THE FIGHT AGAINST BLIGHT

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Inspections of commercial crops in all cotton growing areas of New South Wales during the 1983-84, 1984-85 ad 1985-86 seasons (Table 1) have shown that bacterial blight has been widespread and severe and has caused significant losses to growers. The results of these surveys have emphasized the importance of rain and thunderstorm activity during October, November and December and the presence of the pathogen within planting seed as the two major factors contributing to epidemics of bacterial blight. The effective control of bacterial blight of cotton is essential if yields are to be maximized.

A review of overseas literature shows that several approaches have been recommended for the control of bacterial blight of cotton. These methods include resistant cultivars, destruction or avoidance of infested crop debris, seed treatments, bactericide sprays and clean seed schemes. For various reasons not all of these methods are applicable to the Australian cotton growing situation.

Table 1. The incidence (%) of bacterial blight on cotton seedlings (November surveys) and bolls (March surveys) in commercial fields growing in NSW production areas during the 1983-84, 1984-85 and 1985-86 seasons.

Production Area	Mar.1984 (bolls)	Nov.1984 (seedlings)	Mar.1985 (bolls)	Nov.1985 (seedlings)	Mar.1986 (bolls)
McIntyre	-	10.6	23.3	14.2	18.0
Gwydir	13.8	11.0	27.5	5.2	14.9
Namoi	12.1	15.5	22.3	23.7	31.6
Macquarie	11.2	4.9	12.6	9.5	14.7
Bourke	-	-	0	-	4.4
No. of crops surveyed	28	36	54	38	42

RESISTANT CULTIVARS

The use of resistant cultivars constitutes the simplest, most effective method for controlling bacterial blight of cotton. Resistant cultivars are widely used in Texas, New Mexico and Oklahoma in the United States and in Africa.

The cultivar Siokra which was recently released by CSIRO in Australia is completely resistant to the races of the bacterial blight pathogen present in Australia (Table 2) and the resistance

incorporated into this cultivar has been stable for nearly 20 years in the United States. However, a new race of the bacteria which is able to overcome this type of resistance has developed in the Upper Volta and the Sudan and has been collected and taken to Texas for use in field plots.

There are 18 recognized races of the pathogen plus the new race occurring in Africa and another new race recently reported in Brazil. Experiments at the Narrabri Agricultural Research Station using isolates from both Queensland and New South Wales cotton growing areas have shown race 18 to be predominant in Australia.

Deltapine 90 and Deltapine 61 appear to be very similar in their susceptibility to bacterial blight. This was confirmed by results obtained from the assessment of Cotton Seed Distributors Ltd cultivar trials located in all NSW cotton production areas during the 1985-86 season (Table 2).

Table 2. The incidence of bacterial blight of bolls in Cotton Seed Distributors Ltd cultivar trials during the 1985-86 season.

	mean percentage of bolls with blight		
Trial site	Siokra	Deltapine 90	Deltapine 61
McIntyre valley	0	32.0	27.0
Gwydir valley	0	22.0	24.0
Namoi valley	0	36.0	37.5
Macquarie valley	0	7.5	5.5

DESTRUCTION OR AVOIDANCE OF INFESTED CROP DEBRIS

There is considerable evidence from overseas work to indicate that the bacterial blight pathogen can survive on infested crop debris. Consequently there have been recommendations to either remove or plough in debris from an infected crop or to avoid planting where infested crop debris is present.

During the November, 1984 and November, 1985 surveys of commercial fields in cotton growing areas of NSW the amount of cotton debris from previous crops that was present on the soil surface as well as the incidence of bacterial blight of cotton seedlings was estimated. No correlation between these two factors was apparent. It is possible that the high levels of seed infestation during the last two seasons masked any effect from infested crop debris as a source of the blight pathogen. It is therefore also possible that permanent bed systems which result in high levels of crop debris remaining on the soil surface may favour the survival of the bacterial blight pathogen from season to season.

SEED TREATMENTS

Prior to the introduction of acid delinting the treatment of cotton seed with a bactericide was commonly accepted as an important control practice. Those bactericides which are available for use as seed treatments are not systemic in their action and consequently they are similar to acid delinting in being very effective for the control of bacteria on the seed surface but relatively ineffective for the control of that small

proportion of bacteria within the seed.

Various alternative seed treatments have been tried unsuccessfully. These have included soaking seed in an antibiotic solution and steam sterilisation. Some Russian workers have published results from studies using irradiation with gamma rays. According to the English abstracts of these Russian papers irradiation treatment of cotton seed increased germination, increased seed cotton yield by up to 760 kg/ha, eliminated bacterial blight infestation and showed no adverse effect on plant growth in the next generation. Some of the reported results appear conflicting and the effectiveness, economics and feasibility of this technique need further investigation.

BACTERICIDAL SPRAYS

Bactericidal sprays are sometimes used to control bacterial blight of cotton in India. Various chemicals are used and up to four applications are necessary.

In a field experiment at the Narrabri Agricultural Research Station during the 1985-86 season three applications of a copper bactericide at a rate of approximately 4000 l/ha slightly reduced the amount of blight present on the foliage but had no significant effect on yield. The spray applications were made on 10/12/85, 6/1/86 and 29/1/86 using a portable sprayer. The epidemic of bacterial blight was well established when spraying commenced.

