COTTON PATHOLOGY 2007-2008

S.J. Allen[1], C.M.T.Anderson[2], P.A. Lonergan[2], G. McNamara[1], L.J. Swan[3] and L.J. Smith[4]
Cotton Catchment Communities CRC
[1]Cotton Seed Distributors, PO Box 17, Wee Waa NSW
[2]NSW Department of Primary Industries, Locked Bag 1000, Narrabri NSW
[3]Qld Department of Primary Industries and Fisheries, 203 Tor Street, Toowoomba, Qld
[4]Qld Department of Primary Industries and Fisheries, 80 Meiers Road, Indooroopilly, Qld

Commercial cotton crops across NSW and Queensland were inspected in November-December 2007 and March-April 2008. The incidence and severity of those diseases present were assessed and field history, ground preparation, cotton variety, planting date and seed rate were recorded for each of the 36 and 44 fields that were surveyed in NSW and Queensland respectively. This represents the 25th consecutive season of quantitative disease surveys of cotton in NSW and the 6th consecutive season of cotton disease surveys in Queensland.

Most cotton production areas experienced mild seasonal conditions with monthly average maximum temperatures during summer up to 8^0C below the long term averages. These conditions, accompanied by significant periods of very wet and/or very dry weather, had a considerable effect on disease distribution, incidence and importance. Drought conditions resulted in reduced plantings with many farms in many areas having no crop at all. There were only two crops surveyed in the Macquarie Valley and four crops in the Macintyre Valley. For the second season in a row there was no crop in the Bourke and Walgett area.

With limited water and the big reduction in the number of fields planted many growers avoided those fields with a known history of either black root rot or Fusarium wilt.

Many cotton crops in many areas of both NSW and Queensland displayed evidence of hormone damage from herbicides applied to other crops.

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 (Figure 1) for the crops inspected in Queensland and NSW was 19.5% and 31%, respectively, (22.5% and 28.9% in 2006-07). Seedling mortality was high in the Murrumbidgee Valley (44.5%, Figure 1) but was similar to the long-term average (41%) for that region. The relatively high seedling mortality for the Gwydir Valley (36.4%) resulted from very early planting and problems with moisture. The low incidence of seedling mortality in crops on the Darling Downs (16.9%) and at St George (12.4%) reflects the warmer conditions for establishment that resulted from the later planting window. Six of the ten crops inspected near St George were planted in November.

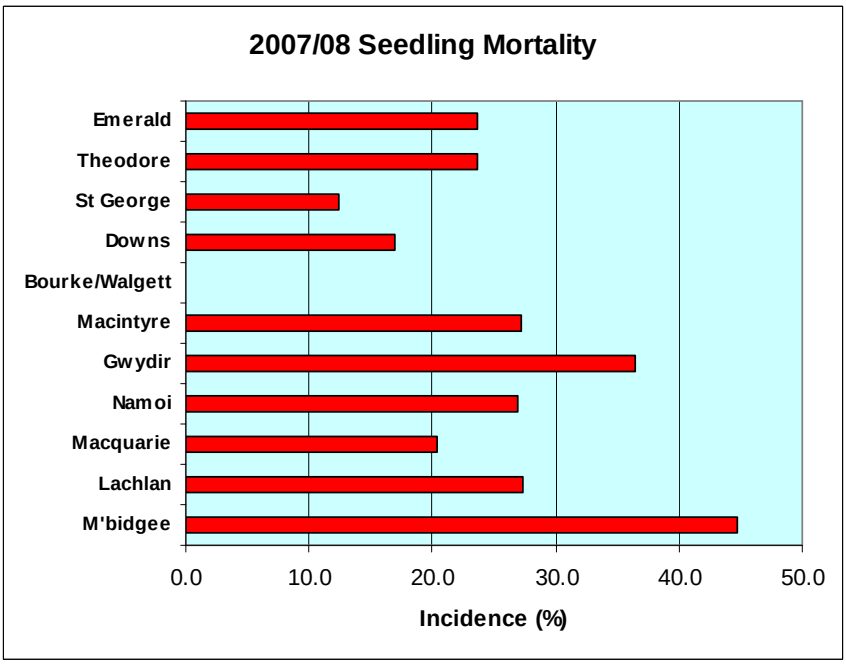

Figure 1. Seedling mortality of cotton in the 2007-08 season was relatively low in most areas except for the Gwydir and Murrumbidgee Valleys (Bourke and Walgett not assessed. Only 2 crops were inspected in the Macquarie Valley and 4 crops in the Macintyre Valley)

Fusarium wilt

There were two new reports of Fusarium wilt from the Theodore area of Queensland and one new report from the Gwydir Valley in NSW. This brings the total count to 82 farms in NSW.

