

US cotton industry finds harmony in Nashville

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The theme of the annual US Beltwide Cotton Conference for 2003, “*In harmony: research, resources, results*”, put the focus on the need to move forward from the domestic and international controversy surrounding the passing of the new Farm Bill, the need to highlight conservation components of the program and a weather damaged crop in the US.

The format for the conference was similar to previous years in that the first two days had a grower focus, with the final two days broken into technical sessions on the various disciplines — plant breeding, entomology, ginning and marketing, diseases, soils, physiology and weeds.

In developments from industry there were a number of new transgenic cotton varieties launched for the 2003 season along with new chemicals for insect pests (Novaluron and Flonicamid), growth regulation (Pix Pentia) and defoliation. John Deere introduced a revolutionary new spindle picker for UNR and laid out their vision for ‘onboard’ guidance and data collection that will support precision agriculture and variable rate applications into the future.

US CROP QUALITY

The second day of the grower (production) conference dealt with issues surrounding the quality and marketing of the 2002 US cotton crop. It started with an excellent presentation on the changes in fibre quality parameters over the past 10 years by Mike Watson of Cotton Incorporated. The 2002 crop in the US was affected first by drought then by drought-breaking rains at harvest, especially in the mid-south, increasing the proportion of the crop classed as light-spotted to 14 per cent of bales.

An analysis of 10 year trends in cotton fibre parameters shows that:

- Average staple has fallen by $1/32$ " to $2/32$ ";
- Micronaire has increased from 4.4 to 4.6;
- There has been little change in strength; and,
- Colour grade remains variable in response to weather.

There has been a dramatic increase in the number of bales discounted for high micronaire in the US in recent years with



Mark Edge, Global Cotton Product Manager, Monsanto, St Louis and Greg Kauter

very little cotton now discounted for low micronaire.

These trends are more troublesome because of the increasing proportion of US crop sold for export. The contraction in the US spinning industry (Table 1) has seen more US bales sold to overseas customers with different expectations of ‘base’ fibre quality.

The final talk of the session was Market Place Insights presented by William Dunavant Jnr. (his 17th such address to the Beltwide Cotton Conference — see following story).

The conference broke into specific discipline conferences (meetings) for the final two days.

COTTON INSECT RESEARCH AND CONTROL CONFERENCE

Research on insect protection dominates the technical sessions of the Beltwide as it does in many other cotton-related meetings around the world. The cost

incurred by the cotton bollworm and the tobacco budworm (the US heliothis) in crop damage and crop protection was estimated at US\$525 million for the 2002 crop. The plant bug or *Lygus spp.* (mirid) is also widespread and the second most damaging pest. The stink bug group (including Green Vegetable Bug) is rapidly emerging as an important pest in Bollgard cotton.

Boll weevil (*Anthonomus grandis*) eradication is still a high priority across the US cotton belt costing US\$125 million in 2002. The stage is also set for the attempted eradication of the pink bollworm with the commencement of a sterile male moth release program. Bollgard cotton, mating disruption programs and targeted insecticide applications have been effective in reducing end of season infestations rates in Texas and New Mexico from 17.6 per 100 bolls in 2001 to 0.8 per 100 in 2002.

Bollgard II has gained approval in the US and the first commercial planting will occur this year. Apart from the important resistance management aspect, Bollgard II offers the US grower a wider spectrum of control of pests than the first generation single gene Bollgard cotton. The second Bt gene (Cry2Ab) is much more effective against armyworms and loopers.

TABLE 1: The contraction of the US spinning industry (million bales)

	Domestic sales	Export sales
1997 (actual)	11.3	7.5
2003 (forecast)	7.5	10.8

The other important advantage of Bollgard II is the much higher level of expression of the second gene (approximately five times the level of Cry1Ac) in all plant parts and over the course of the season. Refuge areas will remain the same as for the single gene Bollgard which, in Australian terms, are already quite low.

Monsanto has undertaken further trial work to assess the contribution of non-cotton hosts, such as corn and sorghum, to the existing Bollgard refuge. Insects can be tested directly to tell the type of plant on which they developed.

As mentioned, the stinkbug group of sucking pests is gaining a lot of attention particularly in areas with a high proportion of Bollgard cotton where previously these pests were incidentally controlled by sprays for heliothis. Thresholds have been re-evaluated for both boll damage and insect numbers.

