Spotlight on Cotton Research

10 YEARS OF THE COTTON RESEARCH & DEVELOPMENT CORPORATION

CRDC

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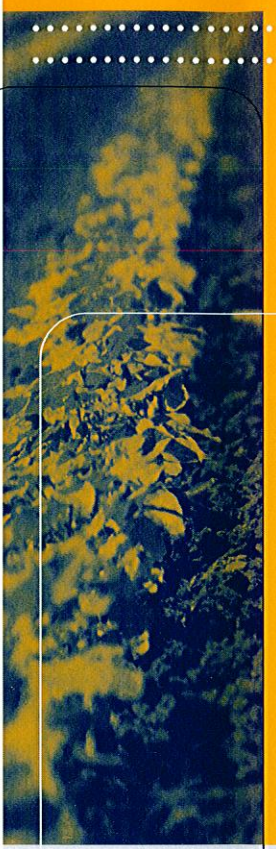
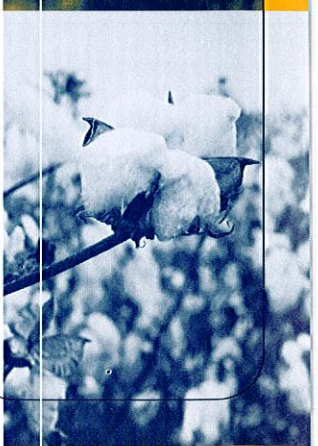
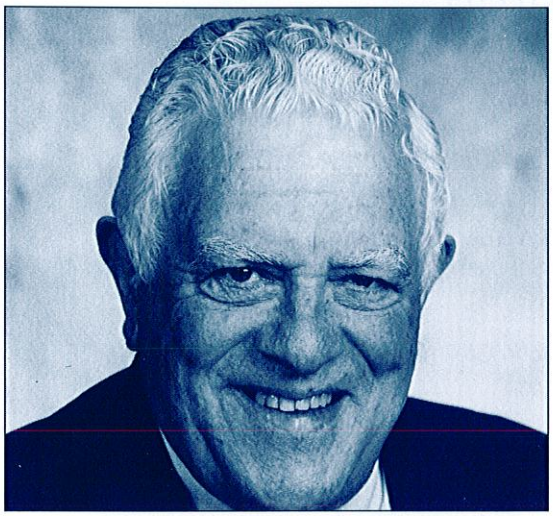




Chairs' review

Maximising Benefits

by John Blood



John Blood

When the Cotton Research and Development Corporation was formed in 1990, it was called upon to play an independent role in co-ordinating and funding research in the cotton industry.

A partnership between the Federal Government and the cotton industry, the Corporation aimed to maximise the value, efficiency and benefit of its spending in research and development. This it has done to great effect, with the industry receiving excellent value for the levy which is matched dollar for dollar by the Government.

During the last 10 years we have seen tremendous improvements, including cotton varieties with increased yields and improved fibre quality, the development of a national co-ordinated cotton extension team, and the introduction of the successful Best Management Practice program, believed to be the first of its kind in the world. Production increased from approximately 1.3 million bales in 1989/90 to a record 3.2 million bales in 1998/99. And the Australian crop now annually generates about $1.5 billion in exports.

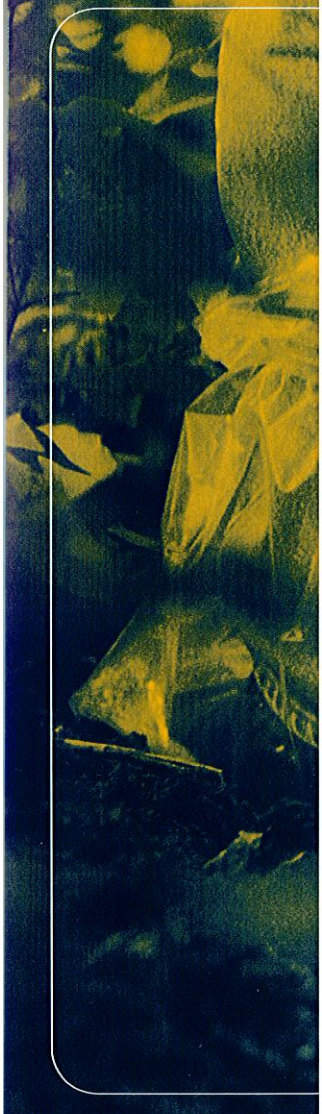
One reason for the industry's success has been its willingness to get behind the CRDC and the research effort in general. This has been facilitated by the Australian Cotton Growers' Research Association, the industry organisation that the CRDC is directly accountable to. A hands-on organisation with a good feel for what's happening in the cotton industry, the Growers' Research Association have been very proactive in sifting through the research applications each year and identifying industry priorities. Always a good way to start a budget year and without a doubt a tremendous plus for the industry.

The Corporation has also achieved success through the participation of its other stakeholder, the Federal Government. There have been excellent Ministers from both sides of politics who have helped the industry and the Corporation. Although the Corporation acts with a lot of independence from Canberra, the Government Director on the Board plays a key advisory role on matters of legislation and Federal policy.

During the time I've been involved with the CRDC, the management and staff lead by Ralph Schulzé have always been an energetic and capable group of people focussed on the needs of the industry. In terms of the research community generally, the industry is very fortunate to have a broad range of experienced people covering the range of research activities.

Much has been achieved during the last decade. With a strong and committed research team and a cohesive industry in support, I look forward to seeing the cotton industry's achievements in the future.

(John Blood was appointed Chairman of the Corporation upon its establishment in 1990 and remained in that role until November 1999. He was previously Chairman of the Cotton Research Council. He is currently Chairman of the Australian Cotton Cooperative Research Centre.)



Thinking Ahead

by Bridget Jackson

Bridget Jackson

Cotton producers spend an extraordinary amount of time and money on research and development. Not only do they participate in research trials on their own farms, but they also talk to researchers, attend at field days, help develop production models, employ cotton consultants, support ACGRA, and support CRDC. Would an industrialist do proportionally as much - I doubt it.

Our job, as the new Board of the CRDC, is to ensure that we 'leverage' our research funds wisely against that input.

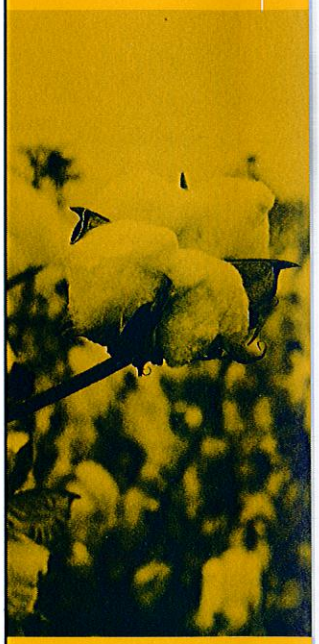
In some areas of research, such as soil and water relationships, we need to improve our understanding of the processes involved. In others, we need to find better ways of managing our crops. How can we make rotations work for the soil and the crop? How can we make insects our allies? How can we work with our neighbours to turn what may seem to be a problem crop next door, into an advantage for both of us? Maintenance of the integrity of the environment is just as important. Are we making the best use of communication systems?

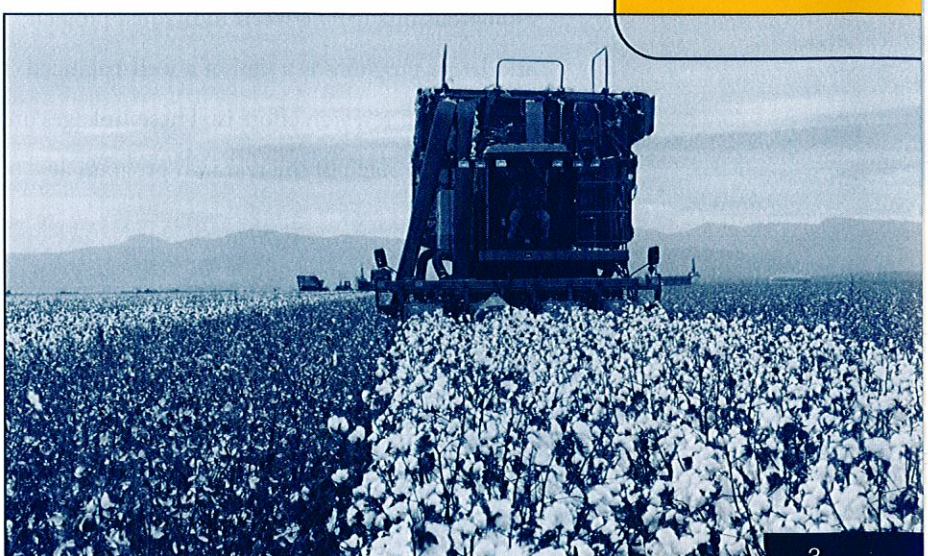
Because of the long lead times in breeding and biotechnology, we need to be futurists when we decide where to invest. In biotechnology in particular, we are looking for plants which are better able to look after themselves, but which also provide benefits to consumers. But what will consumers want in 5 to 10 years time?

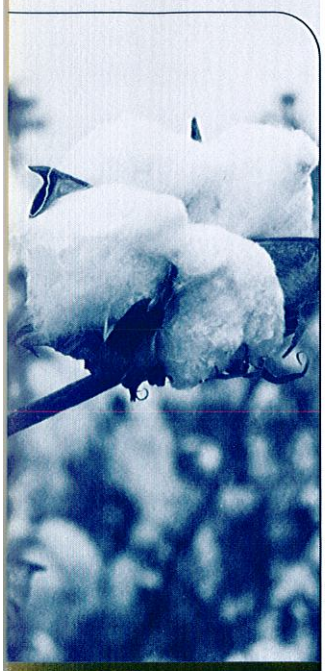
We have an unequalled system of marketing cotton in Australia. But could we improve on it? Do we spend sufficient funds on the development of better harvesting and ginning systems? Are there some good ideas out there that need to be developed?

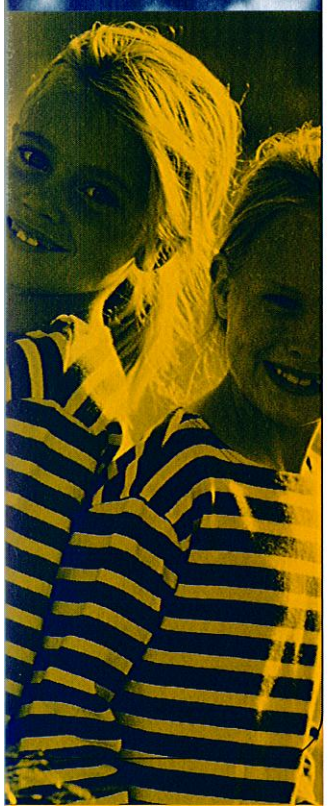
The challenges for the future are exciting, and we look forward to working with the industry to tackle them.

(Bridget Jackson was appointed Chair of the Cotton Research and Development Corporation in November 1999. She is an agricultural consultant based in Sydney.)



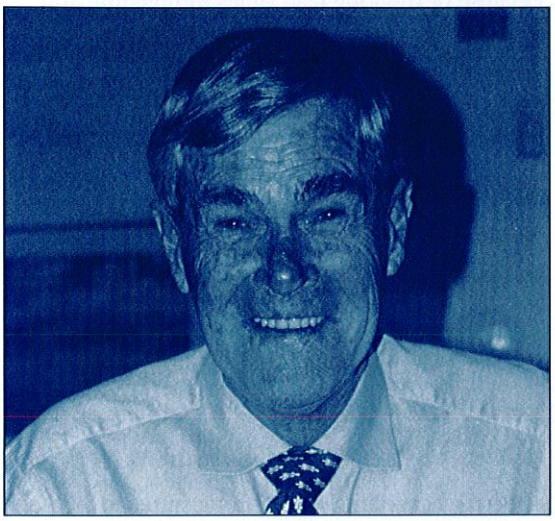






Executive Director's Report

Providing Benefits to Industry *by Ralph Schulzé*



Ralph Schulzé

As you read through this document you will see words such as 'proactive', 'cohesive', 'collaborative', 'comprehensive' and 'integrated' appear throughout. In a sense, these words are the reason the Cotton Research and Development Corporation was created.