Fusarium wilt was most common in crops on the Darling Downs of Queensland where the mean incidence was 11.4% and the disease was found in 9 of the 13 crops inspected – with 69% of plants infected in one field. Despite the avoidance of problem fields because of limited water, the delayed planting window and the availability and use of more resistant varieties – this represents the highest mean incidence of Fusarium wilt in crops on the Downs over the six years of surveys.

The reported high incidence of Fusarium wilt in the Macintyre Valley is misleading as the disease was found in only two of the four crops surveyed and the incidence of the disease in one of those crops was over 80%. Fusarium wilt was also found at low levels in two fields in the Theodore area, in one field near St George and in four of the seven fields inspected in the Gwydir Valley. The disease was not observed in those crops inspected in the Macquarie and Namoi Valleys in the 2007/08 season and has never been recorded in the Lachlan and Murrumbidgee Valleys of NSW or the Emerald area of Queensland. (Figure 2)

Several transects have been established to monitor the impact of seasonal conditions and farming practices on the build-up of the disease in the field. Fusarium wilt was first observed in a few small patches in a field near St George in 2005/06. Irrigation tail water from this field is collected and used in subsequent irrigations of the same field. In just three seasons the incidence of the disease has increased to over 19%.

Fusarium wilt was first observed in 1997/98 in a field near Theodore. The grower established a strict protocol for irrigation and farming operations to minimise the spread of the pathogen. Assessments at seven years and nine years after the original diagnosis showed that the disease was still confined to its original area with the incidence approximately 0.6%. However, following a favourable season the 2007/08 assessment showed that the patch has spread and 6.7% of plants along the transect were found to be affected.

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&F is funded by the cotton industry and is free to growers. The majority of samples submitted return a negative result and some growers who are withholding samples could be worried unnecessarily. Early detection of the disease and establishment of a control program has proven to be the best approach.

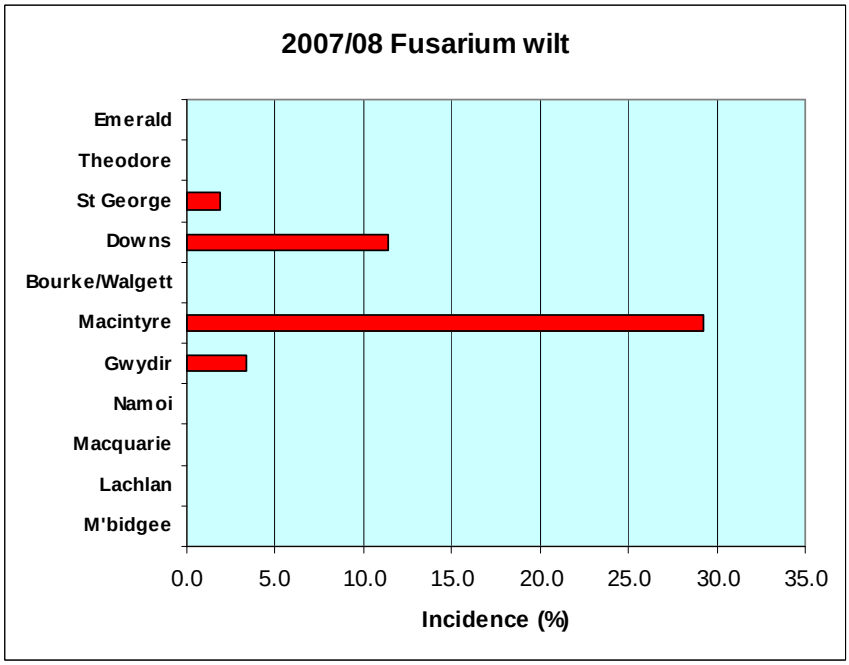

Figure 2. Incidence of Fusarium wilt of cotton in the 2007-08 season (Bourke and Walgett not assessed). Fusarium wilt was only recorded in 2 of the 4 crops inspected in the Macintyre Valley. Over 80% of plants were infected in one of those crops.

Black root rot

Black root rot (Figure 3) has been recorded in all production areas of Queensland and NSW. The disease was observed in 50% of fields and 24% of plants surveyed in the major valleys in NSW (Macintyre, Gwydir, Namoi and Macquarie); compared to 58% and 14% respectively in the previous year. The Namoi valley was again the worst affected with black root rot present in 85% of fields inspected and the mean incidence estimated to be 45% of plants affected. Disease incidence exceeded 60% of plants affected in six of the 13 fields inspected (over 80% in three fields!).

