Cotton Pathology 2010-2011

S.J. Allen[1], K.A. Kirkby[2], J. Lehane[3], P.A. Lonergan[2], B.R. Cooper[2] and L.J. Smith[4]
Cotton Catchment Communities CRC
[1]Cotton Seed Distributors Ltd., PO Box 17, Wee Waa NSW
[2]NSW Department of Primary Industries, Locked Bag 1000, Narrabri NSW
[3]Agri-Science Queensland, DEEDI, 203 Tor Street, Toowoomba, Qld
[4]Agri-Science Queensland, DEEDI Ecoscience Precinct, GPO Box 46, Brisbane, Qld

Commercial cotton crops across NSW and Queensland were inspected in November-December 2010 and February-April 2011. 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 89 and 56 fields that were surveyed in NSW and Queensland respectively. This represents the 28th consecutive season of quantitative disease surveys of cotton in NSW and the 9th consecutive season of cotton disease surveys in Queensland.

The 2010/2011 season generally featured a wet spring, significant flooding in summer and a dry autumn. Consequently, planting was delayed and crop development was slow culminating in a late harvest. The combination of a wet spring and record prices also contributed to a late planting frenzy. These conditions impacted significantly on the incidence and severity of cotton diseases and on the timing of disease surveys (Table 1). The devastating flooding in the Dawson River completely destroyed cotton growing near Theodore and Moura and late season surveys in this area were not possible.

Table 1. *The number of fields surveyed and the timing of surveys for 2010/2011.*

Area/Region	No. of fields surveyed	Early season survey	Late season survey
Burdekin	7	16th Feb.	19th May
Emerald	11	24th Nov.	22nd Feb.
Theodore/Moura	9	25th Nov.	Floods destroyed all crops
St George/D'bandi	16	14th – 15th Dec.	2nd – 3rd Mar.
Darling Downs	13	16th – 17th Dec.	10th Mar.
Bourke/Walgett	14	18th Nov.	14th – 15th Mar.
Macintyre	12	24th – 25th Nov.	31st Mar. – 1st Apr.
Gwydir	12	4th & 24th Nov., 14th Dec.	8th , 28th & 31st Mar.
Namoi	22	22nd , 26th & 29th Nov.	7th, 10th, 11th, 29th Mar, 6th, 7th Apr.
Macquarie	12	22nd Dec.	7th Apr., 12th – 13th Apr.
Lachlan	8	10th Nov., 20th Dec.	16th Mar., 18th Apr.
Murrumbidgee	9	21st Dec.	17th Mar.

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)

Information on the occurrence of volunteer cotton was collected during the annual disease surveys and is based on visits to 42 farms in NSW and 18 farms in Queensland during November and December of 2010 (Table 2). The number of farms with (1) mature cotton plants surviving along roadsides, fence lines, along channels and in tail water return systems or drains, (2) volunteer cotton in fallow or rotation fields and (3) mature cotton plants surviving from the previous season or regrowth from stubs (Ratoon cotton?) in current cotton crops, were recorded.

Table 2. *The occurrence of volunteer cotton plants surviving from the previous season on farms in NSW and Queensland in the spring of 2010.*

	1. Along channels, roads, fences	**2. In fallows and rotation crops**	**3. In the current crop (regrowth from stubs)**	**TOTAL**
In NSW	25/42 (60%)	9/42 (21%)	23/42 (55%)	34/42 (81%)
In Qld	7/18 (39%)	1/18 (6%)	5/18 (28%)	10/18 (56%)
Total	32/60 (53%)	10/60 (17%)	28/60 (47%)	44/60 (73%)

The presence of volunteer plants surviving over from the previous season enables pests and pathogens such as aphids and mealy bug and cotton bunchy top to overwinter and initiate new outbreaks in the spring. Wet weather during September 2010 allowed vigorous growth of volunteer cotton in non-cropped areas. Volunteer cotton plants were observed on 44 of the 60 farms visited during the disease surveys (73%).

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 NSW and Queensland was 31.9% and 25.8%, respectively, (32.5% and 25.8% in 2009-10; 28.8% and 24.9% in 2008-09; 31% and 19.5% in 2007-08). Many growers were able to establish the crop on rainfall with no need to pre-irrigate.

