COTTON PATHOLOGY 2002-2003

D. B. Nehl[1], S. J. Allen[2] and P. A. Lonergan[1]
[1]NSW Agriculture, Locked Bag 1000, Narrabri NSW
[2]Cotton Seed Distributors, PO Box 17, Wee Waa NSW
Australian Cotton Cooperative Research Centre

Commercial cotton crops across NSW (excluding Bourke) and Queensland were inspected in November 2002 and February-March 2003. The incidence and severity of those diseases present was assessed and field history, trash carryover, ground preparation, cotton variety, planting date and seed rate were recorded for each of the 88 and 29* fields that were surveyed in NSW and Queensland respectively. This represents the 20th consecutive year of quantitative disease surveys of cotton in NSW.

In most areas, there was very little rainfall during October and early November 2002. However, hot dry winds resulted in rapid drying of the upper soil profile leading to problems with seedling establishment, which in turn increased seedling mortality. The generally hot dry summer was not favourable to most diseases. The use of varieties with disease resistance, where available, and the minimisation of the spread of soilborne pathogens has been beneficial and should remain a high priority for the industry.

Seedling mortality

As part of the disease survey an estimate of the number of seeds planted per metre is compared to the number of plants established per metre. This comparison produces an estimate of seedling mortality which includes the impact of seedling disease (*Rhizoctonia* and *Pythium*) as well as seed viability, the activity of soil insects such as wireworms, physical problems such as fertiliser or herbicide burn and the effects of adverse environmental conditions.

Mean seedling mortality for the crops inspected in Queensland in November 2002 was 31.5% reflecting the adverse conditions early in the season (Figure 1). Some problems in the northern production areas were a consequence of rushed ground preparation because of rotation out of chickpeas in the preceding winter. In some fields chickpea harvest and cotton planting were only weeks apart. This resulted in problems with chickpea residues and fertilizer burn in some instances.

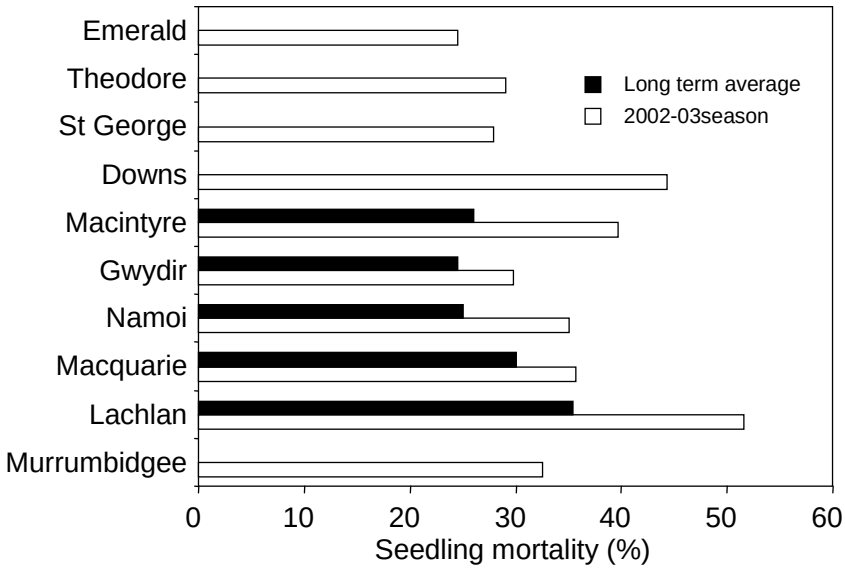

Figure 1. Seedling mortality in the 2002-03 season was higher than average in most areas

Mean seedling mortality for the crops inspected across NSW in November 2002 was 35.2%, which was the highest since 1989 (42.1%). Seedling mortality was lowest in the Gwydir valley (30%) and highest in the Lachlan valley (52%). Due to drying winds in early October and the absence of any rain, many crops were irrigated earlier than usual. Post-emergent seedling disease was severe when these early irrigations coincided with periods of cool overnight temperatures in October or early November. *Rhizoctonia* was prominent on the hypocotyls of dying seedlings. Furthermore, in many areas rapid drying of the soil after planting resulted in a 'compaction' effect that prevented proper root development. Symptoms on cotton roots included distorted tap roots, frequently appearing as a swollen stump level with the base of the planting slot, with a very thin tap root penetrating to the soil below. This restricted root growth resulted in stunted plant growth, wilting and death right up to December. In the Macintyre valley, where Fusarium wilt was present in most crops inspected, seedling mortality in 2002-03 was unusually high (40%).