The distribution of black root rot has expanded in the Lachlan and Murrumbidgee Valleys in recent years. The mean incidence of the disease in the Murrumbidgee Valley increased to over 17% of plants affected in the 2007/08 season. 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.

Black root rot was not observed during surveys in Queensland production areas in the 2007/08 season. The disease has only been rarely observed in the Emerald and Theodore areas over the last six seasons. The late planting window was probably a significant factor for crops in the St. George and Darling Downs areas.

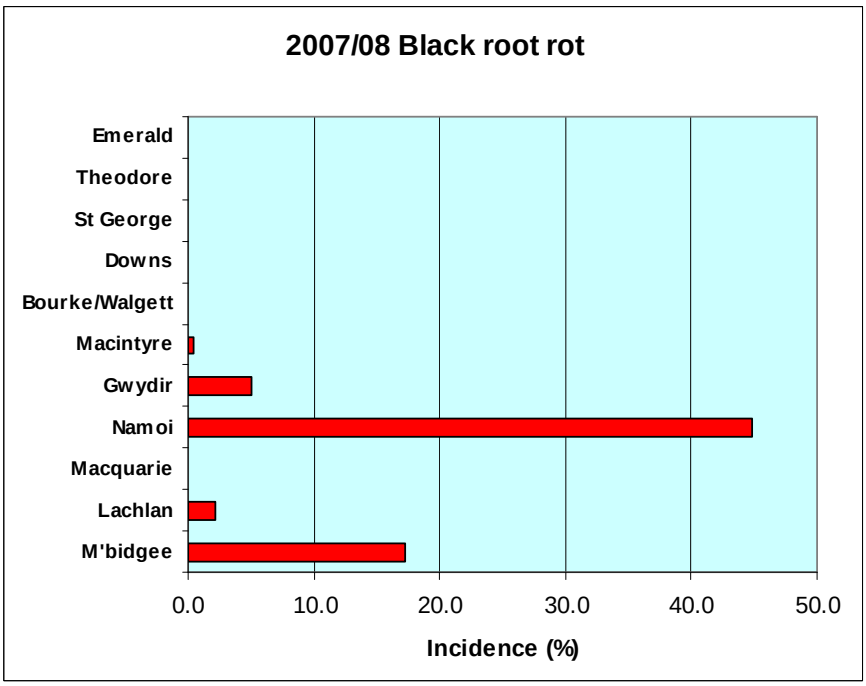

Figure 3. The incidence of black root rot of cotton in the 2007-08 season was high in the Namoi Valley (Bourke and Walgett not assessed. Only 2 crops were inspected in the Macquarie Valley and 4 crops in the Macintyre Valley)

Verticillium wilt

The host plant resistance to Verticillium wilt in Australian cotton varieties is temperature sensitive and the cool conditions experienced during the 2007/08 season favoured the disease. In the Verticillium nursery at the Australian Cotton Research Institute near Narrabri the mean incidence of Verticillium wilt in Sicala V2 was 49% in 2006/07 and 85% in 2007/08.There were 401 less day-degrees accumulated during the 2007/08 season than during the 2006/07 season.

In March-April 2008, the mean incidence of Verticillium wilt across NSW (Figure 4) was 11.2% of plants affected (4.9% and 3.4% in the previous two seasons). This result includes the incidence of Verticillium wilt in the Namoi Valley, which was 28.9% of plants in March-April 2008 (10.4% and 10.1% in the previous two seasons). The incidence of the disease exceeded 30% of plants affected in five of the 13 fields inspected (90% in one field).

Apart from the favourable weather conditions the promotion of varieties with low Verticillium resistant ranks (V.ranks < 80) could be a contributing factor to the higher incidence of the disease. The incidence of Verticillium wilt was assessed in a large scale, replicated variety trial evaluating seven new varieties. The mean incidence of the disease in the four varieties with an average V.rank of 112 was found to be 12% while the mean incidence of the disease in the three varieties with lower V.ranks was over 30%.

Verticillium wilt of cotton was found in a new field in the Murrumbidgee Valley where cotton had not been grown previously. This would indicate that the pathogen is already present in some of the new cotton production areas.

