeds and crops can also be infected by the fungus and act as a source of infection for following cotton crops. The fungus can be spread in seed, crop debris, soil and, water.

The most effective method of control of the disease has been to grow resistant cultivars. The resistant cultivars produced in overseas breeding programs are not immune but show a reduced level of susceptibility to the disease.

Fusarium wilt in cotton in Australia

The identification of Fusarium wilt in cotton in March 1993 was the first confirmed record of this disease in Australia. However, the disease may have been present for several years without being detected. To date the disease has only been positively identified in the Brookstead/Cecil Plains area of Queensland.

Immediately following the detection of the disease on the Darling Downs the issue of quarantining the area was discussed. The disease is seed-borne but discussions with seed suppliers confirmed that planting seed was not drawn form this area and would not be in the future. It was not feasible to impose other quarantine measures nor was it possible to eradicate the disease from the area. This left the question of the quarantine restrictions on imported cotton seed. If the disease was the result of an adaptation within the local *Fusarium oxysporum* population allowing it to become pathogenic on cotton, then new

races could still be imported on cotton seed from overseas. At this time the quarantine restrictions for *F.o.v* in imported cotton seed remain.

Preliminary work to characterise the local isolate of *F.o.v* has started. The differential lines used to type races of the fungus have been imported through quarantine and these are currently being increased. There have also been preliminary attempts to compare the local isolate of the fungus with overseas races using *in vitro* Vegetative Compatibility Groups (VCG) and molecular based RAPD-PCR methods. Early data indicate that the local isolate may be different to the overseas races.

Eleven cotton cultivars have been inoculated with the fungus in pot trials. It must be stressed that inoculation techniques are still being developed but, the eleven cultivars varied in susceptibility to the fungus. The cultivar reactions were as follows:

Least Susceptible:	Siokra L22, Sicala V-1, DP 90 and Pima
Moderately Susceptible:	Siokra L23 and CS189+
Most Susceptible:	Siokra S-324, CS50, CS7S, Sicala 34 and Siokra 1-4

These results were based on the percentage of plants with symptoms of the disease four weeks after their roots were dipped in a suspension of the fungus. The percentage for Siokra L22 was about 34% and Siokra 1-4 about 87%. However, at 7 weeks after inoculation only Pima and Sicala V-1 had less than

50% of plants showing symptoms. How the data from these pot trials relate to the field situation has yet to be determined.

Planned future work in the disease

A new project with support funding from the Cotton Research and Development Corporation (CRDC) has just started, It has the following aims: i) Characterise and type the *Fusarium oxysporum* isolated from wilted cotton in the Brookstead/Cecil Plains area of Queensland. ii) Determine the distribution of Fusarium wilt in cotton growing areas during disease surveys. iii) Determine susceptibility/resistance of the Australian cultivars to the isolate of *F.o.* Field trials are also being planned to screen germplasm in infected areas on the Darling Downs. Data from this project should provide the basis for possible strategies to manage the disease in Australian cotton.

Acknowledgments

Fusarium wilt of cotton was detected during cotton disease surveys conducted with financial assistance from the Cotton Research and Development Corporation.

Literature Cited

Hillock R.J. (1992) Fusarium wilt. In *Cotton Diseases* R.J. Hillocks Ed., CAB International, Wallingford U.K. pp 127-160.