Cotton Pathology


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Commercial cotton crops across NSW and Queensland were inspected in November-December 2009 and February-April 2010. 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 82 and 54 fields that were surveyed in NSW and Queensland respectively. This represents the 27th consecutive season of quantitative disease surveys of cotton in NSW and the 8th consecutive season of cotton disease surveys in Queensland.

Most cotton production areas experienced very dry conditions in October and November with some extreme hot weather in November. This was followed by a wet summer with some cooler temperatures and overcast conditions and very wet weather in March followed by dry weather and a good finish in April. These conditions impacted significantly on the incidence and severity of cotton diseases and on the timing of disease surveys.

Cotton Industry Biosecurity Plan – Crop Surveillance for Priority Pests

During these surveys particular attention was given to the detection of Cotton Leaf Curl Virus, Blue disease, Phymatotrichopsis root rot, the hypervirulent strains of the bacterial blight pathogen, the defoliating strains of the Verticillium wilt pathogen and exotic strains of the Fusarium wilt pathogen. None of these diseases and/or pathogens were observed.

Volunteer cotton – Carry-over from the previous season

The following information was collected at the request of the CRDC during the annual disease surveys and is based on visits to 45 farms in NSW and 28 farms in Queensland during November 2009. The number of farms with (1) mature cotton plants surviving along roadsides, fence lines, along channels and in tail water return systems or drains and (2) mature cotton plants surviving from the previous season or regrowth from stubs (Ratoon cotton?) in current cotton crops, were recorded.

	1. Channels, roads, fences	2. In the current crop	Total
In NSW	17/45 (38%)	17/45 (38%)	17/45 (38%)
In QLD	11/28 (32%) 9/11 in Emerald Theodore	15/28 (54%) 11/15 in Emerald Theodore	20/28 (71%)

The presence of volunteer plants surviving over from the previous season enables pests and pathogens such as mealy bug and cotton bunchy top to overwinter and initiate new outbreaks in the spring. Wet weather during early 2010 has allowed vigorous growth of volunteer cotton in non-cropped areas. These volunteers should be controlled and not allowed to overwinter.

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 etc.) 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 25.8% and 32.5%, respectively, (24.9% and 28.8% in 2008-09; 19.5% and 31% in 2007-08; 22.5% and 28.9% in 2006-07). Problems with crop establishment were noted in most areas. Many growers experienced the warm conditions in early September, and pre-irrigated. Temperatures dropped and planting had to be delayed. When the weather did eventually warm up the moisture had receded and some growers had to irrigate again using valuable water.

In Queensland mean seedling mortality was generally higher than that in the previous season particularly in crops on the Darling Downs, where it was 15.6% last year and 30.9% this year even though six of the 13 crops surveyed were planted in November. Seedling mortality exceeded 40% in all three fields where cotton had been planted after soybean. Mean seedling mortality exceeded 30% in all production areas in New South Wales with the exception of the Bourke and Walgett areas where it averaged 26 % and the Macquarie valley where it averaged just over 40%.

Fusarium Wilt

There were no new reports of Fusarium wilt from either NSW or Queensland this season. The very dry conditions in October and November combined with the very hot weather in November were not favourable for the development of Fusarium wilt (Figure 2). The disease was observed in only 15 of the 54 crops surveyed in Queensland including eight of the 13 crops inspected on the Darling Downs. The incidence of Fusarium wilt averaged 1.8% and 1.1% respectively, for the Darling Downs and St George areas and only exceeded 5% in two fields.

Fusarium wilt was observed in only 12 of the 82 crops surveyed in NSW including seven of the 12 crops inspected in the Macintyre valley and five of the 11 crops surveyed in the Gwydir valley. The incidence of Fusarium wilt averaged 6.3% and 9.3% respectively, for these two production areas. Over 50% of plants were infected in one crop near Boggabilla and in one crop near Moree. Though Fusarium wilt is known to be present and widespread in the Macquarie valley, the upper Namoi valley and Bourke areas it was not detected in the 2009/10 disease survey.

