Industry Approach to Disease Control

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INTRODUCTION

The confirmation of Fusarium wilt in a field north of Moree during the 1996/7 season jolted the cotton industry. Major sections of industry were alarmed at the extent the disease had spread through many cotton production areas of Australia. Unlike most other diseases of cotton, Fusarium wilt poses more questions than answers on how the industry effectively manages and contains the disease in known affected areas. This paper concentrates on the industry's efforts to manage Fusarium wilt.

In 1993 the fungus *Fusarium oxysporum* f. sp *vasinfectum (fov)* was isolated from cotton plants from the Darling Downs, and 1994 from the Boggabilla district. This disease has now been identified at other locations at Mungindi, Boggabilla, Goondiwindi, Moree, and during 1998 at Garah, Miles and Theodore. Fusarium wilt has not been recorded in Central Queensland, St George or cotton production areas in the Namoi and Macquarie Valleys of New South Wales. Two distinctly different strains of *Fusarium oxysporum* f. sp *vasinfectum (fov)* - Downs and Boggabilla, have been identified.

Industry Action

Mid 1997 three major initiatives occurred to address the Fusarium wilt disease problem in the Australian Cotton Industry.

- CRDC conducted a review of industry research requirements for Fusarium wilt.
- National Extension Co-ordinator (Mr Dallas Gibb) was appointed to lead the CRC Extension Team. This appointment formalised the CRC Extension Team's focus on major industry issues. Fusarium wilt was identified as a major industry issue and a priority for the CRC Extension Team to address.
- ACGRA's Fusarium Working Group was formed to raise awareness of the disease throughout the industry. Membership of this working group consists of representatives from all sectors of the cotton industry, as well as growers.

The **result** was a concerted targeted effort to:-

- Increase awareness of the disease Fusarium wilt to all sectors of the cotton industry;

- Develop strategies to control the spread of Fusarium wilt to production areas currently free of the disease.

The success of programs to raise the awareness of this disease has been due to the close cooperation between researchers, both the CRC and the seed companies' extension field staff, and members of the Cotton Consultants Association. This cooperation has resulted in well attended industry field days and seminars being conducted, and the sharing of disease information through reinforced professional links.

Growers have assisted the Fusarium Working Group to establish a cotton industry contractor data base. With the assistance of Mr Adam Kay and CSD Wee Waa, growers were requested to return contact names and addresses of contractors employed on their properties. Grower response has exceeded expectations with a contractor data base being compiled at DPI Dalby. This data base will enable wider dissemination of updated information to minimise the spread of the disease between growing districts to all sections of the cotton industry.

Printed information on the disease has been distributed widely. The new Fusarium wilt leaflet has been posted to every registered grower and CCA member. Mr Dave Larsen has placed Fusarium wilt information on the Internet/Web Page from ACRI Myall Vale. Ms Genevieve McAulay ***Cotton Outlook***, and Ms Margaret Brampton ***Cotton Insights*** have also given valuable support for the timely distribution of Fusarium wilt information.

Mr David Dowling ***Australian Cottongrower*** has supported our information distribution through feature articles in the magazine. ***Australian Cottongrower*** Moree Cotton Trade Show (May1998) sponsored the CRC Extension Team's exhibit at the show. A prominent site coupled with active support from Mr Dowling's own staff, the CRC Extension Team successfully promoted the **'Machinery Washdown'** and **'Be Fusarium Wilt Aware'** message to Trade Show patrons.

Cotton growers are keen for information on management options for Fusarium wilt. Many growers who have had the disease confirmed on their farms are working closely with researchers in cooperative efforts to find the answers to best manage the disease.

Mr Graham Clapham, *'Cowan'*, Cecil Plains, has hosted extensive trials on his property for the past several years. Varietal screening conducted in these trials by Dr Joe Kochman and other researchers with both CSD and Deltapine cotton breeders, have led to varieties with higher

tolerance to Fusarium wilt being developed for the whole cotton industry. Mr Clapham and his fellow trial collaborators are to be commended for their contribution and commitment to Fusarium wilt research, which directly benefits every cotton producer.

Grower experiences in Fusarium wilt management are also contributing to increase the industry's awareness and understanding of the disease. One such example is outlined in the 'Morella' Case Study.