To be an independent player in the cotton industry, in a position to recognise research needs as they arise or before if possible, and to facilitate co-ordination of the research effort and collaboration between industry organisations.

Numerous linkages between individual projects and larger programs is a sign of a well-balanced and focussed research effort is. These linkages are apparent throughout the research program at the CRDC.

With a good mixture of basic and applied research, the Corporation's goal is to provide benefits to the industry. Much of the crop response and physiology work feeds back into the plant breeding program, helping create robust varieties tailored to Australian conditions. The breeding program creates varieties with enhanced agronomic characteristics which are then slotted into farming systems. Work on farming systems assists the development of Best Management Practice.

We've ensured that Australian cotton production has stayed in the lead as far as world production is concerned, by making available the best technical information and by facilitating communication through all sectors of the industry.

During the last 10 years there have been significant advances in varieties produced through the Australia breeding program. Yields are up and the quality of the fibre has improved. Independent evaluations by German manufacturers of mill and spinning equipment concluded that 'remarkable progress' had been made in fibre quality during the last six years. The fibre was 'most desirable for high-speed and fine-count spinning' a market segment held by the world's best cottons.

On-farm management practices have also made a significant contribution to increasing yields by improving water use efficiency, maintaining the structure of the soil and investigating the impacts on soil nutrients of various crops in rotation with cotton. While yields are going up, the incorporation of Integrated Pest Management strategies into farm operations has been shown to help the amount of pesticide sprays go down - for transgenic and conventional cotton.

The Australian cotton industry is also leading the world in the development and adoption of a flexible, industry-wide environmental-management system. The industry's Best Management Practice program is the direct result of a joint CRDC, Land and Water Resources Research and Development Corporation and Murray-Darling Basin Commission research program 'Minimising the impact of pesticides on the riverine environment - using the cotton industry as a model'. At the time the most comprehensive research program of its type ever conducted in Australia, it concentrated on developing practical methods to reduce off-target transport of pesticides, minimising their impact on the rivers and providing a scientific basis for the development of management guidelines and regulatory codes.

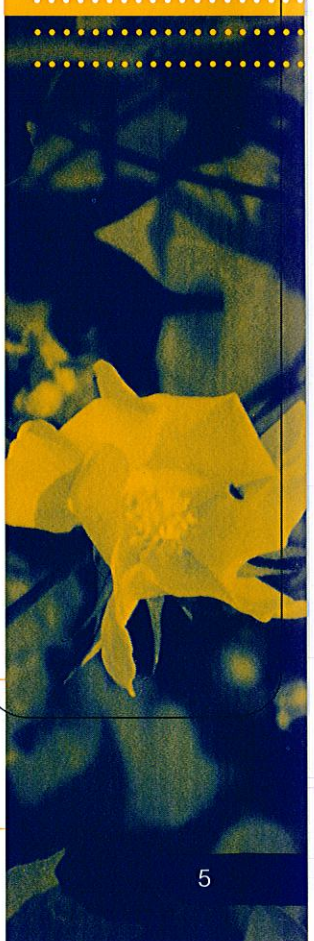
Beyond simply funding initial research and the subsequent development of the Best Management Practices program, the Corporation has also had responsibility for bringing together a rigorous auditing procedure. After two years of work the process is drawing to a close and the Corporation is laying the foundations for a self-sustaining audit office. By going through an audit, individual cotton growers are able to demonstrate their commitment to the environment, neighbours and to the future of their businesses and the industry. The audit procedure also gives growers a method to measure individual progress against a series of industry benchmarks.

The success of the Cotton Research and Development Corporation can be attributed to many things. One which can not be understated is the support of the entire cotton industry and the influence of our industry stakeholder, the Australian Cotton Growers' Research Association. This is a unique organisation in Australian agriculture because it focuses solely on research and development in the context of the needs of the industry, and is not driven by commercial or political forces. By involving the Association in the review of project applications and annual reports, we also ensure the Corporation's research is meeting the requirements of the industry.

I trust you enjoy reading this publication and find it a useful guide to the work of the CRDC from the past decade. If you would like more information on anything contained within, please contact our office. Details are listed on the inside back cover.

(Ralph Schulzé was appointed as Executive Director of the Cotton Research and Development Corporation in 1990, a position he continues to hold and enjoy.)

"... commitment to the environment & to the future of the industry..."



Industry Perspective

Connecting Research with Industry

by John Grellman

John Grellman with his granddaughter Emily on the family property "Beechworth", Merah North, NSW.

The Cotton Research and Development Corporation fulfils a number of challenging roles in its ongoing operation. One of the most important of these is the interface it provides between research and the Corporation's major stakeholder, the Australian cotton producers.

Since its inception, the CRDC has played a major part in encouraging a climate of co-operation between the various research, grower and industry groups. This is perhaps best exhibited by the proactive stance taken when faced with the need to enhance both the effort and resources required to address any potential threats to the production of cotton.

A good example of this proactive attitude is the approach taken by the CRDC to combat the increasing threat of disease in the cotton industry.

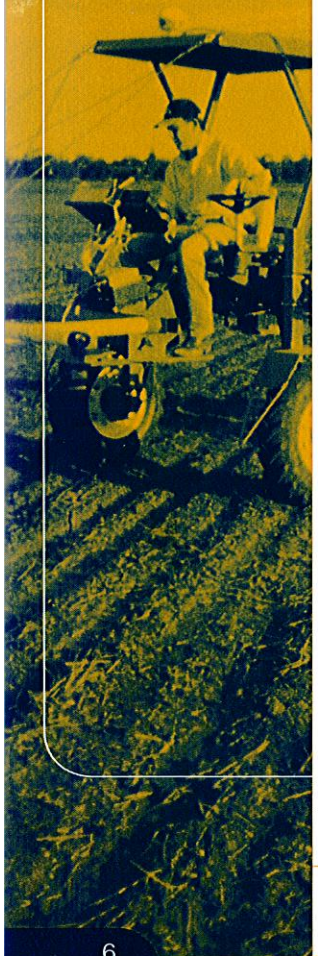
In 1995 the CRDC commissioned a review of the cotton plant pathology research program. The outcome was clear - this research area was grossly under-funded and under-resourced. Following this review, the CRDC and Cotton Seed Distributors joined forces with the CSIRO and NSW Agriculture to fund the building of the new Plant Breeding and Plant Pathology Laboratory at the Australian Cotton Institute at Myall Vale. The new laboratory created much needed additional space to continue the efforts of the breeding program and research into disease pathogens which are a threat to the industry.

During recent years the CRDC has also increased its funding support of research into disease prevention and management. This research includes support for extensive in-field testing, monitoring and grower education as well as conventional breeding and genetic modification techniques to combat diseases in cotton.

In an environment of rising costs and diminishing profit margins, the importance of increased yields to cotton producers cannot be overstated. Over the past 25 years, breeding research has increased average yields in Australia by more than 30%.

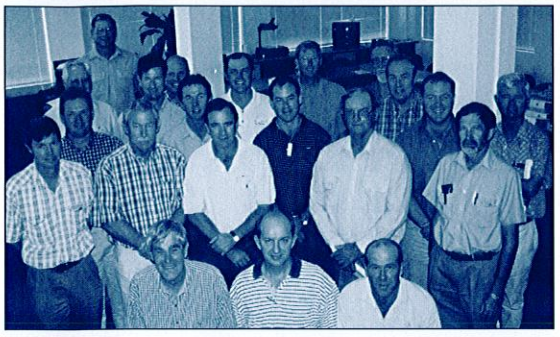
The ongoing direction of essential research funds into the areas of combating disease and yield improvement gives the industry the confidence it needs to continue to grow into the future.

(John Grellman was Chairman of the Australian Cotton Growers' Research Association for two years to September 1999. He is currently Chair of Cotton Seed Distributors and is a Director of the Australian Cotton Cooperative Research Centre. He is a cotton grower from Merah North near Wee Waa in New South Wales.)



"... confidence to grow into the future..."

Playing a pivotal role *by Bruce Finney*



Members of the Australian Cotton Growers' Research Association.

The Australian Cotton Growers' Research Association (ACGRA) undertakes its role as the industry arm of the cotton research team by fostering a collaborative approach to research and development. It is the grower body to which the CRDC is accountable and, as such, has a large input into the direction that cotton research takes. In addition to identifying the research needs of the cotton industry, the ACGRA is responsible for facilitating open communication between researchers, growers and consultants.

The CRDC plays a pivotal role in addressing a number of key issues currently facing the cotton industry including the National Registration Authority (NRA) reviews of pesticides and discussions on Insect Management Resistance Strategy (IMRS) and Transgenic and Insecticide Management Strategy (TIMS).

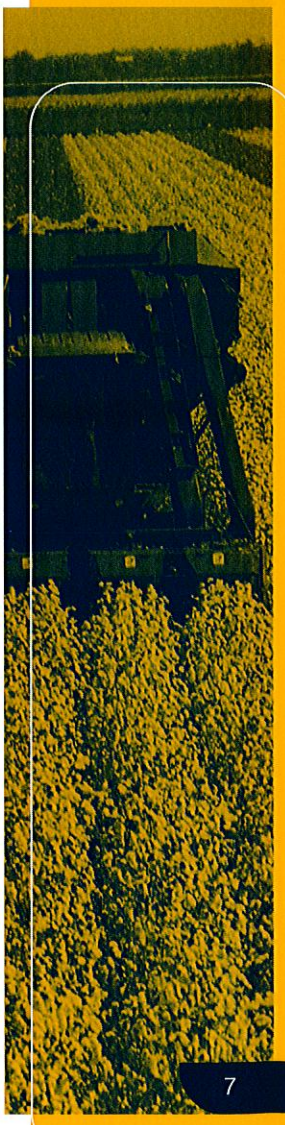
CRDC actively participates in the activities of the national cotton extension team which are vital to ensuring the successful transfer of research findings to growers. This is particularly important when we are confronted with critical on-farm management issues such as the control of Fusarium wilt in cotton. In this respect the Fusarium action group and CRDC funded research has been a critical link in the process of gaining a better understanding of the disease and how it can be contained and managed on-farm. Frequently the work undertaken by the CRDC is "back-room" in nature, providing the underlying technical knowledge and support the industry requires to grow profitably and achieve long term sustainability.

Looking to the future, a key challenge facing the agricultural research effort generally is the maintenance of funding at sufficient levels. The cotton industry will be no exception to this. The CRDC will need to actively seek ongoing, increased support from industry, government and the community in order to maintain the momentum of its research activities. The need to foster a better understanding among these key groups of the importance of the R&D effort to both national and regional economies will be another key challenge for the industry and CRDC in its effort to maintain funding levels.

There is a complex array of issues facing the cotton industry as we move forward into the 21st century. The securing of adequate funds and people to support the ongoing research initiatives is vital to the future of cotton in Australia. This complexity is made all the more challenging as the level of government and community involvement increases accordingly. It is within this climate of increased scrutiny and increased demands that the research activities of the CRDC must remain effectively resourced in order to respond to critical industry issues in a timely and effective manner.

(Bruce Finney is Chairman of the Australian Cotton Growers' Research Association, a position he has held since September 1999. He is Central Region Manager for Twynam Cotton.)

"... a complex array of issues facing the cotton industry..."



The Corporation

Investing in Research

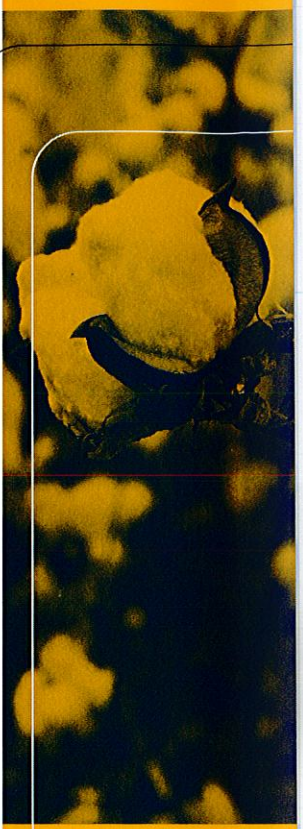
The Corporation's Board, from back left, Dr Neil Forrester, Bob Quiggin, Adam Kay, Dick Browne, Jeff Bidstrup, front, Dr Jim Peacock, Chair Bridget Jackson, Bobbie Brazil and Executive Director Ralph Schulzé.