Transects have been established in fields near Theodore, St George and

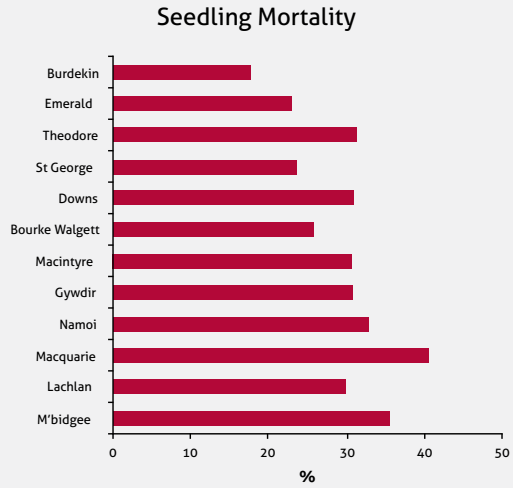

Figure 1. Mean seedling mortality in the 2009/10 season was generally higher than in the previous season. Seedling mortality is derived from the difference between the number of seed planted and the number of plants established.

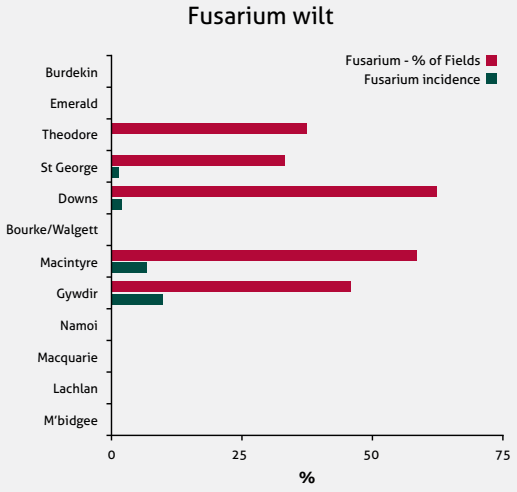

Figure 2. The average distribution and incidence of Fusarium wilt of cotton in the 2009/10 season.

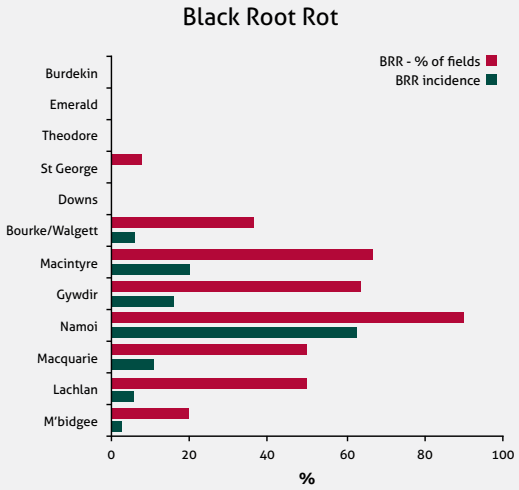

Figure 3. The distribution and incidence of black root rot in cotton in the 2009/10 season.

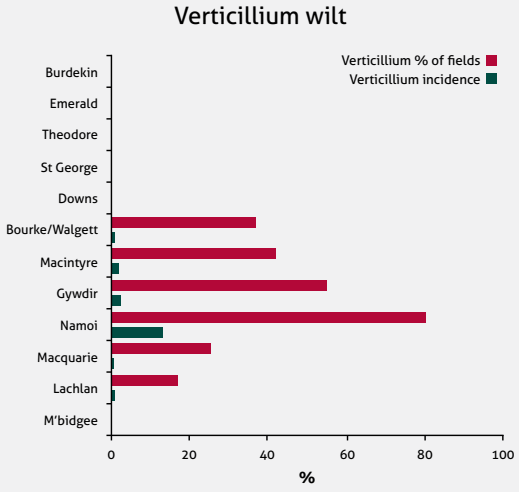

Figure 4. The distribution and incidence of Verticillium wilt of cotton in the 2009/10 season. The disease was present in many areas but the incidence was generally low.

