

DISEASES OF COTTON IN NSW - 1995-96

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Abstract

Verticillium wilt has been recognized as an important disease of cotton in Australia for many years. The common use of very susceptible cultivars resulted in an increasing incidence of the disease until 1990 when a high yielding resistant cultivar was released. The incidence of the disease has subsequently declined considerably. Black root rot, Fusarium wilt, Alternaria leaf spot and bacterial stunt are relatively new diseases which have rapidly increased in importance. The widespread adoption of reduced tillage practices with the retention of crop residues from season to season, the use of susceptible cultivars and the movement of pathogen inoculum in crop residues and soil by flood and irrigation water and on agricultural machinery have contributed to an increasing disease problem.

Verticillium Wilt

Verticillium wilt (Verticillium dahliae) has been one of the most common diseases of cotton in NSW for many years especially in the Namoi Valley region (Table 1). The mean incidence of the disease reached a peak in the 1989/90 season and has since declined significantly with the advent of high yielding, commercial cultivars with resistance to Verticillium wilt. The 1995/96 season was ideal for the Verticillium wilt pathogen and the incidence of the disease in the western areas of NSW, where the Verticillium resistant cultivars have not been so commonly grown, was higher than that previously observed.

The cultivars with resistance to Verticillium wilt are not immune to the disease. The incidence and severity of the disease in these cultivars is significantly lower than that in the susceptible cultivars when grown in the same field. The mechanism of this resistance is still unknown. The results of field experiments (Table 2) and the inspection of commercial crops has shown that repeated cultivation of the resistant cultivar produces a significant decline in the incidence of the disease.

One of the real concerns about the widespread adoption and repeated use of cultivars with resistance to Verticillium wilt is that it may lead to the selection of more virulent strains of the pathogen. To date there has been no evidence of this under field conditions. The severe defoliating strains of the pathogen have never been recorded on cotton in Australia.

Black Root Rot

The pathogen that causes black root rot of cotton (Thielaviopsis basicola = Chalara elegans) has previously been recorded in Australia on numerous ornamentals, legumes, tobacco and radiata and pinaster pine. Overseas reports indicate that it can cause disease in over 137 species of plants.

The disease was first reported on cotton in Australia in 1990. It has since been reported on farms in most cotton growing areas of NSW and on the Darling Downs of Queensland. In disease surveys in NSW in the last two seasons the disease was observed in 21 (22.3%) of the 94 commercial fields that were inspected (Table 3). The incidence of the disease exceeded 20% in 5 fields and 90% of plants were infected in one field in the Macquarie Valley.

The fungus that causes black root rot survives in the soil for long periods as dark, thick-walled resistant spores. The increased use of legume crops in rotation with cotton and weed hosts in the crop rotation assist in survival of the pathogen. The use of permanent bed systems may be contributing to the increasing prevalence of the disease by retaining high numbers of spores in the top of the hills directly beneath the germinating seeds of the following cotton crop. There were four times as many spores per gram of soil in soil collected from the center of the hill along the planting line than were found in soil collected 10cm from the centre of the hill.

Several seed treatments including some of those recommended overseas have been trialled in Australia with generally poor results.

Fusarium Wilt

Fusarium wilt of cotton (Fusarium oxysporum f.sp. vasinfectum) was first observed in a single field of cotton on one farm near Boggabilla in NSW in December, 1994. During the 1995/96 season the disease was found in four additional fields on three farms located near the original site. It would appear that all four of these fields may have been subject to inundation by water that had run-off the original infected field during local flooding that occurred more than five years ago. These same infested fields have again been subjected to local flooding during the 1995/96 season.

Fusarium wilt of cotton was first reported in Australia in crops growing in the Darling Downs region of Queensland in the 1992/93 season. The disease has also been reported in a field near Mungindi in Queensland. Isolates of the pathogen from all three sites and from other parts of the world have been compared using vegetative compatibility and DNA finger-printing (Kochman et. al., 1996). Isolates from the two Queensland sites were identical despite being geographically isolated from each other. Isolates from the

NSW site were distinctly different from the Queensland isolates. All Australian isolates were significantly different from the described races of the pathogen that occur elsewhere in the world.

Field experiments have shown that some of the current Australian commercial cultivars are more resistant than others.

Alternaria Leaf Spot

Alternaria leaf spot (*Alternaria macrospora*) of cotton has been common in Queensland for many years. In 1966 its occurrence in Queensland was described as "general; slight to moderate, sometimes severe in dry crops" (Simmonds, 1966). Prior to the 1987/88 season the disease had not been recorded on commercial cotton crops in NSW.

The results of disease surveys (Table 4) have shown an alarming increase in the occurrence of this disease in recent years. Alternaria leaf spot was found in all 64 commercial crops that were inspected in March 1996 and the mean incidence of the associated boll rot was 0.5%. In one crop 8.5% of bolls were affected. Two of the current commercial cultivars have been identified as being particularly susceptible. Instances of near complete defoliation in both 'hirsutum' and 'barbadense' cultivars have been observed. The disease is particularly severe in crops affected by a potassium deficiency syndrome.

Effective control of Alternaria leaf spot is difficult. It is recommended that growers should avoid the cultivars that are particularly susceptible to the disease. Residues from the previous crop should be thoroughly incorporated after harvest and volunteer seedlings and alternative weed hosts should be controlled. The strategic use of foliar fungicide applications for the control of Alternaria leaf spot of Pima cotton is being evaluated.

Bacterial Stunt

Bacterial stunt of cotton (Nehl et. al., 1996a, 1996b) is a newly described disease of cotton caused by a previously undescribed species of *Pseudomonas*. The disease is characterised by poor seedling growth, browning of the roots and poor mycorrhizal development. Bacterial stunt is most severe in crops growing in nutrient rich, heavy clay soils. The results of surveys indicate that the pathogen is probably widespread in the soil.

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References

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Table 1. The incidence of Verticillium wilt (%) in commercial cotton crops grown throughout New South Wales and in the Namoi Valley only.

Season	New South Wales	Namoi Valley only
1984/85	4.10	5.50
1985/86	4.90	11.10
1986/87	4.10	9.10
1987/88	5.30	13.00
1988/89	9.50	23.70
1989/90	16.60	31.20
1990/91	10.20	22.80
1991/92	12.40	23.40
1992/93	6.00	10.50
1993/94	5.80	8.90
1994/95	6.10	11.00
1995/96	5.00	4.70

Table 2. The mean incidence of Verticillium wilt of cotton with repeated cultivation of either a resistant or a susceptible cultivar.

Season	Susceptible Cultivar	Resistant Cultivar
1991/92	95	
1992/93	97.3	73.7
1993/94	99.7	63.3
1994/95	97	39.3
1995/96	100	41

Table 3. The occurrence (percentage of fields inspected where the disease was found to be present) and mean incidence (percentage of plants infected in those fields where the disease is present) of black root rot of cotton in NSW cotton growing areas.

Season	Occurrence	Mean Incidence
1989/90	1.3	0.001
1990/91	0	0
1991/92	2.3	0.002
1992/93	1.25	0.001
1993/94	6.2	0.55
1994/95	21.6	3.55
1995/96	23.2	4.04

Table 4. The occurrence and mean severity (percentage leaf area infected) of Alternaria leaf spot in commercial cotton crops in NSW .

Season	Occurrence	Mean severity
1987/88	20.6	0.02
1988/89	13.7	0.01
1989/90	3.2	0.003
1990/91	12.2	0.01
1991/92	17.5	0.29
1992/93	36.7	0.1
1993/94	62.5	0.58
1994/95	94.9	0.54
1995/96	100	0.52