Fusarium wilt

Fusarium wilt is not as widespread as other diseases yet. However, its distribution is increasing at an exponential rate. In the 2002-03 season there were seven new reports of Fusarium wilt on farms in NSW, bringing the total count to 72. This included three new cases in the Gwydir valley, one in the Macquarie valley, and one in the upper Namoi valley. All these new cases involved strain 11 (the 'Downs strain') which is the predominant strain. Strain 12 remains confined to a few fields close to Boggabilla, and strain 11 is now present in many of those fields. Unconfirmed reports indicate at least a further two cases in the Gwydir valley. Fusarium wilt has been reported on 31% of the 42 farms inspected regularly in NSW. It must be assumed that the pathogen is more widespread than reported. An epidemic of Fusarium wilt is clearly developing in NSW. If the pathogen continues to spread at the same rate, 90% of farms in NSW will be affected by 2010.

The weather conditions in Queensland production areas did not generally favour the severe expression of the Fusarium wilt early in the season. In a field near Dalby, that had been out of cotton for the previous 8 seasons, 37% of plants had symptoms of Fusarium wilt. There are still no reported cases of Fusarium in the Emerald area.

Further spread of Fusarium wilt is inevitable but efforts to minimise this spread should not be relaxed, as many farms do not have the pathogen. It is important that growers and consultants confirm and declare if the disease is present in an area. The Fusarium wilt diagnostic service provided by the QDPI is funded by the industry and free to growers. The majority of samples submitted return a negative result and some growers who are withholding samples could be worried unnecessarily. Alarmingly, there were reports in the 2002-03 season that some growers are ignoring suspected cases and applying pressure to their staff and/or consultants to prevent confirmation. This is a self-destructive approach to the problem and puts their livelihood, and their neighbour's, at risk. Early detection of the disease and establishment of a control program has proven to be the best approach.

Black root rot

The black root rot epidemic continues to expand in NSW. The disease has been observed in all but one of the farms that are regularly inspected in the disease surveys in the Macintyre, Gwydir, Namoi and Macquarie valleys. In these four valleys 72% of the crops inspected in the 2002-03 season had the disease, averaging 36% of plants (28% the previous season). Across the whole of NSW (including new production areas where the disease is not widely established) an average of 64% of cotton crops and 32% of plants (21% the previous season) were infected by the black root rot fungus. The Namoi and Macquarie valleys were worst affected, with 88% of the crops inspected having the disease. However, the disease was also observed in 50% of fields in the Gwydir and Macintyre valleys which is the highest recorded

to date. Dr Joe Kochman has reported black root rot of cotton in the Emerald and Theodore areas in the last couple of seasons. This means that the disease is now present in all production areas of Queensland. The severity of black root rot increases with successive cotton crops. There are currently no adequate control measures for black root rot. Many farms do not have the disease and farm hygiene should be practiced to minimise further spread.

As in previous seasons, there was no evidence of any interaction between black root rot and seedling mortality in 2002 (Figure 2). This suggests that reports of enhanced seedling mortality in association with black root rot are only applicable to patches of very severe black root rot.

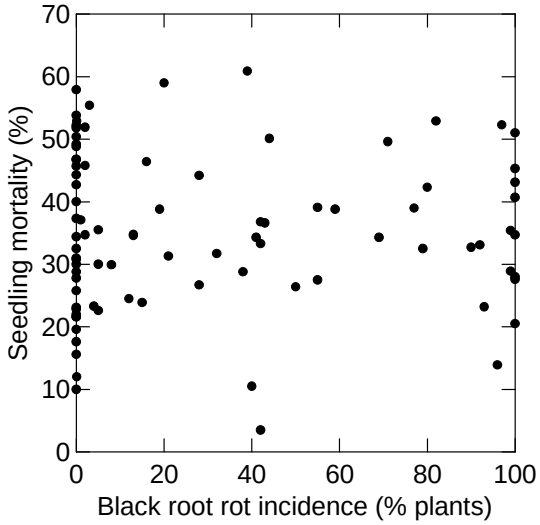

Figure 2. Lack of relationship between black root rot and seedling mortality of cotton across NSW in the 2002/2003 season ($r^2 < 0.001$, $p = 0.94$)

Verticillium wilt

The warm conditions experienced through most of the 2002-03 season were less favourable to the Verticillium wilt pathogen than in previous seasons and the mean incidence of the disease in commercial crops in NSW was 5.6 % of plants, slightly lower than in 2001-02 (6.7%). However, the incidence in most areas was below 4% (Figure 2). The average for NSW was heightened by the Namoi valley where 11.7% of plants had the disease (11.4 % the previous season). This recent increase in the incidence of Verticillium wilt in the Namoi valley probably reflects the declining use of resistant varieties. In the period from 1994 to 1997, around 90% of the Namoi valley crop was sown to resistant varieties (i.e. varieties with a 2002 V-rank of 90 or higher). In contrast, the average use of resistant varieties in the Namoi valley over the last four seasons was less than 50%.