There are no bactericides registered for commercial use on cotton in Australia.

CLEAN SEED SCHEME

One of the major contributing factors to the developmet of epidemics of bacterial blight of cotton in Australia during recent seasons has been the presence of the pathogen within planting seed. Consequently a committee (the Blight Investigation Group) was established in December 1985 under the direction of Cotton Seed Distributors Ltd (C.S.D.) to develop a seed scheme which would reduce the level of seed infestation to less than 0.03 per cent within five years. A seed scheme is being successfully used for the control of bacterial diseases of beans in Queensland and the introduction of a seed scheme for cotton in California in 1957 was effective in completely eradicating bacterial blight from that state.

To be effective a seed scheme for cotton must include disease control strategies at all stages of seed production ie, quarantine, nurseries, pure seed crops and picking and ginning.

Quarantine

It has been suggested that the races of the bacterial blight pathogen now present in Australia were most likely introduced with seed from overseas. The quarantine procedures currently being used for cotton seed imports to Australia are incapable of detecting the presence of bacterial blight in seed lots.

A total of 356 cotton lines were introduced through Australian quarantine stations during the last five years. There were 243 introductions in 1985 and these included 47 lines imported fom College Station, Texas where the cotton breeder has been using the new African race of the bacterial blight pathogen

in field plots.

The Blight Investigation Group has recommended changes to quarantine procedures which include special precautions for introductions from areas where the new race is known to be present and applications of a bactericide to plants in quarantine for the control of any populations of the blight pathogen which may be present on the leaf surface.

Nurseries

The Blight Investigation Group has recommended that nurseries should be established as far away as is practical from susceptible commercial cotton plantings and should be routinely sprayed with a bactericide for blight control. Extra precautions should be taken to reduce further spread of the pathogen during the picking and ginning of nursery lines.

Following the initial meeting of the Blight Investigation Group a permit was obtained to allow the use of a copper bactericide in nurseries during the remainder of the 1985-86 season. Unfortunately bacterial blight was well established in some nursery plots before spraying commenced. During the coming 1986-87 season the spray programme will be commenced at a much earlier date and field experiments at the Narrabri Agricultural Research Station are planned to compare various bactericides so that the most effective chemical may be selected for future use in the nursery situation.

Pure Seed Crops

During the 1985-86 season all blight susceptible pure seed crops were assessed for the incidence of bacterial blight of

bolls. On the basis of this assessment 13 of the 30 pure seed Deltapine 90 crops were rejected by the C.S.D. seed committee and not used for planting seed production. The seed committee also decided to review the acceptance of pure seed crops if they received rain prior to harvest. Recent glasshouse experiments at Narrabri have shown a 130 per cent increase in the level of internal seed infestation when seed cotton was wet prior to ginning and delinting.

Picking and Ginning

Results obtained in overseas studies have shown that the picking and ginning process is responsible for significantly increasing levels of seed-borne blight infestation. Recent studies at Narrabri using cotton obtained from a field which was found to have 50 per cent of bolls with bacterial blight symptoms have confirmed the overseas work (Table 3).

Table 3. Levels of internal seed-borne bacterial blight infestation following various picking and ginning treatments*. 1000 seeds per sample.

Picking and ginning treatment	seed infestation
handpicked, hand ginned, wet acid delinted	0.1%
machine picked, hand ginned, wet acid delinted	2.5%
machine picked, machine ginned, wet acid delinted	4.6%

Samples of dust from gins in the Namoi valley at the conclusion of the 1985 ginning season were found to contain up to

20 million bacteria per gram. The pathogen responsible for causing bacterial blight can be readily isolated from gin saw blades.

Much work is in progress to determine what practices and procedures can be introduced to reduce the role of the picking and ginning process in increasing the levels of seed infestation. The Namoi Cotton Co-operative gin at Yarraman processed commercial Siokra seed cotton prior to a clean down and the ginning of Deltapine 90 seed cotton for pure seed in May 1986. This was found to effectively 'sweep' the gin machinery clean. However the level of contamination on saw blades quickly rose from 0.3 bacteria/cm^2 of blade after the clean down to over 530 bacteria/cm^2 of blade after three days of ginning cotton from a pure seed crop of Deltapine 90.

Experiments using the 90 saw gin at the C.S.D. facility at Wee Waa have investigated the use of antiseptic solutions to eliminate bacterial contamination of gin saw blades. Re-contamination of machinery quickly occurred when infested seed cotton was processed.

The possibility of applying a bactericide to nursery plots and pure seed crops immediately prior to harvesting is being investigated. Such a procedure would ensure that a bactericide was present at all stages during the picking and ginning process.

CONCLUSIONS

* The use of resistant cultivars constitutes the easiest most effective method for controlling bacterial blight of cotton in Australia.

* The development of a clean seed scheme is in progress, however results will not be immediate. Once established the clean seed scheme will play a significant role in reducing losses caused to susceptible cultivars by bacterial blight.

* The use of bactericides as seed treatments or foliage sprays appears to be either ineffective and/or uneconomic.

* The increasing adoption of permanent bed systems and the consequent increased amounts of crop debris remaining on the soil surface may lead to an increase in the survival of the pathogen from season to season.

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