Problems with crop establishment were noted in some areas. These problems included a cold spell in mid-October and the necessity of a quick turnaround between the rain-delayed harvest of a winter crop and the planting of cotton in the same field. The highest incidence of seedling mortality was 36.7% in crops in the Murrumbidgee Valley and the lowest incidence was 18.6% in crops in the Burdekin area of Queensland where planting takes place in late December and January.

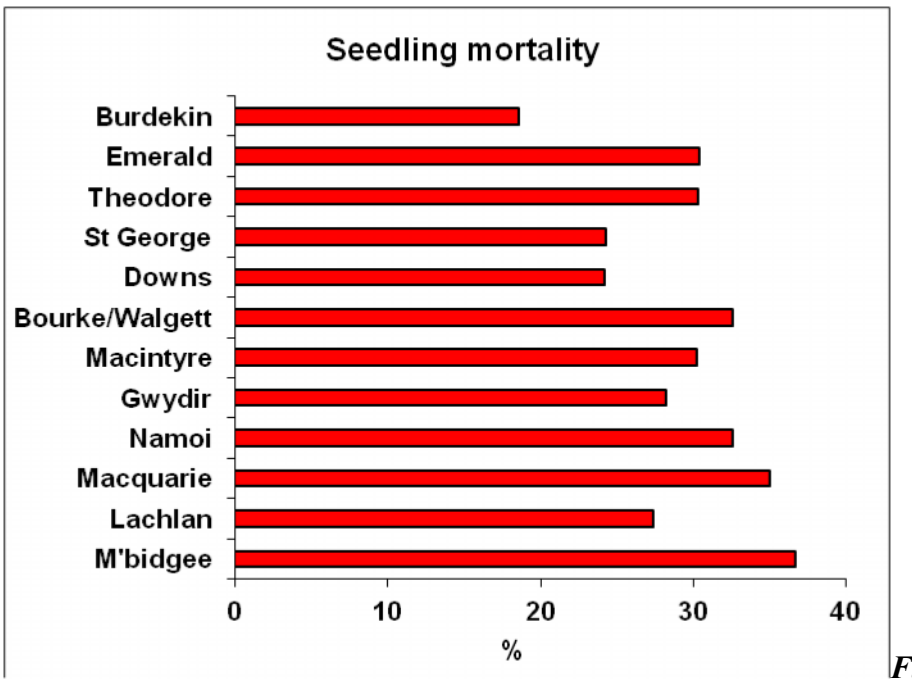

Figure 1. *Mean seedling mortality in the 2010/11 season. Seedling mortality is derived from the difference between the number of seed planted and the number of plants established.*

FUSARIUM WILT

The wet spring, followed by a cool and wet summer, contributed to an increased incidence of Fusarium wilt and negated the usual benefits associated with a delayed sowing. Conversely, the widespread adoption of the new, more resistant, varieties reduced the potential impact of the disease. Fusarium wilt was very obvious during early season surveys where up to 11% of seedlings had been killed in some fields. Later in the season common symptoms included gaps in the stand, stunted growth and a dark brown discoloration of the vascular tissue in the stem. Wilting, dead and dying plants were not always present as was observed in previous years with more susceptible varieties.

There was one new report of Fusarium wilt east of Goondiwindi in Queensland, two new reports of Fusarium wilt in the Gwydir valley of NSW, the first report of Fusarium wilt on a farm in the Lachlan Valley and the first report of Fusarium wilt on a farm in the Emerald area. These new reports were confirmed by Dr Linda Smith (Agriscience Queensland, DEEDI) who provides a free, confidential diagnostic service for Fusarium wilt funded by the Australian cotton industry. All five new reports were found to be caused by the Downs strain of the pathogen.

Fusarium wilt was observed in 22 of the 89 crops surveyed in NSW (Figure 2). including eleven of the 12 crops inspected in the Macintyre valley and seven of the 12 crops surveyed in the Gwydir valley. The incidence of Fusarium wilt averaged 8.8% and 9.9% respectively, for these two production areas where four fields had in excess of 25% of plants affected. Though Fusarium wilt is known to be present and widespread in the Macquarie valley and the upper Namoi valley it was not detected in these areas in either the 2009/10 or the 2010/11 disease surveys.