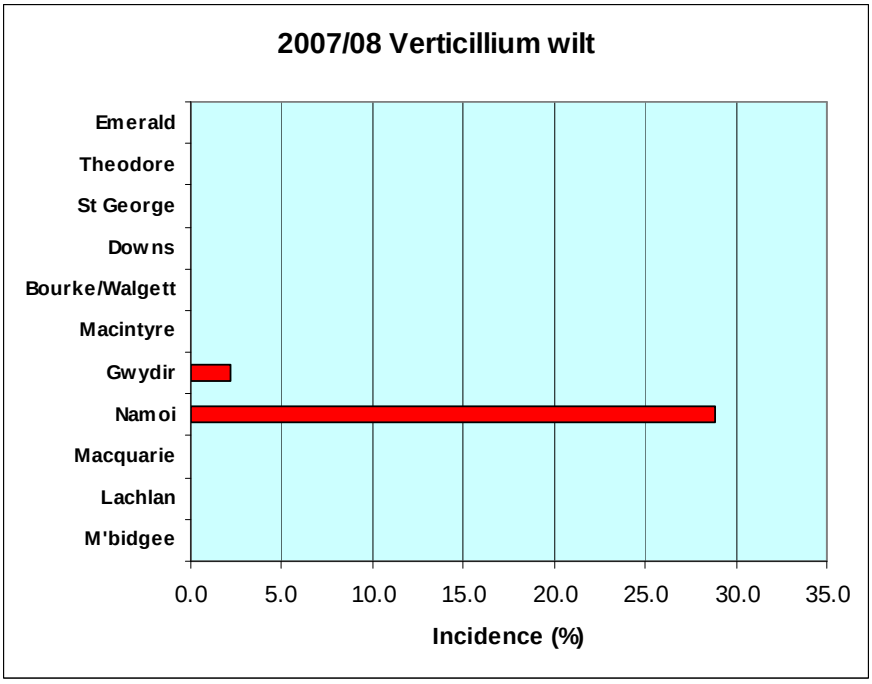

Figure 4. The incidence of Verticillium wilt in March 2007-08 was greatest in the Namoi Valley (Bourke and Walgett not assessed. Only 2 crops were inspected in the Macquarie Valley and 4 crops in the Macintyre Valley)

Boll rots and tight lock

Boll rots involve the complete collapse of the boll –'boll wall and all' - and result from fungal infection that is sometimes assisted by insect damage. Tight lock describes the failure of locks to 'fluff out' when bolls open and is also caused by microbial infection that is sometimes assisted by insect damage. These microbes include both bacteria and fungi and can be introduced to the lock by rain splash from the soil, airborne spores from other plants or by insects feeding through the boll wall before the boll opens. Severe boll rot and tight lock occur when there is a coincidence of wet weather, maturing bolls and the appropriate fungi that can thrive on pure cellulose.

The average incidence of boll rots in NSW and Queensland cotton crops was estimated to be 0.8% and 2.7% respectively. Wet weather prior to harvest in the Emerald, St George and Theodore areas contributed to mean incidences of 4.9%, 3.9% and 2.7% respectively with up to 25% of bolls affected in individual crops. (Figure 5)

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. Boll rots caused by other pathogens tend to be more frequent in crops with tall dense canopies. It was estimated that 4.5% and 5% of bolls were affected by Phytophthora boll in two crops in the Namoi valley.

A few bolls with boll rot or tight lock symptoms were collected from each crop surveyed during the end of season disease surveys in February-March 2008 and the associated fungi were identified by direct observation. A species of *Colletotrichum* that is reported to cause Anthracnose boll rot of cotton was found to be most common and widespread with the charcoal rot fungus, *Fusarium* spp. and *Alternaria* spp. also observed frequently. *Colletotrichum* sp. was observed on bolls collected from five of nine farms in Queensland and nine of 20 farms sampled in NSW - including farms in the Gwydir, Namoi, Macquarie and Lachlan Valleys. Prior to this observation the only report of *Colletotrichum* sp. on cotton in NSW was an unconfirmed report from Richmond, NSW in 1923.