The Cotton Research and Development Corporation was established in October 1990 under the Primary Industry and Energy Research and Development Act (1989).

A partnership between the Federal Government and the Australian cotton industry, the Corporation is accountable to Parliament through the Parliamentary Secretary to the Minister for Agriculture, Fisheries and Forestry Senator the Hon, Judith Troeth and to the industry through the Australian Cotton Growers' Research Association.

The Corporation is based in Narrabri, North West New South Wales and is the only Rural Research and Development Corporation to be located away from a capital city. Being in the heart of one of Australia's largest cotton growing regions and close major research facilities means we can keep in close contact with growers, researchers, processors and the communities we serve. The Corporation funds research to answer specific regional problems as well as industry-wide issues, and CRDC-funded trial work takes place in every major cotton growing area in Australia.

We are supported financially by growers through a levy of $1.75 per 227kg bale of cotton produced while the Federal Government provides a matching contribution up to 0.5 per cent of the gross value of production. The Corporation also receives income from royalties on the sale of planting seed of CSIRO-bred Australian cotton varieties, and we carry invested reserves to supplement our income when necessary. Interest earned on these investments is used to offset administrative costs and supplement research spending. A nine-member Board, with representatives of science, industry, Government and the wider community, leads the Corporation.



The Executive Director manages a team of eight full- and part-time staff who handle day-to-day Corporation administration and research program management.

Following a review earlier this year, the Corporation's research program was restructured into an Outcome/Outputs framework as required by Federal legislation. This review also allowed the Corporation to ensure it was maintaining a focus on research priorities set by the industry and Government.

For more information on how we will achieve our Outcome, see our Annual Operating Plan, Strategic (Five Year) Plan, or our website www.crdc.org.au.

Through the research and development program we strive to bring benefits to the industry, the regions and the community. With a broad approach we aim to enable the Australian industry to satisfy the world's demand for high-quality natural fibre while ensuring the sustainability of our natural resource base.

We consult formally and informally with the whole industry, not just the traditional production base. In areas we feel are not being adequately addressed by existing or proposed research we commission studies.

Above all, we work to ensure our investment in research is providing value to our stakeholders, cotton growers through the levy input, and the community through the Federal Government commitment.

Corporation staff pictured with Chair Bridget Jackson and Executive Director Ralph Schulzé (front centre), from back left, Peta Slack-Smith, Karen Larsen, Helen Dugdale, Di Purcell, Robin Logan, front Bruce Pyke and Tim Lester. Not in photograph, Angela Wiseman.

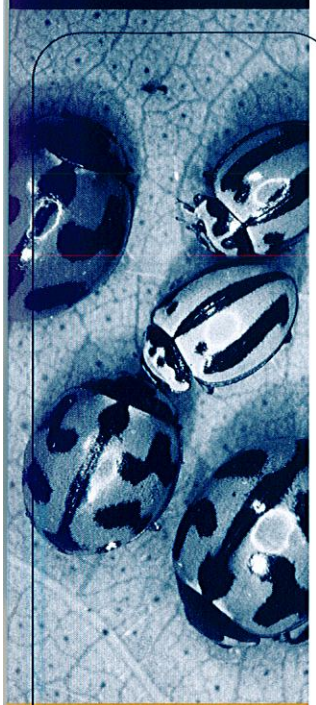
"Our Outcome: A more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to regional communities and the nation..."

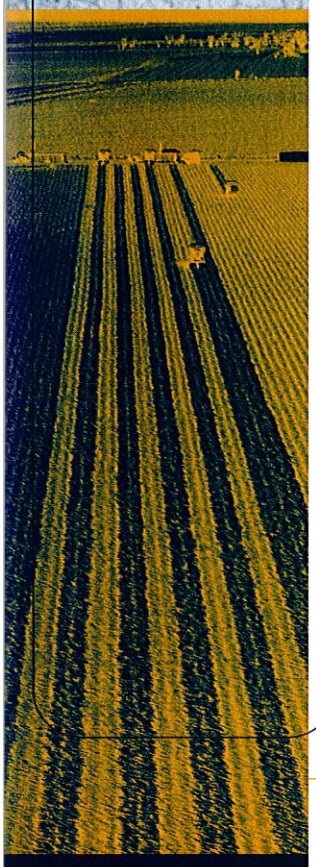
Pest Management

10 Years of Challenges

by Dr Vic Edge

Lady beetles are important predators in cotton. Picture: C. Mares.



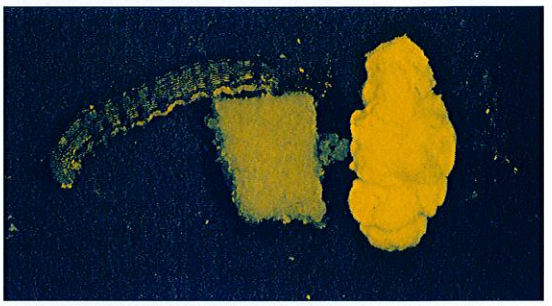


The last decade has seen the Australian cotton industry face a number of major challenges relating to the control of insect and mite pests and the off-farm impact of pesticides. These have included: the deteriorating resistance situation in *Helicoverpa armigera*, and the lack of effective new insecticides; serious insecticide residue problems in cattle, resulting in the loss of Helix® and major new restrictions on the use of endosulfan; pesticide contamination of rivers in cotton growing areas; and increasing community health concerns regarding pesticide spray drift.

In spite of these problems, the cotton industry has flourished and much of this success has been due to research supported by CRDC. During the past 10 years the Corporation has directed almost half of its research budget to the critical areas of developing pest management programs to reduce reliance on conventional pesticides and establish systems to minimise the off-farm impact of pesticides.

Key outcomes of the research have been:

- the introduction of INGARD® (single gene Bt-cotton) supported by a comprehensive resistance management strategy;
- the development of the resistance management strategy for conventional pesticides, based on detailed monitoring and analysis of underlying resistance mechanisms;
- greater appreciation of the role of beneficials (predators and parasites) in cotton pest management and increased emphasis on maintaining and augmenting beneficials though innovative techniques (research on food sprays' for predators has been a catalyst for this);
- greater adoption of higher damage thresholds, particularly early in the season, and the development of more user-friendly decision support systems; and,
- greater acceptance of the importance of area-wide management of heliothis, based on the manipulation of cropping systems (such as avoiding a succession of heliothis susceptible crops) and the use of trap crops, followed by pupal destruction to reduce heliothis populations.



A caterpillar infected by the Beauveria fungus is covered with a layer of velvety white spores, right, with a healthy Heliothis caterpillar on the left. Fungal diseases may affect key pest caterpillars during prolonged moist periods.

During the next 5 to 10 years, two-gene Bt-cotton should significantly reduce the number of sprays for caterpillar pests. However it does not provide immunity to resistance in *H. armigera*, or control sucking insects and mites. Consequently, it is essential that research is conducted one a range of pest management options, including the strategic use of pesticides, to ensure that a sustainable management system is established. Research should also continue to reflect community concerns regarding environmental and health issues associated with the use of pesticides.

(Dr Vic Edge was appointed to the Board of the Cotton Research and Development Corporation in 1990, a position he held until 1999. Previously he was a member of the Cotton Research Council. He is a pest management consultant based in Sydney.)

..the Corporation has directed almost half of its research budget to critical areas of developing pest management programs...

Reaping Benefits

by Dr Neil Forrester

The threat of major pest damage remains a major risk factor for the future viability of the Australian cotton industry. Consequently, the CRDC continues to invest heavily in pest management and associated research and development. There are currently 40 directly funded research projects which are addressing various aspects of pest management including resistance, damage thresholds and the impact of predators and parasites. Pest research also feeds into other areas including Best Management Practice, Plant Breeding and Farming Systems.

A major achievement of the past decade in the area of pest management has been the introduction of Bt transgenic cottons. The development of this technology was achieved against a backdrop of increasing resistance problems and environmental issues with conventional synthetic insecticides. The Bt transgenic cottons have certainly made a positive impact on decreasing the industry's reliance on conventional insecticides.

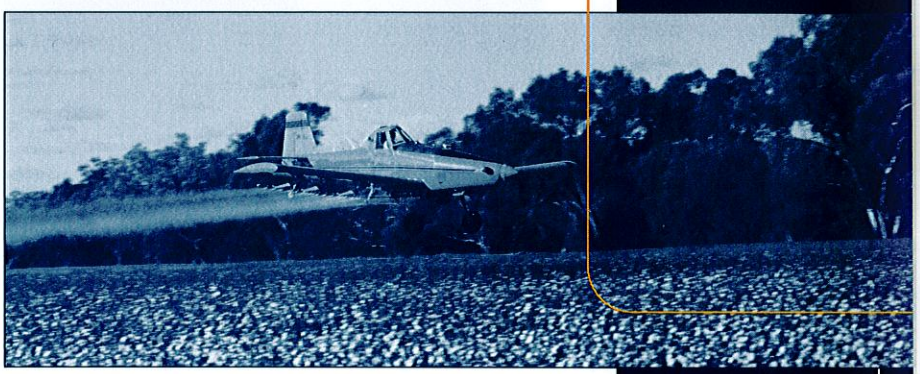
The industry will continue to reap the benefits of this research as the technology improves and two-gene Bt-cottons are introduced. This will result in fewer sprays for the key caterpillar pests of cotton such as heliothis, rough bollworm and tipworm. The number of broad-spectrum sprays will be reduced significantly giving Integrated Pest Management (IPM) a better chance to operate effectively, particularly as more selective products and non-chemical control techniques are developed.

The prospect of the potent combination of two-gene Bt-cottons, more effective use of parasites and predators and more selective pesticides certainly augers well for the future of sustainable IPM in Australian cotton.

The future challenges for pest management in cotton include:

- gaining public confidence and support for genetically modified organisms;
- containing the escalating costs of crop protection;
- managing resistance to both transgenics and conventional synthetic insecticides; and,
- addressing the increasing importance of sucking insects (aphids, stink bugs) and the diseases that they can transmit, as the number of chewing insect (caterpillar) sprays declines.

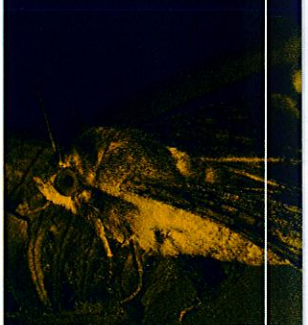
...a positive impact on decreasing the industry's reliance on conventional insecticides.



An exciting new era

The Australian cotton industry and its associated researchers have done an excellent job in improving the industry's cotton pest management strategies over the past 10 years but I believe we will be able to achieve even more in the next decade. We are at the forefront of an exciting new era for Cotton Pest Management and the Australian cotton industry is well placed to take advantage of this with its world class researchers, growers, consultants and support industries.

(Dr Neil Forrester was appointed to the Board of the Cotton Research and Development Corporation in November 1999. He is Vice President Entomology of Delta and Pine Land International.)



Helicoverpa armigera moth. Picture C. Mares.

Diseases and Weeds

Searching for Solutions

by Bruce Pyke

Soil-borne fungal spores that cause the disease Fusarium Wilt can be transmitted from infected areas to uninfected areas through the movement of vehicles, water and people. Measures to prevent this transmission, including foot baths and 'Fusarium boots', pictured, are an important part of farm hygiene procedures.

In the battle against crop diseases, plant breeding is a key weapon. Through the breeding of resistant cultivars the industry has had considerable success against Bacterial Blight, and the balance with Verticillium Wilt has been changed.