Growers and consultants in the US are becoming increasingly interested in the toxicity of new insecticides on insect natural enemies. Studies involving both predators and parasites show the variability of the impact of various chemicals on beneficial insects. This work would support the



Adam Kay, CSD (left) and Brian Duggan, CSIRO Kununurra (right) join in discussion with USDA and researchers during a break.

development of a ranking system similar to the Beneficial Disruption Index developed by Australian Cotton CRC researchers.

New transgenic insect protection products are on the horizon with the launch of VIP (vegetative insecticidal protein) from Syngenta and WideStrike from Dow AgroSciences. Both products are based on strains of Bt and have a broad spectrum of activity against Lepidopteran pests, but

there was no data presented on activity against the Australian species of *Helicoverpa*.

COTTON PHYSIOLOGY AND SOIL SCIENCE

Much of the soils research focused on precision farming techniques for fertiliser application and the use of chicken manure as a soil conditioner and source of fertiliser. With several hundred million chickens

in each of the major cotton producing states in this area there is a lot of interest in how to use their waste. Precision farming is also gaining in popularity as growers increasingly use yield maps and apply fertilisers and gypsum or lime accordingly.

The problems facing the cotton industry are stratification of P and K in the top soil and the loss of N through leaching. The use of cover crops and minimum tillage are also increasing, particularly in the south-east on sandy coastal plain soils. There was considerable interest in using hairy vetch due to its ability to suppress soil diseases and Austrian winter peas — both of which were found to fix large amounts of nitrogen.

There is increasing interest from Cotton Incorporated in research directed towards cotton physiology. Cotton yields have not increased significantly in the US for several years while yield stability is falling. Cotton Incorporated is particularly interested in research aimed at yield composition and how that can be used to consistently increase lint yield in the future.

One of the more interesting talks on this subject was a preliminary report on breaking yield down into its components (boll number, boll weight, turnout, seed number and lint weight per seed). The report found that while the seeds of smaller seeded cultivars had a relatively larger surface area for their weight they also had a less stable yield. It was reasoned that more energy was required to produce the extra number of seeds. It will be interesting to see where this research goes to from here.

COTTON IMPROVEMENT (PLANT BREEDING)

A number of papers were presented regarding the movement of pollen from and between transgenic crops. Most of these studies highlighted the relatively small distance that cotton pollen moves if insect pollinators are not involved.

One paper examined the difficulties that conventional cotton breeders can face keeping transgenics out of their new conventional varieties when transgenic plants are in close proximity.

Dr John Adamczyk from USDA at Stoneville presented information on the expression of Bt cotton and how genetic background can create variability in the levels expressed. Some of the data suggested a single gene may suppress expression in some varieties and further work will be conducted to confirm this.

A joint session was held of the Improvement Conference and the Quality Measurement Conference to overview the components of a major new project — the



A panel of growers discuss innovative technologies

Variety Evaluation Project. This project is similar to the CRDC 'Field to Fabric' initiative and some of the work CRDC has invested in at looking at the spinnability of Australian varieties. The US researchers are now co-ordinating a huge evaluation along similar lines.

DISEASE COUNCIL

The Cotton Disease Council featured a seedling disease workshop for cotton growers, and a special colloquium on 'Fusarium wilt of cotton in Australia' as well as the presentation of 36 papers and eight posters. Sixteen of the 36 papers presented were concerned with the root knot and reniform nematode problems that affect much of the US cotton belt. Seven papers dealt specifically with Fusarium wilt, six papers covered seedling diseases including black root rot and there was one paper each on Verticillium wilt, bacterial blight, boll rots, bronze wilt and cavitation/phomopsis boll dangle.

The 'Fusarium wilt in Australia' colloquium attracted considerable interest and was well received. It was chaired and addressed by Professor Pat Colyer from Louisiana who visited Australia and reviewed the Fusarium work in February, 2002.

Presentations were also made by Stephen Allen, Adam Kay and Joe Kochman from Australia and by Mike Davis of the University of California at Davis. Mike reported that he had been unable to detect the Fusarium wilt pathogen in white fuzzy seed exports from Australia to the US from limited sampling.

He indicated that he had found races 1, 2, 4 and 8 of the Fusarium wilt pathogen present in California. Race 8, previously

thought to be confined to China, was found in samples collected in California in the 1970s. Race 4 was found to be particularly devastating on pima cotton in California. The Australian races were distinct from other described races.

In a paper presented in a general session of the Disease Council, Al Bell from Texas claimed to have found the Fusarium pathogen in samples of Australian fuzzy seed (stock feed) export shipments. But the source of his samples was questioned and he was unable to get any infection of seedlings with stem puncture inoculations.