CASE STUDY 1 - 'MORELLA'

'Morella' is a 1400 Ha irrigated cotton property located just south of Boggabilla on the McIntyre River flood plain. The soil types are predominantly black cracking clays with intrusions of red box soils.

This farm has been producing back to back cotton for fourteen years, growing predominantly Siokra varieties prior to the Fusarium wilt being found.

Fusarium oxysporum f.sp *vasinfectum (fov)* was detected in one field in December 1994. The outbreak was first noticed as wilting and dying plants during a hot period in early December. Spread was general across all the field with some hot spots that showed up by late January. The disease was noticeably more common on the tail drain end of the field.

WHERE DID THE DISEASE COME FROM ?

As the disease had not been noticeable in the previous cotton crop (1992) investigations into why the sudden appearance of the disease in a general pattern were necessary. In the previous crop to the identification of the disease, the field in question had Dolichos grown as a green manure crop, so samples of the seed and stubble were taken, but no sign of Fusarium was found.

The other possible contributing factor was that no fertiliser was used on this block, possibly making the plants more susceptible to disease attack. The fact that Siokra varieties had been grown on this field for the prior six seasons would have increased selection for the disease resulting in a significant build in soil inoculum levels.

TWO STRAINS OF FUSARIUM

By the end of the 1994 season genetic fingerprinting showed that the Fusarium found at 'Morella' was a different strain to the Fusarium on the Darling Downs. This finding endorses the assumption that the disease was naturally occurring in the soil and was selected for by repeatedly growing susceptible cotton varieties.

DEGREE OF SPREAD

In 1994 Fusarium was only found in the one field of 'Morella'. In 1995 that field was fallowed. Only isolated plants were found in the adjoining field of a susceptible variety.

To date the disease has still only been found in the three adjoining fields on 'Morella', but only as isolated plants. However, neighbouring farms have identified the disease in the past few seasons when growing susceptible varieties. The spread onto these neighbouring farms has been attributed to machinery movement and water harvesting of storm water off the affected field.

MANAGEMENT

The disease to date appears to be contained to one portion of the farm and some key management tools being exercised are:-

(a) Varieties: Variety selection is critical on 'Morella', any fields with the same water source or Fusarium present are set aside for Sicot 189. Susceptible varieties have been shown to build up the disease levels quickly and are not grown on any fields now. However Sicot 189 appears to be reducing the disease levels.

Dr Stephen Allen (NSW Agriculture, ACRI) sampled the 1994 cotton crop and established an infection level of 13.4 % across the field. A cereal fallow and two Sicot 189 cotton crops later, the disease infestation level had dropped to 3.4 %.

(b) Machinery Hygiene: 'Morella' has adopted a policy of machinery clean down between fields as well as machinery entering or leaving the farm.

In the clean down process all plant material and soil is removed by either high pressure air or washing. The machinery is then sprayed with a mist of a chlorine solution.

(c) Field Staff: With field staff such as bug scouts and agronomists, the fields with Fusarium are always left to last for checking and in wet conditions the farmer's vehicles are used to reduce the risk of moving the disease in mud.

(d) Trials: NSW Agriculture has established trials in the first affected field looking at fertiliser interactions, varietal differences, seed treatments and biological control agents.

Deltapine is using this field to screen variety trials for Fusarium tolerance. The site has been used in the past season as a demonstration site to educate field agronomists on disease identification.

YIELDS

Since the identification of Fusarium on 'Morella' the fields affected have only grown Sicot 189. Consequently, disease symptoms have not been that obvious and yields on both crops have been between 9.4 bales per hectare and 9.9 bales per hectare. No yield penalty has been experienced with the affected fields yielding as well as the non affected fields.

'MORELLA' SUMMARY: It would appear that with the current management practices and varietal selection that the spread of Fusarium can be minimised and the cotton can still be grown quite economically. The biggest adjustment to be made is in farm management with particular emphasis on farm hygiene to prevent the spread of the disease onto neighbouring fields and farms.

Notification and Washdown Strategies

The ACGRA Fusarium Working Group has provided the forum for discussion of options to develop strategies for machinery washdown, and has highlighted the importance of grower notification of production areas where Fusarium wilt has been confirmed.

Seed companies are dependent on trial and seed production from Fusarium free areas. The importance of Fusarium wilt identification, and the notification to industry can not be overstated.