But the biggest disease challenges facing the industry right now, Fusarium Wilt and Black Root Rot are posing significant challenges to our plant breeders. While the breeders are making steady progress on reducing cotton's susceptibility to Fusarium Wilt, other research is ensuring that both diseases are being attacked on a number of fronts and using a range of approaches. These diseases have now spread to most districts and so the pressure is on to find answers.

Advancements in biotechnology may hold some solutions, but the Corporation is also investigating alternatives including using soil microorganisms as biocontrol agents against fungal spores, biofumigation of soils and ways to "vaccinate" plants against diseases.

While basic research and advanced techniques have helped the industry deal with disease incursions, a major leap forward has been the development and promotion of improved farm hygiene practices.

Come Clean, Go Clean is an important rule in preventing the spread of soil-borne diseases.

Australian-native wild-cottons, such as this one found in the Northern Territory, may hold a key to introducing Fusarium Wilt resistance into commercial crops.

With the help of the extension team, growers are learning how to apply the science of farm hygiene to their operations; to be conscious of the movement of vehicles and machinery between fields, farms and valleys, and ensuring equipment is properly cleaned before entering the paddock.

Weeds compete with young plants for nutrients.

Watching the Weeds

The advent of minimum tillage and reduced traffic farming has seen changes to the spectrum of weed problems for many growers.

Traditionally nutgrass has been a significant focus for researchers and while this weed is still very difficult to control, there is now a much greater understanding of how to manage it.

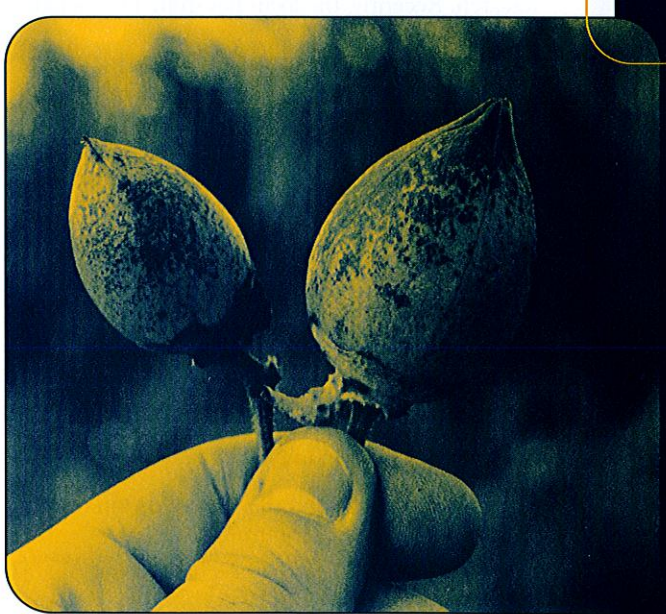
The focus for weeds is now much more on integrated weed management as part of the whole farming system, rather than looking for solutions to individual weed problems.

The introduction of transgenic varieties which will give plants a degree of herbicide tolerance will provide growers with opportunities to implement new strategies to manage weeds and potentially reduce weed control costs and the use of residual herbicides.

Our next challenge is to discover the best way to integrate the new herbicide-tolerant varieties into the farming system to help us reduce overall herbicide use while maintaining effective weed control and minimising the chances of weeds developing resistance.

(Bruce Pyke is Research and Extension Manager with the Cotton Research and Development Corporation.)

Take All weed Polymeria longifolia.



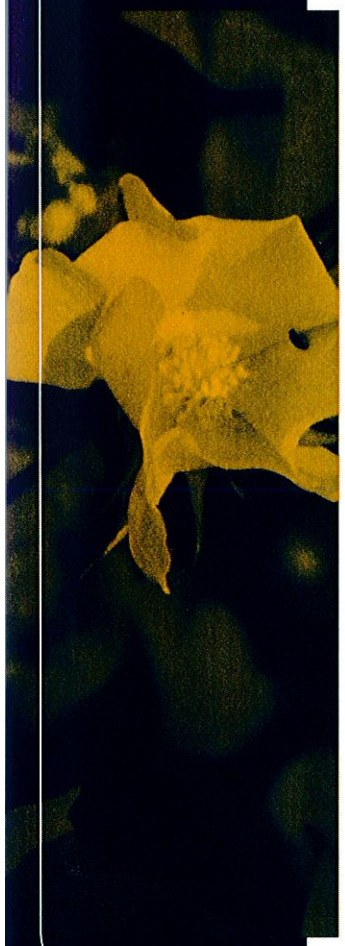
The boll on the left, from a plant infected with the Bunchy Top disorder, is much smaller than the boll from a healthy cotton plant.

... be conscious of the movement of vehicles and machinery...

Soils
Striking a Balance

by Adam Kay

The Mobile Electromagnetic Sensing System, pictured, to assess soils salinity and related parameters on field, was designed by John Triantifilis during a CRDC-funded post-doctoral fellowship



The CRDC continues to support a farming systems approach to soil and agronomic research. During the initial years after the formation of CRDC, production was the major focus of cotton soil research. Recently, the focus has shifted to include environmental and sustainability issues as well. Now the CRDC approaches soils management research aiming to achieve a balance between the production and environmental/sustainability issues.

An important Soil Research Workshop, supported by the CRDC and the Cotton CRC, was held in June 2000. This workshop looked at specific soil research topics including an examination of existing knowledge and the identification of any gaps in this knowledge base and opportunities for the future. It also analysed the links between the various research groups and how to improve communication between them.

The soils research currently being undertaken attempts to link in with several of the current national priorities in this area including erosion, salinity and acidity.

Essentially, the core objectives of the soil management research are:

Production - to maintain or improve production eg soil structure, plant nutrition.

Environmental - to minimise environmental impacts eg salinity, soil quality.

As with all agricultural research, the challenge for those on the ground is to translate the research findings into workable farming practices that can be implemented by farmers to help them achieve the identified benefits and outcomes. An example is the work currently looking at deep drainage on cotton vertisoils and other cotton soils to understand what water is moving past the root zone. Minimum tillage is another example. The uptake of minimum tillage and controlled traffic across the industry has been high. There is a lot of interest among farmers in the retention of stubble and planting directly into this.

Analysis of these soil samples was a key part of the post-doctoral fellowship of Craig Stewart. Stewart's research investigated the relationship between nutrient levels and lint yield, with a view to incorporating the research into Precision Agriculture.

The transfer of research information to farmers has been assisted by the production of a series of useful reference guides including SOILpak and MACHINEpak. The latest addition to this group of publications is NUTRIpak which is due for release later this year. It is a practical guide to cotton nutrition and covers all aspects of fertiliser management, the role of various essential plant nutrients as well as other important scientific information.

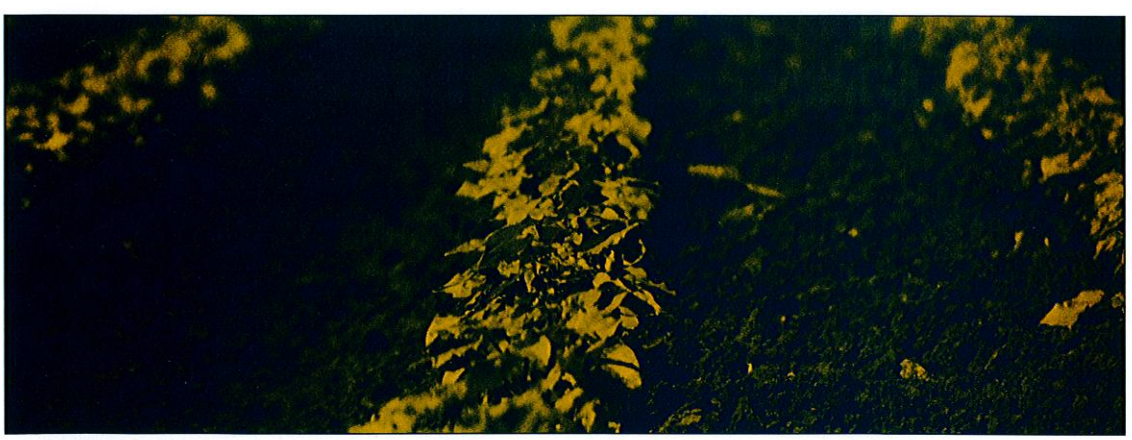
SOILpak has been the focus of cotton soil management issues and has been recently updated and reviewed. An excellent video has been produced by NSW Agriculture to guide growers through its use.

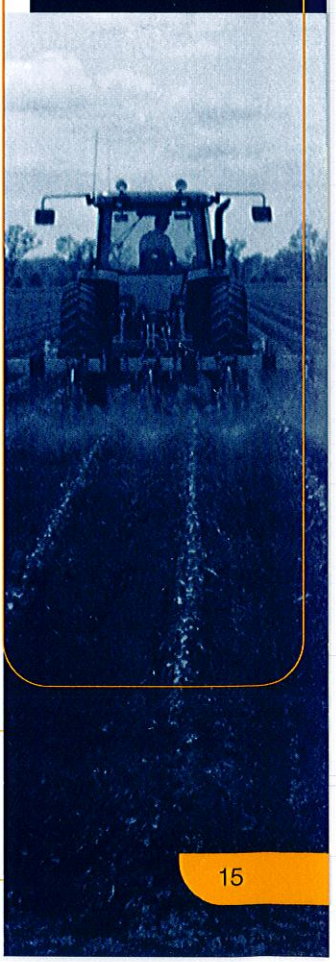
The Future

Drainage, storage and leaching are key areas of focus for soil management research in the future. New projects are also focussing on crop nutrition including nitrogen as well as other important nutrients. Soil microbiology is a developing area and baseline work is being undertaken to better understand the critical relationships to soil management.

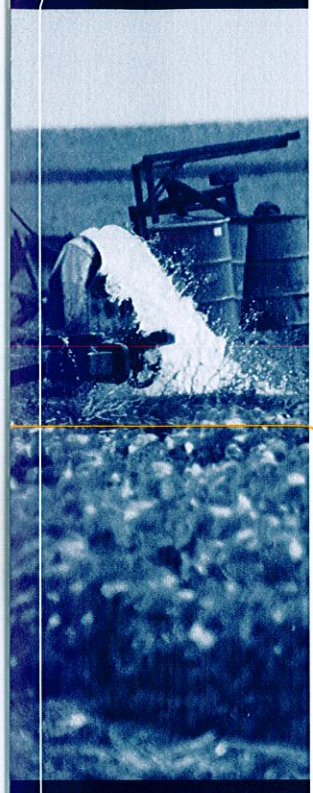
Rotation work is still continuing and has highlighted the benefits of legumes in the rotation. Work has shown that allelopathic (negative impact on the next crop) affects can occur if the rotation crop is allowed to set seed and is then green manured. These effects are reduced by terminating the legume rotation earlier or harvesting the grain.

(Adam Kay was appointed to the Board of the Cotton Research and Development Corporation in November 1999. He is Executive Manager of Cotton Seed Distributors.)





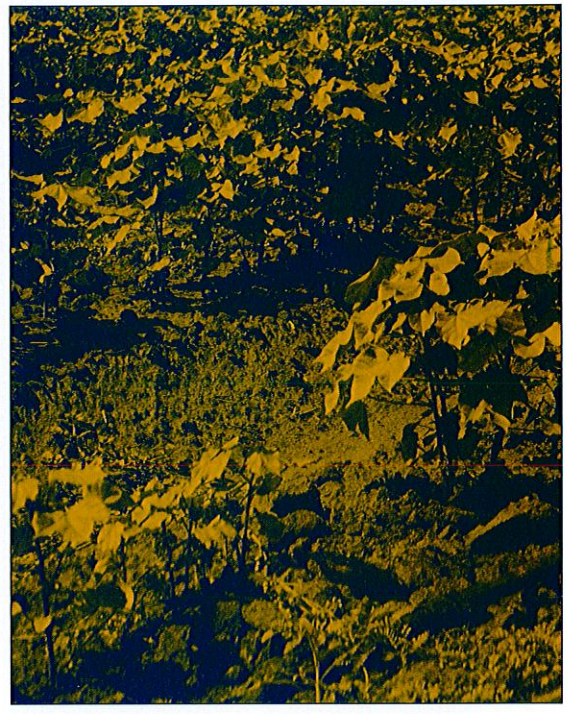
... the challenge is to translate the research findings into workable farming practices ...