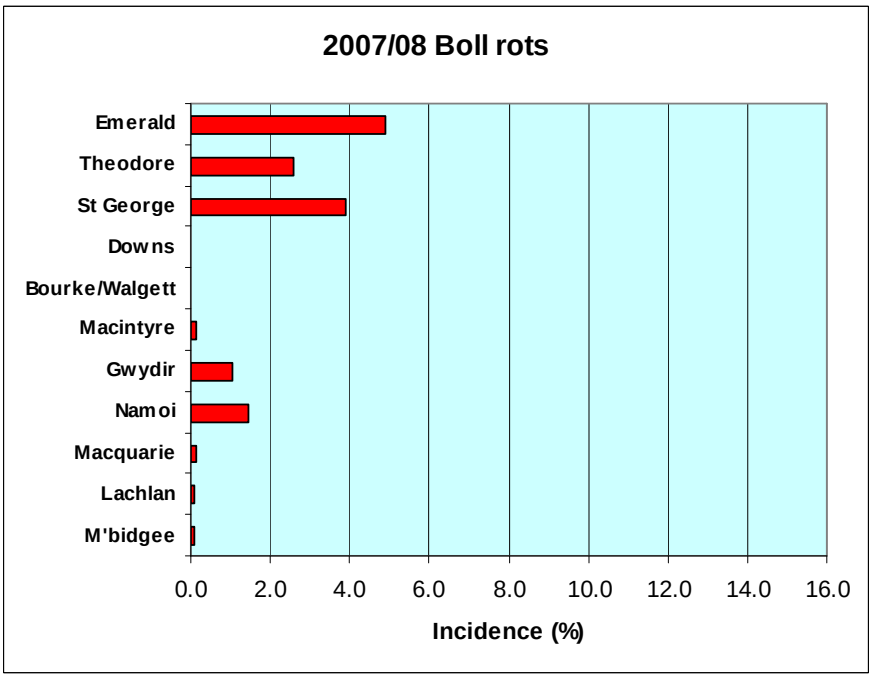

Figure 5. The incidence of boll rots, including those caused by *Phytophthora* and other fungi, in 2007-08 was very low except in the Emerald, Theodore and St George regions where wet conditions were experienced during boll opening

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. Alternaria leaf spot was observed in trace amounts in many, but not all, crops surveyed throughout NSW and Queensland in February-March 2008, with the mean severity (percentage of leaf area infected) estimated to be 0.2% and 0.8% respectively. One crop in the Emerald area had 5% of the leaf area affected with some defoliation.

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. Bunchy top was observed in crops near Theodore and St George and on the Darling Downs. Symptoms were observed in 10% of crops inspected in Queensland and the average incidence of bunchy top in these crops was 1.0%. Bunchy top was observed at a low incidence in 14% of fields inspected during the NSW surveys.

Other diseases and disorders

Sorghum allelopathy. Sorghum has come into prominence as a rotation crop in recent years. When fresh sorghum residues are incorporated into the soil they break down and produce substances that are toxic to other plants. This is called ‘allelopathy’. In some Asian countries they soak fresh sorghum residues in water for 24 hours to produce a natural herbicide called ‘sorgaab’ that provides significant weed control. Freshly incorporated legume residues can also produce allelopathic effects.

Sorghum allelopathy can sometimes cause problems for seedling root development and stand establishment when cotton is planted into freshly incorporated sorghum residues. It is all a matter of timing. Sorghum residues should be either retained on the surface or incorporated well before cotton is planted to avoid problems.

Six of the cotton crops surveyed near Emerald in October 2007 followed a crop of sorghum. Allelopathy contributed to areas of slower growth and reduced seedling vigour in several of these crops and plant stand was reduced to 4.2 plants/metre in one crop.

Tobacco Streak Virus (TSV)

(from information supplied by Murray Sharman and Denis Persley of the QDPI&F at Indooroopilly)

TSV was identified in 2006 as the cause of the disorder which has resulted in severe dieback in sunflower crops in the Central Highlands in recent years. In the 2006/07 summer, many mungbean crops were also affected by TSV with impacts on yield ranging from minor to severe. TSV has now been found in several cotton crops within the irrigation area of Emerald. Preliminary results from glasshouse trials and field observations suggest that TSV may not cause significant disease or losses in central Queensland cotton. The virus is present in Parthenium weed populations and is spread by thrips.

Sclerotinia sclerotiorum was observed in a crop near St George. The symptoms, included a rot of stems and bolls, with white mycelium (fungal growth) on the outside of the stems and the characteristic large black sclerotia on and within the bolls. Sclerotinia has occasionally been observed in association with boll rots in previous surveys but the problem usually only occurs when the canopy of the crop is dense enough to create very moist conditions. *S. sclerotiorum* is not likely to be a problem in crops with a normal canopy structure.

Acknowledgments

This research was made possible with the financial support of the Cotton Research and Development Corporation, Cotton Seed Distributors Ltd., NSW Department of Primary Industries and Queensland Department of Primary Industries and Fisheries.