The disease was observed in only 11 of the 47 crops surveyed in Queensland including nine of the 13 crops inspected on the Darling Downs. The incidence of Fusarium wilt averaged 2.8% and 0.6% respectively, for the Darling Downs and St George areas and only exceeded 5% in two fields (Figure 2).

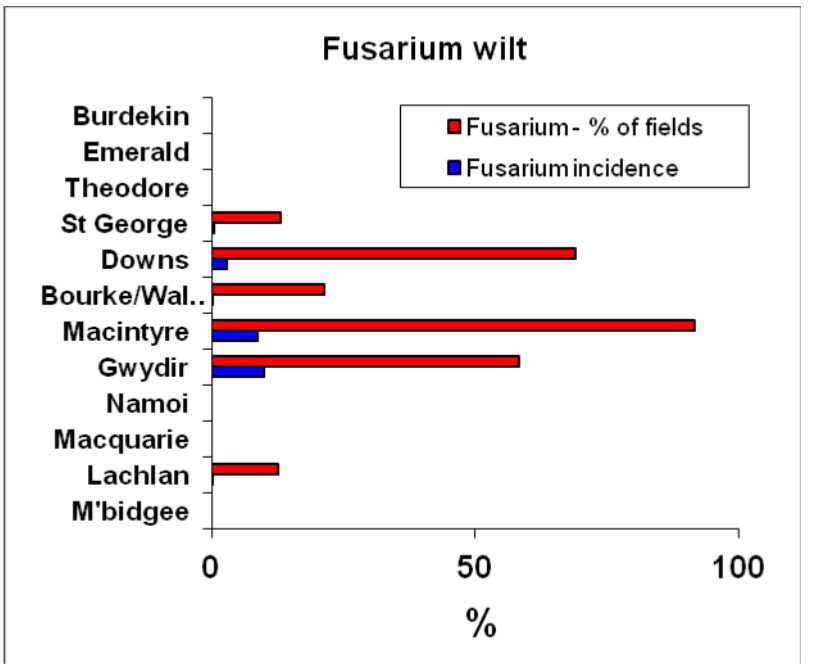

***Figure 2**. The average distribution and incidence of Fusarium wilt of cotton in the 2010/11 season.*

Transects have been established in fields near Theodore, St George, Boggabilla and Gunnedah. The incidence of Fusarium wilt is assessed along these transects in seasons when cotton is grown in these fields. Assessments during the 2010/11 show an increase of between 60% and 320% in disease incidence in five of the six transects despite a four-year rotation with cereals, fallows and sorghum in two of the fields. The only decline in the incidence of Fusarium wilt was observed in a rain-grown crop growing in a field that had not grown cotton for five years.

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 seasonal conditions in the spring and early summer of 2010 were very favourable for black root rot.