Water
An Integrated Approach

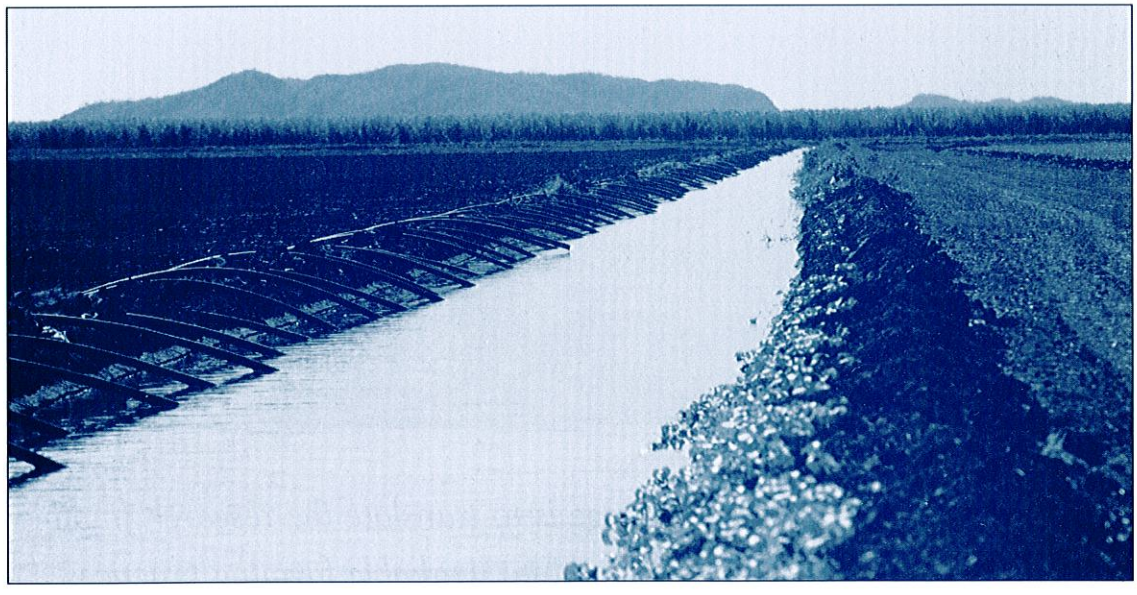
by Dick Browne

Most of the irrigated cotton production in Australia occurs in areas where the water supply can be unreliable. This has meant cotton farmers have to be very conscious of water use efficiency.



Drip irrigation systems can improve water use efficiency.

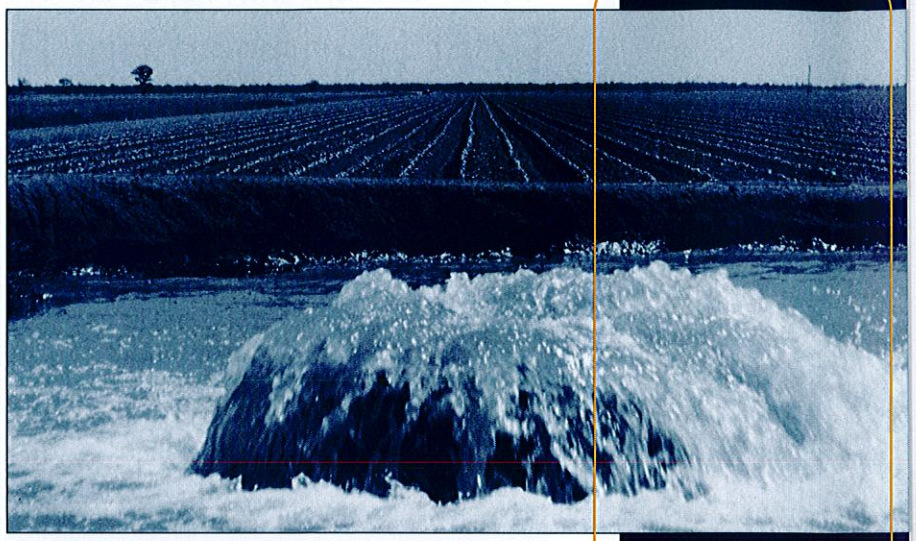
Water management is an integral part of the whole farm system. The significance of water management was recognised very early into the development of the modern industry, when it became clear that farming techniques were having a negative impact on soil structure. Irrigation practices in farming systems were subsequently improved and with that came an awareness that improving irrigation practice to reduce waterlogging led to automatically increased water use efficiency. As the knowledge of on-farm impacts grew, so did the questions about impacts off-farm. The desire to find out how the industry interacted with riverine environments, and the fate of pesticides in the water on and off-farm lead to the major five-year collaborative study "Minimising the impact of pesticides on the riverine environment using the cotton industry as a model". This study was funded jointly by CRDC, Land and Water Resources Research and



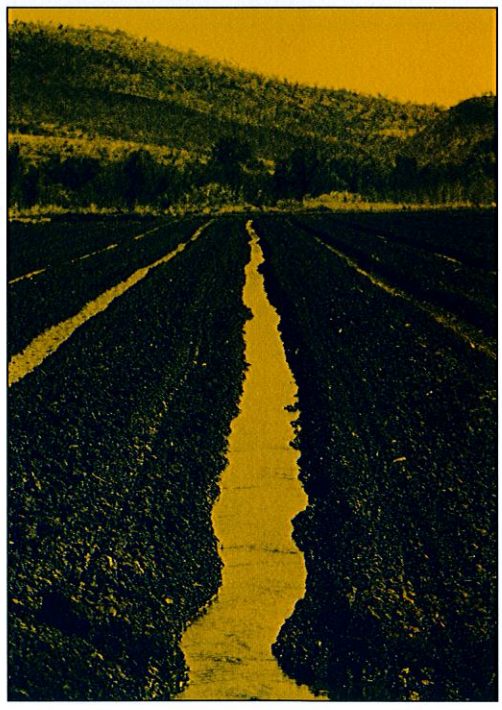
Development Corporation and the Murray-Darling Basin Commission, and the industry's Best Management Practices program is a direct result. An integrated approach to research has meant that the industry has been able to identify and respond to challenges as they arise, whether they are environmental, managerial, social or political. However, much of the research in this area is combined into other research programs, meaning many of the benefits are hidden.

In recent times the NSW and Queensland State governments have been driven to water reform by the Council of Australian Governments agreement to cap extractions from the Murray-Darling Basin. The impact of water reform is moving the industry towards a new set of benchmarks for water use efficiency, while avoiding negative environmental impacts.

With increased regulation and reduced agricultural water allocations, irrigators will look for further ways to maximise the value of the water that is available. The likelihood for the cotton industry is increased use of alternative delivery systems, such as drip irrigation or overhead sprays.



Irrigation Flow



(Dick Browne was appointed to the Board of the CRDC in November 1999, and is the Director responsible for the Water research program. He is General Manager of Auscott Midkin.)

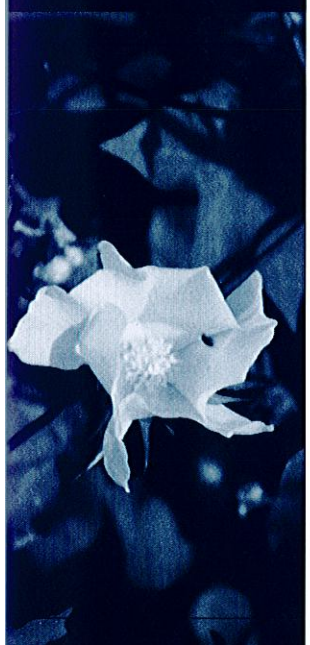
"... a new set of benchmarks for water use efficiency, while avoiding negative environmental impacts."

Best Management Practice

The Beginnings of the Best Management Practice

by Dave Anthony

... a better understanding of cotton's interaction with the riverine environment...



Extract from "Outcomes of the program for the Australian cotton industry and directions for the future", in Minimising the impact of pesticides on the riverine environment: key findings from research with the cotton industry - 1998 conference papers.

We live in an era where three forces environmental ideals, community perceptions of agriculture and production agriculture - are not in harmony. Like the Earth's tectonic plates, these forces continually thrust against one another building tension eventually spilling into controversy, anxiety and uncertainty. Into this state of tension in 1993 was thrust a five-year scientific research and biological monitoring program examining aspects of the cotton industry's interaction with the riverine environment.

Emerging from the program in 1998 are outcomes which are spearheading action to meet long-term environmental, social and agricultural needs. When Land and Water Research and Development Corporation, Cotton Research and Development Corporation, Murray-Darling Basin Commission and NSW Environmental Protection Agency initiated the joint program 'Minimising the impact of pesticides in the riverine environment - using cotton as a model', in 1993, there was no certainty as to what the program might encounter.

As with most journeys these organisations had an end in mind - a better understanding of cotton's interaction with the riverine environment and the development of ways to minimise any negative impacts.

Strongest and likely to be the most long-lasting of all the outcomes has been the initiation of a world class BMP system for cotton growers that should serve as a model for many other broad acre agricultural industries.

(Dave Anthony was appointed to the Board of the Cotton Research and Development Corporation in 1990, a position he continued to hold until 1999. He is Chief Operating Officer of Auscott Australia.)

Chemicals stored in accordance with Best Management Practice principles.

Ensuring Sustainability

by Bobbie Brazil

Following the conclusion of the joint "Minimising the impact of pesticides on the riverine environment" program, it was imperative that the cotton industry used the information obtained. The development of best management practices based on sound research and practical knowledge was seen as the most effective way to do this. After a period of extensive consultation with growers, researchers, chemical application groups and regulatory authorities, the first edition of the Australian Cotton Industry Best Management Practices manual was released in December 1997.

The manual's contents are currently being reviewed in line with feedback received from across the industry. The second edition will be ready for release during October 2000.

Continuous improvement

The aim of the BMP program is to ensure the industry has a process for continuously improving environmental management strategies and importantly, for documenting management practices. A collaborative Australian Cotton Industry Council sub-committee is overseeing the program's management, development and implementation into industry.

If the industry is to receive the recognition it deserves in relation to the BMP program, it must have more formal recognition from various regulatory authorities. Gaining this recognition from regulators will be one of the major challenges for the industry in the future.

From the outset, the adoption and implementation of BMP by the cotton industry was an enormous undertaking, requiring significant resourcing from industry organisations and growers. An indication of its success is that many in the industry believe the concept transcends the manual based program and now permeates all aspects of the farming business. It has become a philosophy of management that aims for excellence on a farmwide scale.

Significant challenges

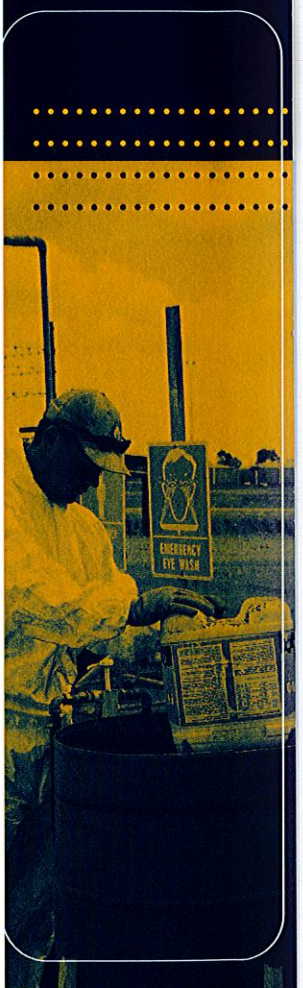
The CRDC remains committed to the ongoing improvement of the BMP program including the development of a realistic but rigorous audit component. It believes BMP offers the cotton industry an excellent opportunity for ensuring environmental sustainability now and into the future.