Fusarium wilt is known to be spread in infected trash or plant material and in infected mud or soil. Growers should demand washdown of machinery, particularly machinery arriving from

another district, before commencing work on their property. These hygiene measures equally apply to all farm machinery (eg pickers, grain harvesters) and vehicles entering properties to undertake contract work, and purchases of second hand machinery.

Dr Stephen Allen's motto - "Come Clean, Go Clean" can only assist to minimise the spread of Fusarium if growers insist washdown strategies are implemented on their own farms.

BENLATE PERMIT FOR WASHDOWN APPROVED

The National Registration Authority has issued Permit No PER1584 for the use of Benomyl (Benlate WP) as a machinery washdown to reduce the spread of Fusarium Wilt.

Approved product:- Du Pont Benlate Fungicide Wettable Powder containing 500 g/kg Benomyl (active constitute).

Application rate:- 60 grams product per 100L water.

NRA Permit No PER1584 is effective from 11 May 1998 to 31 May 1999.

Important Points to note are that:-

- Permit has been issued on circumstantial evidence of efficacy only;
- Permit is issued without the support of the manufacturer and in no circumstances is the manufacturer to be subject to liability as a result of the use of the product as specified by Permit No PER1584;
- Cleandown of machinery with high pressure water to remove soil and debris required prior to application of Benlate fungicide;
- Approved for use in NSW, QLD & WA only.

Trial work has been instigated at Plant Pathology, DPI Farming Systems Institute's Indooroopilly Laboratories to determine the effectiveness of this off-label recommendation for future applications for this permit to be extended.

Ginning Guidelines

Guidelines for procedures on how cotton ginning organisations should handle Fusarium wilt affected seed cotton were adopted by the Ginners Association for the 1997/8 ginning season. Grower declaration of the presence of Fusarium wilt in fields is critical for ginning organisations to manage modules appropriately to minimise any potential spread of the disease. The 'Koramba Cotton - Koramba Ginning' Case Study outlines the measures implemented by that organisation to manage the threat of Fusarium wilt.

CASE STUDY 2 - 'KORAMBA COTTON- KORAMBA GINNING'

'Koramba' first grew 405 Ha of cotton in 1985. After acquiring adjoining properties the property now totals 16 195 Ha, with 4 656 Ha developed for irrigated cotton, and 1 619 Ha for dryland winter cropping. In 1992, 'Koramba' built a four stand Lummus gin to service the area west to Dirrinbandi, east to Goondiwindi, and south to Moree. Production this season is expected to reach 112 000 bales.

Having a gin and cotton farm in a valley with Fusarium, puts us in a unique position. Our main priority is to keep our own farming operation free of Fusarium, assuming, of course, that we don't already have it.

The gin and the farm are two separate entities and are basically neighbours. Being that way it is possible to isolate one from the other, but, as with any other neighbour, **traffic** is the common denominator. Traffic to, and from a gin yard is constantly busy for any ginning operation, and in our situation there is traffic to be considered from both the farm and client properties.

Our own traffic is easily managed, we can control our own situation very effectively. It is a far more difficult task with all other traffic and requires management systems for control, and co-operation from all parties concerned.

Appreciating that Fusarium wilt *is* in the valley, **the simple first step to control is to ask growers to notify us of cotton arriving from affected fields.** Designing management systems and implementing them are where the major challenges exist. Differentiating between realistic and practical measures and what could be termed ideal circumstances again is a challenge to meet.

To put in wash pads, rinsing bays and other such measures to treat approximately 5000 flat top trucks and chain beds from other properties is an ideal, but impractical measure. The solution is to 'quarantine' our farm from the gin yard environment. It must be also recognised that to achieve a full quarantine in our situation is, for all purposes, impossible.

Having said that, we must take every step possible to reduce our exposure risk level. As far as we are concerned that sums it up - reducing our exposure level, we don't think it can be eliminated, but it certainly must be reduced as far as possible.

We have our own machinery moving from the gin yard to the farm constantly, particularly the chain bed. Cotton delivered from nominated Fusarium fields from other farms are allocated a specific area in the gin yard. A coordinated delivery and ginning timetable enables this to be a small area of the yard and is rotated to all Fusarium cotton. Our own cotton is not put on these beds so there is no potential for lint or trash from these beds to be taken onto the farm via the chainbed. Moonbuggies are also solely allocated to these receivals and gin runs and then decontaminated prior to being returned to general on line duties.