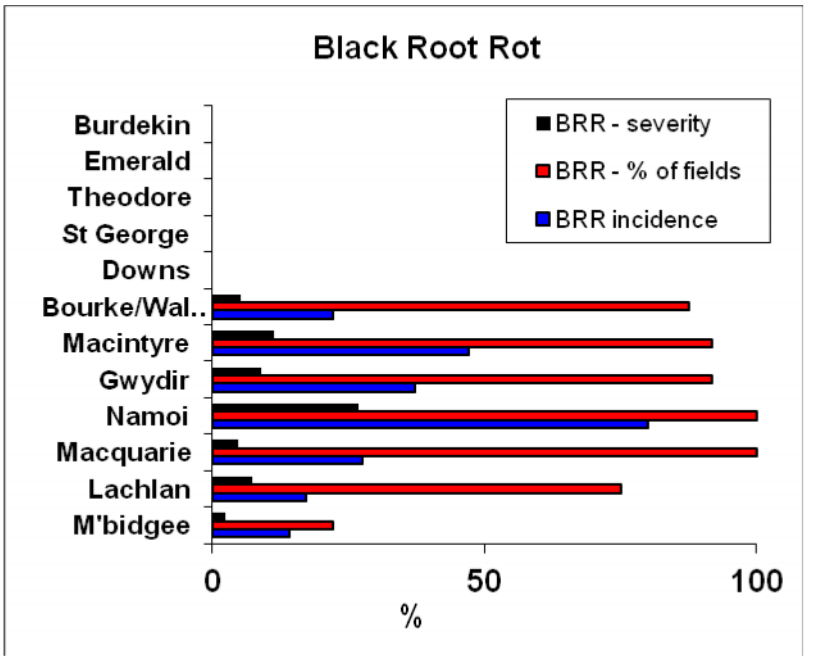

Figure 3. *The distribution, incidence and severity of black root rot in cotton in the 2010/11 season.*

Black root rot was observed on 93% of farms visited and in 83% of the fields surveyed in NSW (Figure 3). The average incidence within fields was 41% and mean disease severity was 1.18 (11.8% of each tap root blackened). The disease was most common in crops in the Namoi valley where it was observed in all of the fields surveyed. The average incidence within fields was 80% and the incidence exceeded 80% (of plants infected) in ten of the fields. The mean disease severity was 2.69 (26.9% of each tap root blackened). There were also fields in both the Gwydir and Macintyre valleys where the incidence of black root rot exceeded 90%. The incidence of black root rot in crops in the Namoi, Gwydir and Macintyre valleys was substantially higher than ever recorded previously.

Black root rot has previously been observed in all Queensland cotton production areas except the Burdekin. There were several reports of black root rot in cotton crops on the Darling Downs and at St George. However, wet weather delayed the surveys until mid December by which time the weather had warmed and plants were growing away from the symptoms.

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 4.1% of plants infected (Figure 4). The average incidence of Verticillium wilt of cotton in NSW was estimated in previous surveys to be 3.8% and 3.7% for the 2008/09 and 2009/10 seasons.

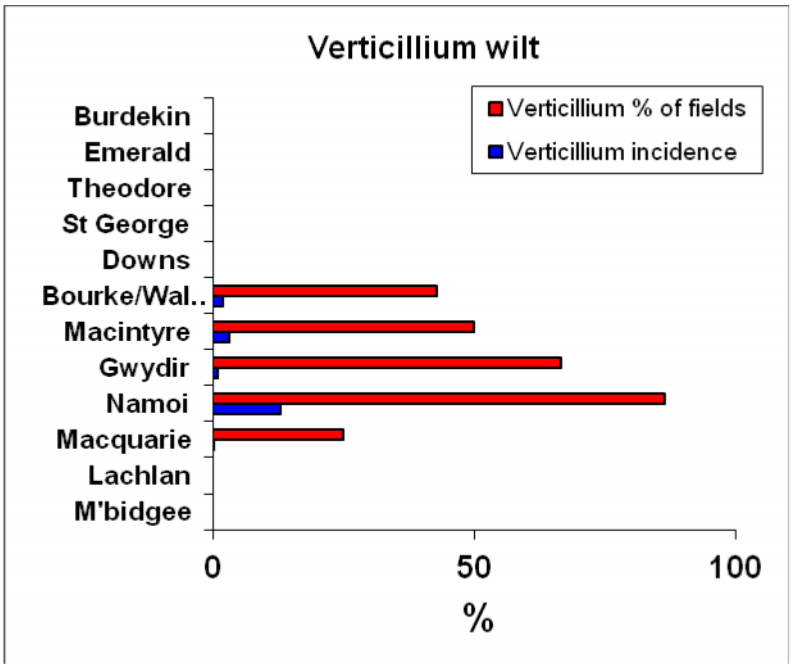

Figure 4. *The distribution and incidence of Verticillium wilt of cotton in the 2010/11 season. The disease was present in many areas but the incidence was generally low.*

Verticillium wilt was observed in 86% of fields surveyed in the Namoi valley where the average incidence of the disease was 13.1% of plants infected (compared to 14.0% and 12.7% in the previous two seasons). The worst affected fields had 41%, and 71% of plants with symptoms. It is interesting to note that these fields had had 68% and 96.5% 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.