Significant challenges still exist, particularly in maintaining and sustaining a healthy natural resource base on which to farm. Certainly the most difficult issue at present is determining an appropriate level of water use across virtually all the cotton growing regions. In addition, the spectre of salinity, changing land use practices and vegetation management are industry-wide issues which also need to be addressed. For everyone to be assured of a future, we must vigorously scrutinise the management and use of our natural resources and examine how community concerns regarding that use can be alleviated.

BMP and the management of environmental and sustainability issues has always been a core business area for the cotton industry and the industry is a leader in the field. The industry's leadership has taken a proactive approach to these issues in the past and will continue to do so in the future. This leadership role and proactive approach is reflected in the research work of the CRDC.

(Bobbie Brazil was appointed to the Board of the Cotton Research and Development Corporation in November 1999. She is also a member of the Board of the Australian Cotton Co-operative Research Centre. She is a cotton grower from the Darling Downs with a background in environmental law.)

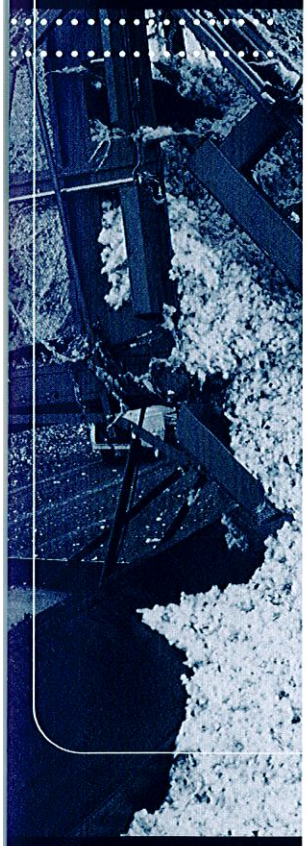
... a philosophy of management that aims for excellence on a farmwide scale...



Best Management Practices is a philosophy which has permeated all aspects of farm operations, including correct cleaning and removal of used chemical containers.

Community
A Holistic Approach

by Bob Quiggin



When people think of the role played by Research and Development Corporations, the science, research and extension activities are what normally come to mind. For the cotton industry, the aspect of community is also very important.

For example, the cotton farmer of the year award is not based solely on the aspects of productivity or profitability (although these are important) but upon the whole systems approach.

The CRDC is very aware of cotton's role in rural communities and of both the positive and negative impacts that are associated with the industry. A great deal of consideration and work by a number of industry bodies goes into ensuring that cotton fulfils the role of the good neighbour in local communities.

This was well illustrated by the cotton industry's response to the endosulfan crisis, which had the potential to divide rural communities along industry lines. The industry responded in a number of ways, including the funding of research by the CRDC into the effects of endosulfan on riverine environments, research into the facts surrounding the actual cases of endosulfan contamination of beef, and the development and promulgation of the Best Management Practice program.

In a broader sense, the CRDC has been actively involved in the support of rural communities, through the funding of programs designed to encourage women in the cotton industry to become more involved in industry activities and by sponsoring places on the Australian Rural Leadership Program.

The increased focus on environmental sustainability for the cotton industry will have direct flow-on benefits to farms and communities in cotton-growing districts, in the form of lower environmental stresses. The cotton industry is justifiably proud that its profitability directly benefits local rural communities, generating jobs in support industries and retail outlets alike.

The CRDC has adopted a holistic approach to its community goal. This means that while many specific projects do not fall under this goal, it underlies the decisions taken by the Board on a range of other issues.

(Bob Quiggin was appointed to the Board of the Cotton Research and Development Corporation in November 1997 and is the Government Member. He is the Director, North Asia Section of the Market Access and Biosecurity Business Group, Agriculture, Fisheries and Forestry - Australia.)

"...direct flow-on benefits to farms and communities in cotton-growing districts, in the form of lower environmental stresses."

The Australian Cotton Industry - Some Facts

From The Australian Cotton Industry: An Economic Assessment prepared for the CRDC by the Centre for International Economics and Cameron Agriculture, December 1995. Supplementary data from the Australian Bureau of Resource Economics (ABARE) and the Raw Cotton Marketing Advisory Committee (RCMAC).

- By 1992 cotton was Australia's fourth largest rural export earner and Australia was the world's fourth largest cotton exporting nation. In 1992 gross value of production was approximately $950 million from 2.2 million bales, record Australian production to the time. The record was reset in 1997, 1998 and 1999, with production reaching 3.2 million and an estimated export value of $1.7 billion. Australia is now the world's third largest cotton exporter.

- During the early nineties cotton accounted for about 8% of the gross value of agricultural production in NSW and 3% in Queensland.

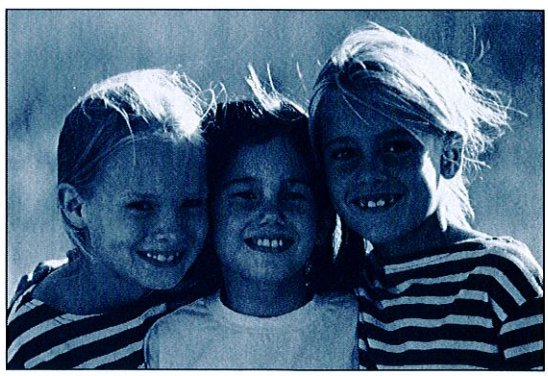
- The cotton industry stimulates regional economic activity. It was estimated that for every one person employed directly in the growing of cotton in the Gwydir Valley, another two people have jobs directly or indirectly associated with cotton in the rest of the region.

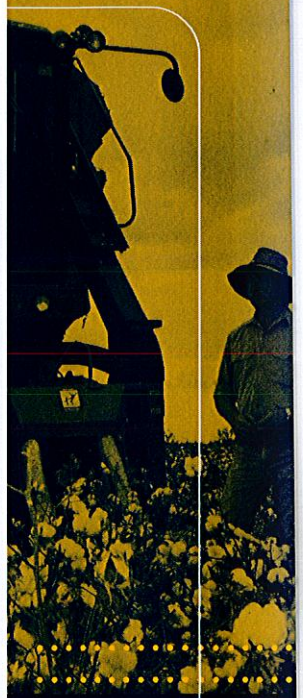
- Effective and focussed R&D has been a major factor behind the rapid development of the modern cotton industry. A key focus has been the breeding and commercial development of plant varieties suited to Australian conditions. This led to yield improvements of about 60% since the early 1970s and significant improvements in fibre quality.

- Cotton is an efficient contributor to the entire Australian economy and not just to particular regions.

- The first decade of irrigation in the Namoi Valley, one of the largest cotton producing catchments, saw the populations within and near cotton developments grow substantially - Wee Waa by 68% and Narrabri and Gunnedah by about 30% .

- As cotton production expanded, so did a number of supporting industries including cotton consultants, seed suppliers, oil seed processors, machinery suppliers and repairers, earth moving contractors, harvesting contractors and ginning providers.

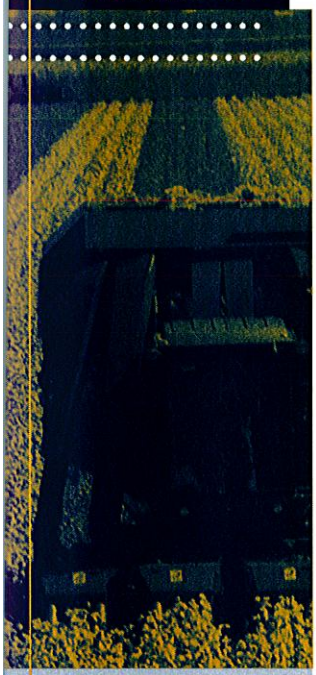


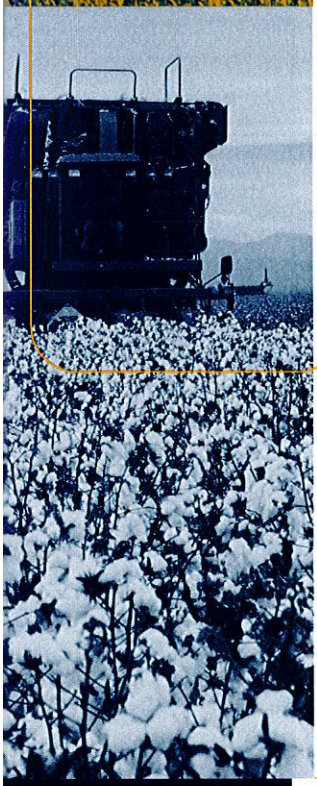


Processing and Market

From Field to Fabric

by Ralph Schulzé





Australian cotton has a strong international reputation, thanks in the most part to the inherent quality of the fibre. The whole breeding program has focussed and will continue to focus on building strong characteristics into the fibre, including length, strength, maturity and uniformity. Breeders are very conscious of the need to satisfy the market's demand for high quality fibre.

Recently their performance in this regard was assessed in a collaborative project undertaken by two German equipment manufacturers (see next page). They assessed Australian cotton varieties as 'outstanding' and urged us to maintain our focus on breeding for fibre quality and 'spinability'.

To fully exploit inherent fibre qualities sophisticated ginning is required, particularly in seasons where the harvest weather and other environmental factors have not been ideal. The need to strengthen our technological support and resources in this area was identified by the industry several years ago. As a result a research program addressing the needs of ginners was initiated at the University of Southern Queensland - and is already making a valuable contribution.

Moving further along the 'field-to-fabric' chain, CSIRO Textile Technology was funded to determine if there were better ways of measuring fibre maturity. This work opened up further opportunities and as a consequence the Geelong-based group has become a core partner in the Australian Cotton CRC. The group is researching ways to add value to Australian cotton. There is no government involvement in the marketing of Australian cotton, and the considerable private investment has kept the industry focussed on the requirements of the market. To assist in this regard the Corporation, encouraged by the Australian Cotton Shippers Association and the Australian Cotton Growers' Research Association, is funding a study of impediments to international cotton trade.

The Australian cotton industry's 'field-to-fabric' chain involves ginners, classers, shippers, spinners, a range of other service providers and Government interests. This group is represented by the Raw Cotton Marketing Advisory Committee which is a committee of the Australian Cotton Industry Council. The Corporation provides a level of assistance to the Marketing Advisory Committee by acting as the secretariat. In turn the Committee helps keep the CRDC aware of issues beyond the farm gate to augment guidance on production-related issues from the Australian Cotton Growers' Research Association.

The Corporation also participates in another Australian Cotton Industry Council committee - the Cotton Evaluation and Advancement Committee - which is charged with developing evaluation systems to more closely reflect value differences in Australian cotton.

(Ralph Schulzé is the Executive Director of the Cotton Research and Development Corporation, a position he has held since the Corporation was formed in 1990.)

"Breeders are very conscious of the need to satisfy demand for high quality fibre."

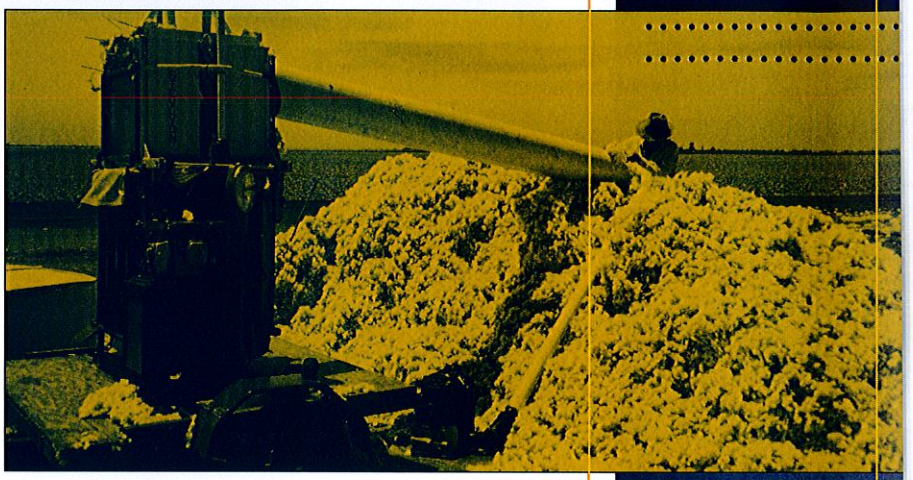
The Spinning Value of Australian Cotton *by Chris Faerber*

Extract from a report of the same title to the 10th Australian Cotton Conference, Brisbane, August 16-18, 2000.