Boggabilla. The incidence of Fusarium wilt is assessed along these transects whenever cotton is grown in these fields. Assessments during the 2009/10 season show reductions in disease incidence from 6.6% in 2008/09 to 1.3% at Theodore, from 19.4% in 2007/08 to 3.5% at St George and 19% in 2007/08 down to 7% at Boggabilla.

Several factors may be contributing to this apparent decline in the incidence of Fusarium wilt.

These include:

(i) Dry spring weather and delayed planting. Six of the 13 fields surveyed on the Darling Downs were planted in November. Previous work has shown that dry spring weather and delayed sowing can significantly reduce the incidence of Fusarium wilt for the whole season.

(ii) More resistant varieties. During the last two seasons the most popular commercial cotton varieties have been Sicot 70BRF with an F.rank=113(19) and Sicot 71BRF with an F.rank=120(15). Previously the most popular variety was Sicot 71BR with an F.rank=101(14).

(iii) The widespread use of BION seed treatment. This product has been shown to provide some control of Fusarium wilt and black root rot through systemic induced resistance. Over 1000 tonnes of cotton planting seed treated with BION was sold for planting in the 2009/10 season.

Black Root Rot

Black root rot of cotton is favoured by cool weather conditions early in the season. The pathogen colonises the root surface, suppresses the development of secondary roots and stunts seedling growth. When temperatures rise the tap root expands and the blackened root surface is sloughed off and disappears. The dry and hot weather in November 2009 enabled cotton seedlings with adequate moisture to grow away from the disease with less stunting than usual.

Black root rot was observed on 93% of farms visited and in 58% of the fields surveyed in NSW (Figure 3). The average incidence within fields was 23% and mean disease severity was 0.97 (9.7% of each tap root blackened). The disease was most common in crops in the Namoi valley where it was observed in 18 of the 20 fields surveyed. The average incidence within fields was 62% and the incidence exceeded 90% (of plants infected) in eight of the fields. The mean disease severity was 2.83 (28.3% of each tap root blackened).

Black root rot has previously been observed in all Queensland cotton production areas except the Burdekin. Surveys were completed in Emerald and Theodore in early November and in St George and the Darling Downs in late November and early December. Six of the 13 fields surveyed on the Downs were planted in November and two were planted in late October. The late planting and the dry, hot start to the season resulted in very few records of the disease in this survey. Generally the warmer climate of Queensland does not favour black root rot. The mean minimum and maximum temperatures for October, 2009 were 15.5C / 32.4C for Emerald and 11.1C / 28.0C for Narrabri.

Verticillium Wilt

Verticillium wilt is also favoured by cooler weather and is rarely observed in Queensland production areas. The disease was observed in 36% of fields surveyed in NSW. However, the average incidence was only 3.7% of plants infected (Figure 4). This represents the lowest average incidence of Verticillium wilt in NSW for several years.

Verticillium wilt was observed in 80% of fields surveyed in the Namoi valley where the average incidence of the disease was 12.7% of plants infected. The three worst affected fields had 42%, 52% and 85% of plants with symptoms. It is interesting to note that the fields that had 85% and 52% of plants with Verticillium wilt at the end of the season had had 95% and 100% of plants with black root rot at the beginning of the season. The interactions between the pathogens that cause black root rot and Verticillium wilt and the effect of that interaction on cotton needs to be investigated.

Significant yield reductions are most likely when cool wet overcast weather occurs mid-season and symptoms of Verticillium wilt become apparent. The 123mm and 192mm rainfall recordings in Moree and Wee Waa in December 2009 may have been important. Symptoms of Verticillium wilt usually become most obvious late in the season as temperatures become lower. Past research has shown that late season disease development results in minimal losses because fruit load has already been set.