In Queensland, Verticillium wilt was present in many of the crops that were inspected in the Darling Downs and St George areas in March 2003. Generally the incidence of the disease was quite low, although 16% of plants were affected in one crop near St George where the field had a 20 year history of continuous cotton.

The overriding factor in the severity of Verticillium wilt is prior cropping history. In some fields severe Verticillium wilt resulted in premature defoliation of plants late in the season; symptoms that could be confused with Fusarium wilt. These fields generally had a history of high levels of Verticillium wilt. If the trend for declining use of resistant varieties continues, then the severity of Verticillium wilt will increase accordingly.

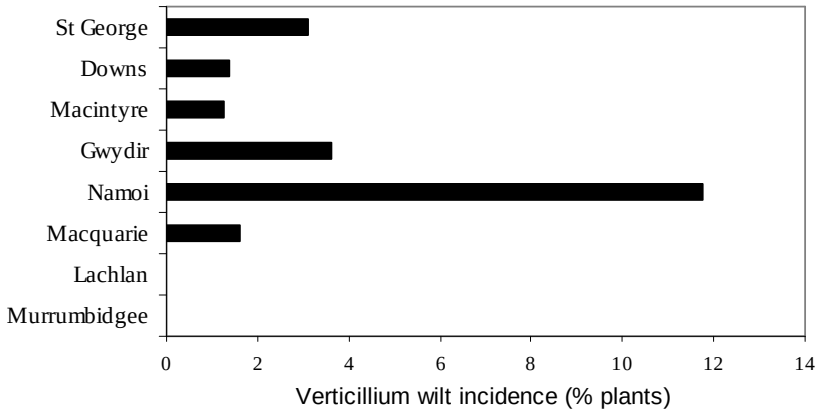

Figure 2. Incidence of Verticillium wilt in the 2002-03 season in Australia (Verticillium wilt has not been recorded on cotton in central Queensland or the Murrumbidgee valley)

Boll rots

Phytophthora boll rot develops when low bolls are inundated with flood or irrigation water or when soil is splashed up onto low bolls as they approach maturity. The dry conditions during the summer of 2002-03 were unfavourable for Phytophthora boll rot, and its incidence was one of the lowest on record; averaging 0.13% of bolls for NSW production areas, compared with 0.45 % in the previous season. Other boll rots are most common in tall rank crops with dense canopies, particularly when combined with extended periods of wet and overcast weather late in the season. The incidence of other boll rots was less than 0.07% across NSW.

Alternaria leaf spot

The pathogen that causes Alternaria leaf spot survives on crop residues from the previous season. Its survival is favoured by dry winter conditions and the retention of cotton crop residues on the soil surface. No substantial damage to seedlings by *Alternaria* was observed in the 2002-03 season. Alternaria leaf spot was observed in most field fields surveyed throughout NSW and Queensland in March 2003 but the severity was generally very low; in NSW 0.14% of leaf area was affected, which was similar to the previous season.

Cotton bunchy top

Symptoms of cotton bunchy top include small bolls, small leaves and short internodes, usually accompanied by a distinctive light-green angular mottle occurring around the margins of the leaves (the leaf mottle may be masked if infestation by aphids or mites is severe), and usually confined to a few plants or a distinct patch. The leaf mottle symptoms occasionally occur unaccompanied by the bunchy growth habit if plants acquire the disease late in the season. None of the symptoms of leaf mottle or complete bunchy top were observed in any of the 88 and 15 cotton crops inspected during February and March of 2003. A single plant with a bunchy growth habit but no other symptoms was observed in one field. Compacted bunchy growth alone is not diagnostic for cotton bunchy top, as similar bunchiness can also be observed in association with Fusarium wilt, herbicide damage and other factors.

Other diseases and disorders

Sudden wilt was observed as isolated plants in a number of crops that were inspected in March 2003. Sudden wilt is caused by ‘ordinary’ species of Fusarium that are usually non-pathogenic and it is often associated with waterlogging. Affected plants wilt, defoliate and die. Plants may produce regrowth in some situations. Sudden wilt does not re-occur in the same places in the following crop.

Acknowledgments

This research was made possible with the financial support of the Cotton Research and Development Corporation and Cotton Seed Distributors. Thanks are extended to Wayne O'Neill, Queensland DPI, for diagnostic tests.

*Only 15 of these fields were revisited in March 2003.