Likewise we have a responsibility to every other client of our gin not just ourselves. Again with coordinated module deliveries and yard space we are able to dedicate one moonbuggy to handle the modules from Fusarium fields.

Communication is a key to keeping all growers, loader operators and truck drivers informed and hopefully happy with the situation. Accepting and handling Fusarium modules can alter the order and apparent service to all incoming trucks. Response from ill informed truckies when others go around him in a gin yard are not printable; we have had it in the last season. When Fusarium cotton is not being delivered or ginned that moon buggy is returned to online service after being washed and decontaminated.

The three sources of Fusarium via a gin yard are dirt, seed cotton and trash. None of these three are really controllable to the full extent but again minimising risk is best form of action. All parties have a part to play here from the grower through to the ginner.

Dirt is easily picked up with modules but this is pretty well unavoidable unless the bottom part of the module is left behind. Mud on the other hand is generally avoidable and is probably much more of a risk to us. Preferably the Fusarium fields should be picked and these modules transported in a minimum of time frame. The big unknown of course is the weather, none of

us are able to control this but we can attempt to judge it.

Seed cotton, along with dirt or mud pose a risk to the grower as well as to the ginner/farmer. We don't know whether lint in a module is carrying a Fusarium spore, or if any at all. But a poorly built module has far greater potential of spreading lint around the district than does a well built module. Consideration should also be given to the height of a module. Appreciating the freight advantage of a large module compared to a smaller module, it is also true that much more lint will be lost from under the trucking tarp from an 'oversized' module. The lint falling from these modules doesn't choose where to fall. So the potential spread is from the position the module is built, to the gin feeder bay and everywhere in between, including through the farmers own property, along the roads, at the gin entrance and in the gin yard.

Trash is basically the responsibility of the ginner, although it is obviously found in cotton dropped from a module. After ginning, the two by-products, seed and trash, are sent in different directions. The trash is stored somewhere in close proximity to the gin while the seed is exported off site.

Firstly the gin must be careful where trash is stored. Obviously, flood free is a critical consideration when choosing the site , and a well sheltered site is preferred. Even though there is no obvious advantage to the gin to store this product in a flood free area (which is probably ideal for module yard use) we have a moral obligation to handle and store this trash in as 'safe' a place as possible. In the long run this will be very beneficial to all concerned. Transporting the trash in a 'hygienically' efficient manner is near on impossible but again every effort must be made.

Fuzzy seed should be treated as a commodity of value. Truck drivers will over fill their trailers to compensate for settling in travel and to keep their weights up. To them a little bit of spillage over the sides and from under their tarps is no great deal, but firstly it is lost income, and secondly another source of potential contamination.

The sources outweigh the potentials, and are both outweighed by the risks. I haven't worked out how to stop a seed from sticking in the tread of the cruiser ute, or the mud from getting under guard or the wind from blowing the trash. But we can reduce lint falling from the module, the chance of dirt and mud being transported and we can isolate cotton at the gin. We can stop gin equipment from being used on other growers trucks etc. while receiving Fusarium cotton.

Easiest of all, we can design management systems to reduce our own level of exposure and the level of exposure of other growers as well, but we can't do it on our own.

Traffic control is the most critical system of all. Control the movement of the cotton and we will minimise the potential exposure. To control the movement of cotton we must control the picking and module building, the module lift, the flat-top truck / chain bed, the receival of the module, the machinery to unload the flat tops and then load the gin and then the post ginning by-products.

'KORAMBA COTTON- KORAMBA GINNING' SUMMARY:

Easily said and printed, hard to implement, but very achievable. 100% achievable? I doubt it, but we as a ginner/grower, must try, for the sake our own production and as a responsibility to our clients. Controlling the spread of Fusarium is important to buy time until solutions to stop this disease can be discovered

CONCLUSION

All sectors of the cotton industry have collectively worked together and have been very successful in raising awareness of Fusarium wilt. While the industry awaits the availability of Fusarium wilt resistant cotton varieties, development and implementation of management strategies to contain and manage this disease will depend on this industry collaboration continuing.

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