This report is a summary of a partnership project, involving Australian as well as overseas co-operators, which was conducted to evaluate four Australian cotton varieties in terms of their utility value to the textile mill and their agronomic and thus economic viability on the cotton production side. The four varieties, Sicala 40, Siokra V16, Sicala V2I, and Sicot 189, were grown and ginned by Auscott Ltd., Narrabri, within the framework of a Cotton Seed Distributors variety trial. These varieties are representative of the bulk of Australian raw cotton production. As a result of a co-operative approach pursued by the Cotton Research and Development Corporation, two renowned German manufacturers of mill preparatory equipment and open-end spinning frames, i.e.Truetzschler GmbH & Co. KG and Schlafhorst Autocoro GmbH, respectively, joined the consortium and conducted processing studies on a laboratory scale with sample bales that were shipped to Europe.

Each of the four Australian cotton varieties investigated during this study exhibited truly outstanding fibre properties, particularly in terms of strength, staple length and fineness. Continuing efforts to improve the present quality of Australian cotton varieties and germplasm have culminated in fibre descriptions which appear most desirable for high-speed spinning - a segment which traditionally is occupied by [a] few of the world's best cottons.

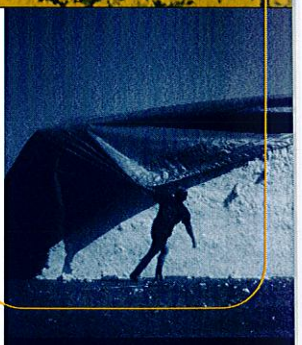
Through benchmarking analysis of the final quality parameters and processing performance, the cottons investigated could actually be approved as excellent high-quality raw materials for present mill fibre quality needs and upscale textile products.



Post-doctoral fellow Grant Roberts examined the impact ginning has on the fibre quality.

Remarkable progress with respect to fibre quality has been made in Australia since the first joint variety evaluation project of this nature [was] embarked upon some six years ago. Considering the continuous technological and engineering advance in all segments of the textile industry and the fierce and truly global competition among textile producers, the Australian cotton community is encouraged to continue focussing on and striving for the further fibre quality improvements to adjust to the future and perhaps even more challenging demands of their customers.

(Chris Faerber represents Truetszschler GmbH & Co. KG, Moenchengladbach, Germany.)



"...excellent high-quality raw materials for present mill fibre quality needs and upscale textile products."

Plant Breeding & Biotechnology

Harnessing Technology

by Dr Jim Peacock

Untreated conventional cotton (left) versus INGARD (right).

The development and commercial introduction of INGARD® cotton varieties and management systems has been a major success for plant breeding and biotechnology.

The introduction of transgenic cotton was a very important opportunity for the cotton industry - an opportunity to couple the management and use of a technology with the powers of that technology.

Ten years ago the industry faced a major problem due to increasing resistance of pests, and particularly of *Helicoverpa armigera*, to available insecticides.

Four years after the first INGARD cottons were planted commercially in Australia, the technology is recognised as being able to significantly reduce the amount of pesticide required. The resistance management strategy has successfully prevented any sign of resistance appearing in the target pest populations and provides benefits for conventional and transgenic cotton crops.

The future will see transgenic varieties featuring two individual systems of action, with the potential to substantially reduce the amount of chemical pesticides used in the cotton industry to control Helicoverpa pests and severely limit the chance of resistance developing.

Conventional breeding and transgenics are parallel and integrated procedures which are delivering tangible benefits to the Australian industry.

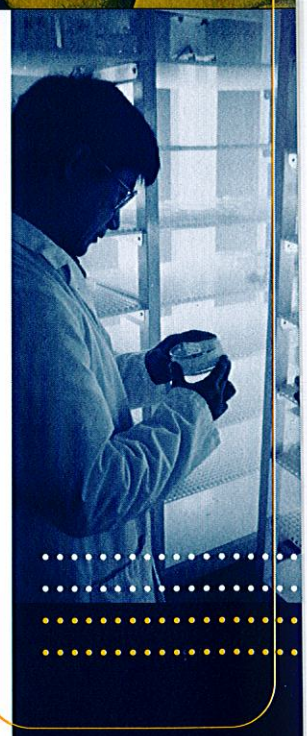
Yields have been increasing by almost two per cent per year on average for the last decade. And the breeding program has delivered varieties offering increased choice and adaption for local conditions in growing regions stretching from the Hay Plains in southern NSW to Emerald in Central Queensland.

We have cotton varieties with different season lengths, substantially improved fibre quality combining length, strength and fibre maturity, and greatly increased disease resistance.

The breeding program has moved relatively quickly to combat the latest disease threats, Fusarium Wilt and Bunchy Top, with biotechnology to partner conventional breeding techniques in order to bring improved varieties to the industry as soon as possible.

Parliamentary Secretary to the Minister for Agriculture, Fisheries and Forestry Senator Judith Troeth, right, inspects fuzzy seed at Cotton Seed Distributors delinting plant at Wee Waa, NSW. CSIRO-bred Australian varieties are commercialised by CSD and account for the majority of the Australian crop.

(Dr Jim Peacock was appointed to the Board of the Cotton Research and Development Corporation in 1990. He was previously a member of the Cotton Research Council. Dr Peacock is Chief of CSIRO Plant Industry.)



'Conventional breeding and transgenics are parallel and integrated procedures, delivering tangible benefits to the Australian industry.'

Farming Systems
A Basis for Success

by David Hamilton

It is has been estimated that half of the yield increase of the last decade was due to improved management practices. In the big picture we have seen enormous gains in the performance of the farming system compared to 10 years ago.

The yield expectations of growers have increased from 5 to 6 bales a hectare to 7 to 8 bales a hectare or more. This is an enormous improvement of which 50% is due to improved management of Farming Systems, and which represents excellent return on investment for the Cotton Research and Development Corporation and the Australian cotton industry.

Management strategies have been developed for the weed complexes in every valley, water management strategies have improved and areas for further improvement have been identified, and we've incorporated practices such as pupae control and Integrated Pest Management into farming systems. All of these steps are helping to reduce pesticide use and improve yields.

One of the great achievements in Farming Systems in recent times has been developing our understanding of the management of water and nitrogen on-farm and the benefits we can get from crop rotations and the management of tillage.

By using controlled traffic to minimise compaction, fallow management to maximise rainfall storage, and by manipulation of soil nitrogen we have been able to steadily improve crop yields throughout the country.

Some of the challenges have been to use minimum tillage while still ensuring pupae are destroyed in winter, to manage higher volumes of cotton stalks from high yielding crops after harvest and to maximise the return on irrigation water from lower-value crops in rotation with cotton.

The challenges of the future include ensuring our farming systems minimise the use of pesticides and their movement from farm to environment, the elimination of any problems with soil water tables and salinity, and to fit cotton production snuggly into farming systems with the other crops in rotation and in adjoining fields, and particularly when field crops and livestock are farmed simultaneously.

(David Hamilton was appointed to the Board of the Cotton Research and Development Corporation in October 1993 a position he held until 1999. He is Director of the Queensland Department of Primary Industries' Farming Systems Institute.)

"... excellent return on investment for the CRDC and the Australian cotton industry."

Time for Fine Tuning

The cotton farming systems of the future could be quite different to that of today. Researchers will continue to improve and adjust practices which have been part of mainstream activities, and continue to challenge the industry with new practices aimed at improving production and resource use efficiency.

According to CRDC Director Jeff Bidstrup, water use efficiency is going to be one of the most important focuses for farming practices in the years to come. This will be an outcome of increased regulation now being placed upon irrigators. Growers will be under pressure to maintain output but to do so more efficiently and with less water, less chemical and possibly less area planted to cotton each season.

"Fine tuning of farming systems has been occurring, with improvements coming through the modelling of farm rotations to develop more practical options. Crop modelling will increasingly be used to improve water use efficiency by helping to better define the major deficiencies in the system," he said.

Continuing advances in precision farming techniques will take the guess work out of field layout and nutrient application, and this will improve the efficiency of our farming systems further.

Adjustments in crop rotations, planting into standing stubble and changes in irrigation technology will also contribute. And just as research has demonstrated many opportunities for refinement during the last 10 years, so the industry will look to research to guide the way during the next 10.

"Dryland growers will have to concentrate more on producing quality product ... and will need to ensure row configurations and better varieties are matched to achieve this."

"Ultra Narrow Row configurations will also require us to ask some new questions and seek new answers. With ultra narrow row growers will also have to be very cognisant of quality issues."

The introduction of new technologies, including herbicide-tolerant transgenic varieties, will help to solve some of the difficulties currently experienced with techniques that to date have shown promise, such as planting into standing stubble, he said.

(Jeff Bidstrup was appointed to the CRDC Board in November 1999. He is a cotton grower from Warra on the Darling Downs.)

Mixed cropping, such as this strip area of sorghum, cotton and lucerne, trap crops and rotations are all used to maximise the efficiency of the farming system.

"Growers will be under pressure to maintain output but to do so more efficiently ..."

Extension
Meeting Challenges

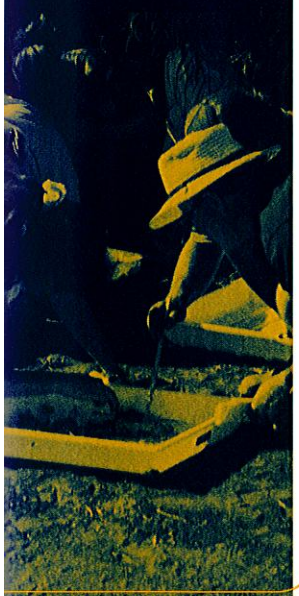
by Bruce Pyke

Translating research findings into on-farm practices can be a challenging task. For the cotton industry, successful transfer of technology and knowledge from researchers to growers relies on a team of specialists - industry development and extension officers.

In 1995 the Cooperative Research Centre for Sustainable Cotton Production and the Cotton Research and Development Corporation conducted a review of extension within the industry. The feedback from industry was clear - growers wanted more extension personnel, particularly in areas away from major research centres.

During the past five years the CRDC has answered this call. The Corporation now funds, partially or fully, Industry Development Officers for the Macquarie Valley, Bourke, Gunnedah, Hillston, Goondiwindi, St George/Dirranbandi and Emerald. There is also a CRC-funded development officer in Moree, while the Queensland Department of Primary Industries employs a development officer for the Darling Downs. District agronomists employed by the state agricultural departments also assist the cotton extension team part time. The whole cotton extension team is co-ordinated by the Australian Cotton CRC.

Workshops and field days are among the most popular and successful methods to transfer research to industry.



A firm link

Each development officer provides a firm link between the industry in their region and the larger research effort. They act as a conduit for information about general issues while also able to address the concerns affecting the growers in their areas. Development officers conduct field trials and adapt research from other areas.

In those areas where the industry is expanding, the development officers are there on the ground to encourage sustainable development and farming practices. They ensure new growers have access to the latest management strategies and the technical information with which to implement Best Management Practices.

Another outcome of the extension review was the establishment of a National Extension Coordinator to orchestrate the activities of the extension team. This position is now fully funded by the CRDC through the Cotton CRC.

(Bruce Pyke is Research and Extension Manager with the Cotton Research and Development Corporation.)

... a conduit for information about general issues while also able to address the concerns of growers...

A Common Approach

by Adam Kay

The consolidation of the cotton industry's extension workers into one, co-ordinated and nationally focussed team has been successfully implemented. This has produced a number of benefits on the ground and further development of the team approach to activities will occur in the future. It allows for a common approach to be taken on important issues across the industry. A critical aspect of the extension team's work is priority setting (addressing grower and environmental needs) and planning. The team will need to further develop and refine its high level of adult education skills to continue the successful transfer of knowledge and technology from researchers to growers.

The future direction of the cotton extension team's activities will cover a number of key issues including computers and the internet, grower groups, benchmarking and evaluation activities.