Boll Rots

The incidence of boll rots was higher than previously recorded in all cotton production areas (Figure 5). In some areas the wet and overcast weather continued for several weeks after the surveys were finished and the final incidence would have been substantially higher than that recorded. Late season rainfall also interfered with the timing of some surveys and consequently some surveys were completed later than usual. The average incidence of boll rots was recorded as 9.7% for NSW and 7.3% for Queensland (2.7% and 1.9% in 2008/09).

In Queensland production areas the weather conditions resulted in low boll set mid-season and many crops became tall and rank. Rainfall at Emerald in January (117mm) and February (216mm), at St George in February (124mm) and March (249mm) and in the Burdekin in March (189.6mm) caused the development of high humidity within the canopy and newly opened bolls quickly succumbed to the common boll rotting fungi.

In NSW Phytophthora boll rot was common. The pathogen survives in the soil and is splashed up onto low bolls that are about to open. Heavy rainfall events in February and March, and low-set bolls favour disease development.

Other diseases and disorders

Alternaria leaf spot and premature senescence

Alternaria leaf spot was present at low levels in almost all crops and was generally of minor significance. Some defoliation may occur late in the season especially when plants are exposed to extended periods of wet

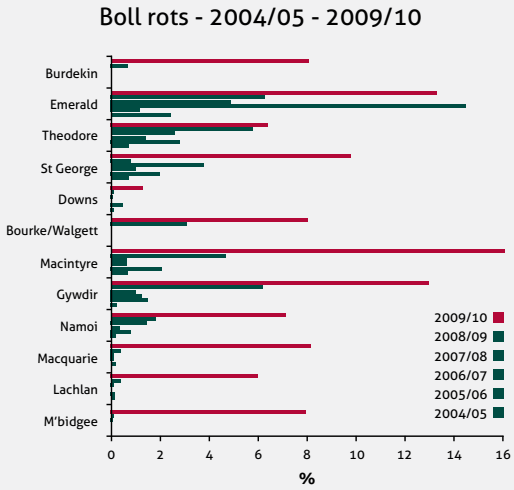

Figure 5. The average incidence of boll rots in each of the cotton production areas for the 2009/10 season (red) and the previous five seasons (black). These figures may under-estimate the final incidence as assessments are usually completed after the final irrigation and several weeks before harvest.

weather when they are beginning to show signs of 'cut-out', low Potassium or premature senescence. Defoliation caused by Alternaria leaf spot was reported from the Emerald area as a result of the extended wet weather in February that occurred after surveys were completed. Rain and consequent flooding in the St George and Dirranbandi areas delayed surveys and prevented assessment of Alternaria leaf spot and premature senescence.

Above average rain in March, rank growth, high humidity and heavy dews favoured some premature senescence (2.8% of plants), boll rots (8.05% of bolls) and leaf spots causing defoliation of lower leaves in crops in the Burdekin valley of Queensland.

Cotton bunchy top

Bunchy top was commonly observed on volunteer cotton plants surviving over from the previous season. A large area of severely affected plants was observed in a field near Theodore.

Tobacco Streak Virus (TSV)

The very dry and hot start to the season with negligible thrip activity resulted in virtually no movement of the virus from parthenium weed into young cotton crops. TSV has only been recorded on cotton in central Queensland.

Seed rot

Symptoms of seed rot include a soft brown rot of developing seed within the bolls that may not become apparent until the bolls either drop or open prematurely. Only one or two locks, or sometimes the whole boll, can be affected. Seed rot appears to be caused by either bacteria or fungi that are introduced into the young developing boll by sucking insects such as the green vegetable bug. The average incidence of seed rot in cotton crops in the Burdekin valley was estimated to be 5.6%.

Acknowledgments

These surveys were made possible with the financial support of the Cotton Research & Development Corporation, the Cotton Catchment Communities CRC, Cotton Seed Distributors Ltd., Industry and Investment, NSW and the Queensland Department of Education, Economic Development and Innovation. The assistance of Dr Murray Sharman, Dr Cherie Gambley, Dr Alison Seyb and Bethany Cooper is gratefully acknowledged.