BOLL ROTS

The reported incidence of boll rots (Figure 5) can be affected by planting date, survey date, distribution of bolls on the plant and the size and density of the crop canopy as well as by the timing and intensity of wet weather. Overcast weather and waterlogging contributed to low retention early in the season and few low bolls in many crops. This resulted in a lower incidence of the boll rots that develop when soil is splashed up onto low bolls.

Delayed maturity in crops on the Darling Downs and at Emerald resulted in few open bolls and consequently a lower incidence of boll rots at the time of survey. In contrast, the average incidence of boll rot in the more advanced crops in the St George and Dirranbandi area was 5.25% and exceeded 10% in four of the 16 crops surveyed.

The average incidence of boll rots was recorded as 0.7% for NSW and 2.7% for Queensland (2.7% and 1.9% in 2008/09; 9.7% and 7.3% in 2009/10).

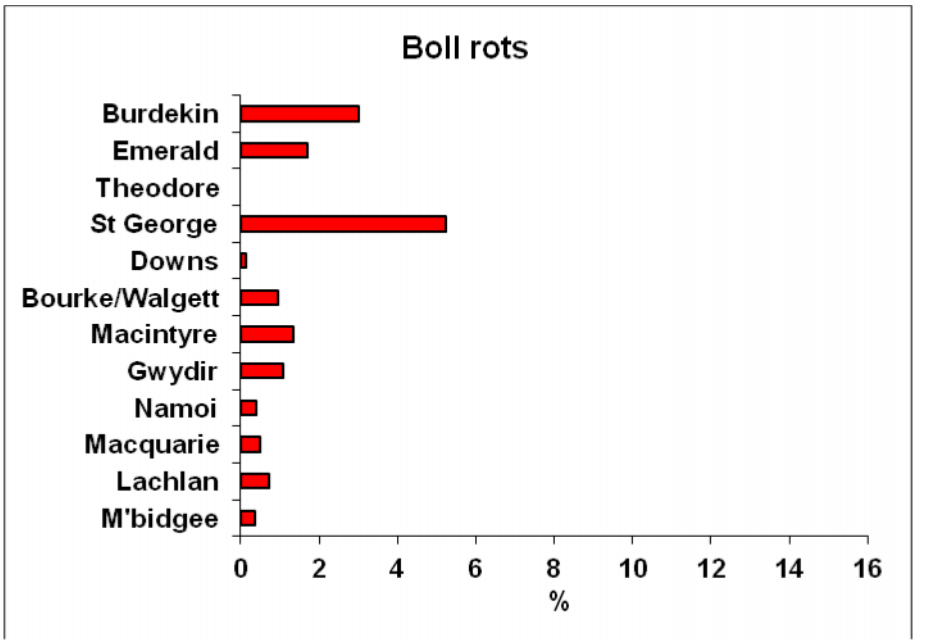

Figure 5. *The average incidence of boll rots in each of the cotton production areas for the 2010/11 season. These figures may under-estimate the final incidence as assessments are usually completed after the final irrigation and several weeks before harvest.*

BUNCHY TOP

According to the 2007/08 disease survey cotton bunchy top was observed in 10% of crops inspected in Queensland and in 14% of fields inspected during the NSW surveys.

During the 2008/09 season symptoms were observed in 7% of crops inspected in Queensland and the average incidence of bunchy top in these crops was <0.1%. Bunchy top was observed in 11% of fields inspected during the NSW surveys where the average incidence was 0.2% of plants with symptoms. The incidence of bunchy top in three crops in the Lachlan Valley was found to be 5%, 4% and 1%.

The 2009/10 disease survey report indicated that "Bunchy top was commonly observed on volunteer cotton plants surviving over from the previous season" and "A large area of severely affected plants was observed in a field near Theodore". The disease was found in 6% of crops inspected in Queensland and 7% of crops in NSW.

Bunchy top was observed in 73% of crops inspected in Queensland during late February and early March, 2011 (Figure 6) and the average incidence of bunchy top in these crops was 0.53%.Symptoms were apparent on single plants and rarely in patches. The incidence of bunchy top in some fields on the Downs was up to 3%.