He did claim infection by his 'Australian' isolates with a root dip inoculation method. His results are in disagreement with the results of two studies in California and the work of Joe Kochman in Australia.

US cotton growers are concerned and specifically asked if planting seed grown in Australia for the US market was being produced under the Australian cotton industry protocol for producing Fusarium-free seed.

COTTON WEED SCIENCE RESEARCH CONFERENCE

Research surrounding Roundup Ready and the second generation Roundup Ready Flex from Monsanto dominated the weed management presentations this year. Numerous studies highlighted that crop safety to the current product was maximised by adherence to the Roundup Ready label.

Roundup Ready Flex will have an expanded over-the-top application window and greatly improved crop safety. The improved expression in pollen will also relax the amount of precision required in the post-directed applications.

Some papers provided further validation of the competitive nature of early weed infestations. Such studies are relatively easy now with Roundup Ready cotton. These trials conclude that heavy weed populations (even of small weeds) during plant establishment can result in a competitive disadvantage to the cotton crop. In Roundup Ready cotton, weed competition can be virtually eliminated by two applications in the OTT window. About 44 per cent of Roundup Ready fields were treated in this way in 2002.

There is no doubt that weed control is moving towards predominately post-emergence knockdown strategies with a number of papers reporting on trials with Staple, Envoke, Roundup Ready, and Liberty Link cotton. Approximately half the cotton acreage in the US no longer receives a pre-emergence residual herbicide application. Bayer CropScience will have limited areas of Glufosinate-ammonium resistant cotton available in the US in 2003.

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Recordings of selected presentations can be found at www.csd.net.au or for details of any of the papers mentioned please do not hesitate to contact the authors of this article; Greg Kauter (07 4671 1648) or Brian Duggan (08 9166 4059).



New products the future of cotton biotech

Two major announcements were made at the Beltwide about potential new cotton biotech products. Both Syngenta's Vip gene and Dow's Widestrike may offer some new biotech choices to cotton growers over the next few years.

These are in addition to the announcements by Monsanto on the approval for Bollgard II and updates from Bayer on the future introduction of Liberty Link cotton.

Syngenta's Vip

Vip (vegetative insecticidal protein) cotton is the working name of a new product which has been submitted for registration with the US Environmental Protection Agency. Syngenta anticipates registration in time for US commercial sales in 2004.

Vip Cotton controls target pests through a novel mode of action.

It offers broad-spectrum, full season control of major lepidopteran pests, including heliothis and Spodoptera species such as fall armyworm and beet armyworm.

Current transgenic traits utilise proteins from the *Bacillus thuringiensis* bacterium known as delta endotoxins. The Vip protein (discovered by Syngenta in 1994) is an

exotoxin derived from the *Bt* bacterium. It is structurally, functionally and biochemically different to Bt delta endotoxins, making Vip cotton a potential choice to minimise the threat of insect resistance.

The Vip protein is expressed in the entire cotton plant, including the floral parts, to provide complete plant protection. When pest larvae feed on Vip cotton, the protein is ingested and causes the larvae to stop feeding and soon die.

"Despite heavy bollworm pressure in North Carolina in 2002, Vip Cotton delivered effective control throughout the season," said JR Bradley, professor of entomology at North Carolina State University.

"After years of study, Vip Cotton is expected to be our first introduction into the transgenic cotton market," said Ken Flower, Syngenta global seed and traits manager for cotton. "The new technology will have an immediate impact as an alternative to what is currently available and promises to offer even more benefits as our research continues."

Dow's Widestrike

Dow AgroSciences announced the selection of WideStrike as the brand name for its cotton insect protection trait.

The product — a combination of the Cry1F and Cry1Ac Bt proteins — has been in development and field study by Dow AgroSciences for several years. This is a different combination of Bt proteins than current commercial transgenic products. It is on track for regulatory approval and commercial introduction in 2004.

During 2002, the WideStrike insect protection trait was in 75 extensive agronomic, efficacy and resistance management trials across the US cotton belt. Preliminary results from those trials show season-long protection against a broad spectrum of lepidopteran pests such as cotton bollworm, tobacco budworm, pink bollworm, beet armyworm, fall armyworm, yellowstriped armyworm, cabbage loopers and soybean loopers.

An Experimental Use Permit for 2003 trials is expected from the US Environmental Protection Agency, with full federal registration anticipated in 2004. WideStrike will be introduced in elite varieties from Phytogen Seed Company in 2004, and is expected to be available in varieties from other cottonseed companies by 2005.