In Emerald symptoms were apparent in the upper canopy while at St George and on the Darling Downs affected plants were stunted and largely hidden within the canopy. Bunchy top was seen in 10 of the 13 crops inspected on the Downs. It is interesting to note that the three crops where the disease wasn't observed were all Siokra 24BRF while the 10 infected crops were either Sicot 71BRF or Sicot 74BRF.

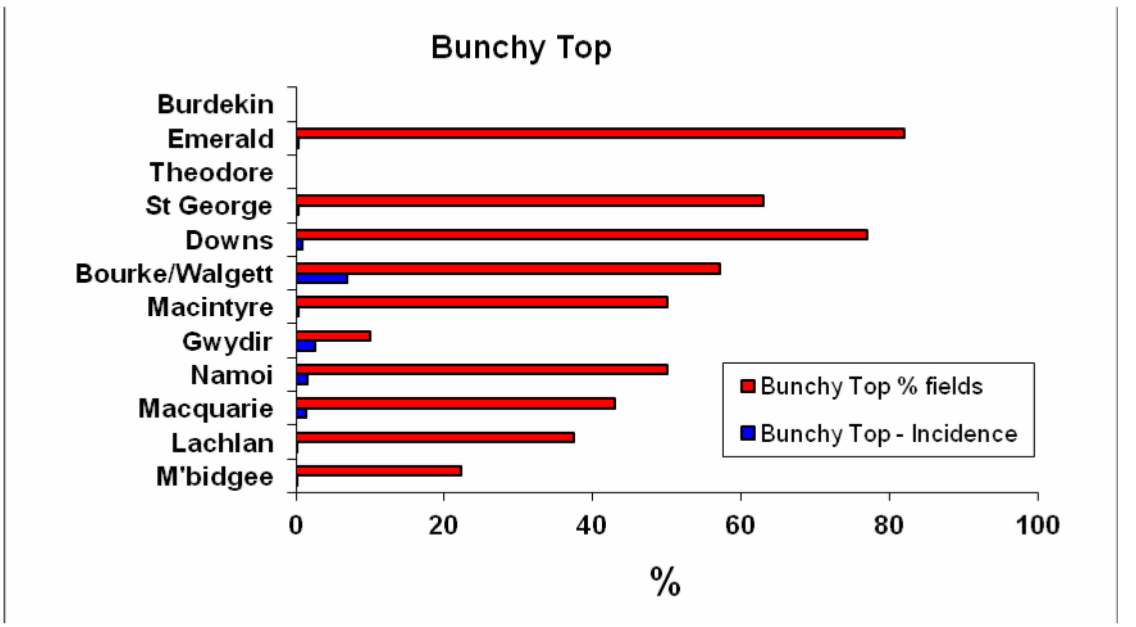

Figure 6. *The distribution and average incidence of bunchy top in each of the cotton production areas for the 2010/11 season.*

In NSW, bunchy top was observed in 43.0% of crops surveyed in March and April, 2011 (See Table 1) with the average incidence being 2.1%. Bunchy top was particularly apparent in some fields in the Bourke/Walgett region where the average incidence of cotton plants with symptoms was 6.9%. The incidence of the disease in two crops on one farm was estimated to be 48.5% and 43%. The worst affected fields in the Namoi and Gwydir valleys had 28.5% and 25.5% of plants with symptoms. There was an apparent association between a high incidence of bunchy top in a crop and large numbers of volunteers with bunchy top symptoms nearby.

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. Premature senescence caused some concern in some crops to the North and West of Emerald.

Wet weather through until early April favoured some premature senescence (2.3% of plants), and leaf spots causing defoliation of lower leaves in some crops in the Burdekin valley of Queensland.

Tobacco Streak Virus (TSV). TSV was observed in nine of the 14 crops inspected in central Queensland in November 2010. The average incidence of the virus was 0.61% with 3% of plants with symptoms in one field.

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 2.3% (5.6% in the 2010 season).

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., NSW Department of Primary Industries and the Queensland Department of Education, Economic Development and Innovation.