The widespread use of computers on farm will see an ongoing need for the extension team to pull together decision support systems and models of key research findings into a simple decision making form for the grower. The internet will also play an important role in the dissemination of critical information from the extension team to the industry.

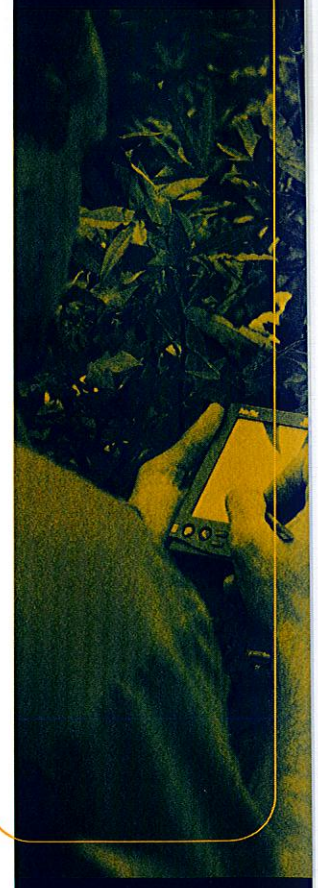
Although the potential to develop new high tech extension approaches in the future does exist, the extension team will still need to demonstrate new technology and techniques in their local area, face to face with growers. This traditional role of the extension worker is likely to be enhanced by the use of other technology driven methods.

The extension team will continue to play a key role in the co-ordination and facilitation of grower groups such as IPM groups, area wide management groups and BMP groups. The use of grower groups is a highly effective technique that enables growers and consultants to interact and learn from each other.

Another important issue to be tackled in the future by the extension team is benchmarking and the evaluation of projects undertaken. The effectiveness of different techniques and projects that are carried out needs to be documented to ensure growers continue to receive value for their research dollar.

(Adam Kay was appointed to the Board of the Cotton Research and Development Corporation in November 1999. He is Executive Manager of Cotton Seed Distributors.)

The traditional role of the extension worker is likely to be enhanced ...

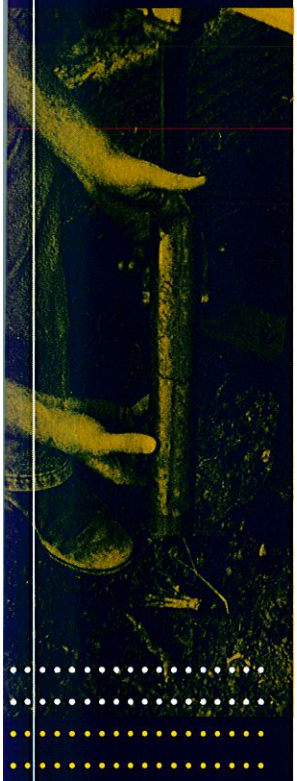


The continuing development of the successful decision-making software CottonLOGIC will see it available with a companion program for hand-held computers.

Human Resources

Training for the Future

by Ralph Schulzé



The Corporation believes that a strong research effort will rely on having a committed group of properly trained scientists. To this end we have made a significant contribution by funding post-graduate awards and post-doctoral fellows.

In fact the CRDC generally supports about 18 post-graduates at any one time, quite a high percentage when you consider the size of the Corporation compared to other rural Research and Development Corporations in Australia. Past recipients of post-graduate funding include Dr John Triantifilis, and Dr Stuart Gordon.

This program has meant that in effect many new researchers coming into the industry are being trained by the industry - establishing a strong loyalty to Australian cotton.

The Corporation also supports Human Resources in the research community by supporting appropriate opportunities for scientific exchange travel. We encourage our researchers to find the best in the world, keep up with it and match it. Travel gives our researchers new ideas, new contacts and an appreciation of the different ways to solve similar problems.

We have been involved in building international networks through our assistance in organising the first World Cotton Research Conference held in Brisbane in 1994, and the second World Cotton Research Conference in Athens in 1998.

With no commercial or political position the Corporation plays the role of "honest broker" in the industry and several years ago initiated, with other industry organisations, the first Strategic Plan for the Australian cotton industry.

Currently the Corporation is involved with finalising the audit process for Best Management Practice and establishing an office to co-ordinate the auditing procedure, before it will be handed to the industry as a complete structure.

And our ongoing challenge is to keep bringing new and enthusiastic scientists into the industry and blend them with established and experienced researchers. We also need to be continually identifying ways that research and extension staff can be used to their full extent and ensure their ongoing job satisfaction.

(Ralph Schulzé is the Executive Director of the Cotton Research and Development Corporation, a position he has held since the Corporation's formation in 1990.)

"...many new researchers coming into the industry are being trained by the industry..."

Encouraging Creativity

by Bridget Jackson

People are our most important resource. To maintain a strong, committed and innovative research effort we must ensure our personnel are well-trained and adequately resourced.

It is also critical to long-term success that the depth of skills in research is maintained - particularly in the areas such as breeding, entomology and pathology. To this end we will continue to work with universities and others, and encourage young scientists to fully develop their skills. We will continue to provide support through post-graduate awards and post-doctoral fellowships.

For established research and industry personnel domestic and international travel remains an important mechanism for maintaining enthusiasm and an outward-looking industry that matches or leads the world.

We will be encouraging creativity, and considering innovative requests for funding in the human resources area and throughout the research program. We will be promoting communication between the sectors of the industry.

The success of the research program in general, and of critical industry programs such as Best Management Practice in particular, depends upon motivated and skilled people. But we may have to rethink how we are trained and how we work. Agronomists of the future may be sociologists as well. Regions might employ Ecology Managers.

The on-going challenge for the CRDC is to identify the industry's requirements, and where appropriate initiate action early to minimise any delays in meeting those requirements.

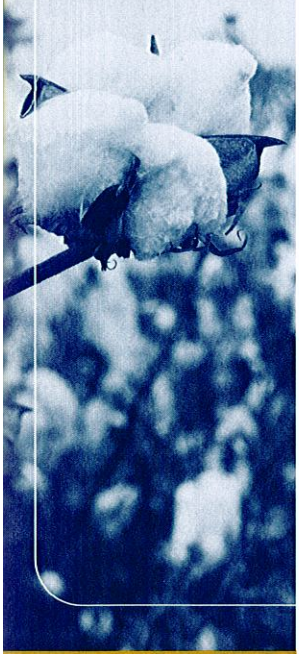
(Bridget Jackson is Chair of the Cotton Research and Development Corporation and was appointed in November 1999. She is an agricultural consultant based in Sydney.)

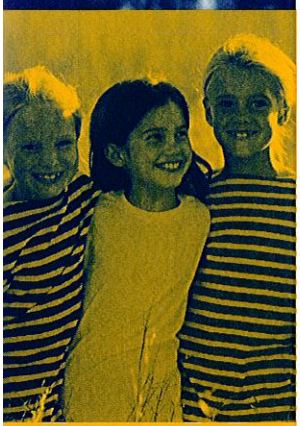
"We don't need to be a nation of rocket scientists to see that sustainable, well-paid, interesting jobs in this century are going to belong to the countries that harness new ideas stemming from the application of science and technology" - *Prof. Sue Serjeantson, president of the Federation of Australian Scientific and Technological Societies - Sydney Morning Herald 17/7/00.*

"...It is critical to long-term success that the depth of skills in research is maintained..."

Final Reports

Final Reports





Following is a listing of all the Final Reports for funded projects which the Cotton Research and Development Corporation is currently holding. This listing includes some projects initiated by the Cotton Research Council prior to October 1990 when the Corporation was established. If you would like more information on any of the listed projects, please write to: Reports Library, Cotton Research and Development Corporation, PO Box 282, Narrabri, NSW, 2390 or email crdc@crdc.org.au. Please include the project title, project number and the file number.

How to read this list

Project Title Includes: will include details such as whether the research was completed by a Post-Graduate scholar, whether the research was Commissioned by the Corporation, or if the project related to Travel.

Project Number: Contains the code of the research organisation, for example CSE is CSIRO Entomology. See below for a full explanation of organisation codes.

File Number: The first two digits is the year is which the project was started.

Organisation Codes

ANU	Australian National University
BAE	Australian Bureau of Agricultural and Resource Economics
CAE	Canberra College of Advanced Education
CDL	Cotton Seed Distributors Ltd
CRC	Australian Cotton Cooperative Research Centre (and predecessor)
CRDC	Cotton Research and Development Corporation
CS	CSIRO
CSA	CSIRO Atmospheric Research
CSE	CSIRO Entomology
CSO	CSIRO Soils
CSP	CSIRO Plant Industry
CWT	CSIRO Wool Technology (now Textile and Fibre Technology)
DAN	NSW Agriculture
DAQ	Department of Primary Industries, Queensland
DDI	Darling Downs Institute of Advanced Education
DI	Dunluce International
ICM	ICMS Research
MA	Macquarie Agribusiness
MCK	McKenzie Soil Management
MH	Agricultural Health Unit, Moree District Hospital (New England Health)
MNZ	Massey University, New Zealand
MP	Mason Planters
NCQ	Collaboration between NSW Agriculture, CSIRO Entomology and Queensland DPI
NEA	National Centre for Engineering in Agriculture
QAC	Queensland Agricultural College
SIR	SIRATAC Ltd
UA	University of Adelaide
ULA	La Trobe University
UMON	Monash University
UN	University of New South Wales
UNE	University of New England
UQ	University of Queensland
US	University of Sydney
USQ	University of Southern Queensland
UTE	University of Technology, Sydney, Centre for Environmental Toxicology
UTS	University of Technology, Sydney
UWA	University of Western Australia

PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Postgrad - Belinda Townsend "Molecular biology of gossypol biosynthesis in cotton"	ANU3C	95/056
A study of marketing options for cotton in Australia	BAE2C	88/1361
An analysis of optimal futures positions for cotton growers facing price and yield risk	BAE3C	91/0235
Improving irrigation efficiency through remote sensing	CAE1C	88/2583
Regrowth capabilities of Australian varieties after damage by hail	CDL1C	90/1222
Karyl-lee Capel and Dr Lindsay Campbell to attend 1992 Cotton Conference.	CDL2C	92/0425
Management of cotton crops following damage by hail.	CDL3C	93/023
Dynamics of Bt protein in Ingard cotton	CRC3C	97/051
To understand the impact of Pesticides on the Environment, using Cotton as a model	CRC5C	91/0329
Organic Pest Management in Cotton	CRDC01C	93/0101
Water Contingency	CRDC02C	93/0044
Commissioned Research "Endosulfan degradation on grazing pasture"	CRDC07C	96/035
Commissioned Research "Trees on Cotton Farms"	CRDC10C	96/042
Commissioned Research "Australian Cotton Classing Standards"	CRDC12C	96/046
Commissioned Research "An assessment of the agronomic and socioeconomic aspects of water use efficiency and asset use efficiency in the Australian cotton industry"	CRDC16C	96/074
Commissioned Research - Silver Whitefly - Trials in the Burdekin	CRDC20C	95/58
CRDC Workshops - World Cotton Research Conference - 2	CRDC45C	
Roger Hayhurst - Neps and Short fibre	CRDC78C	
Spray Application Program - ground rig operator guidelines	CRDC108C	
Breeding high quality cotton	CS01C	85/0983
Development of SIRATAC Mk 11	CS02C	85/1040
Shallow leading tines for deep tillage	CS03C	91/0225
National Facility for assessment of cotton fibre quality	CS06C	85/1019
Development of improved cotton varieties	CS11C	85/1016
Physical degradation of clay soils in relation to management for	CS12C	85/1015
Heliothis ecology and behaviour	CS13C	85/1014
Research computing	CS14C	85/1013
Development of pheromone trapping devices for monitoring He	CS15C	85/1011
Development of stable cotton production systems	CS16C	85/1012
Degradation of insecticides	CS17C	85/1009
Radar and night vision device observations of Heliothis moth fli	CS21C	85/1056
Development officers for SIRATAC	CS23C	85/1065
Machinery for large scale cotton experiments	CS24C	85/1024
Research computing - plotter facility	CS25C	85/1068
Dr GP Fitt attend 6th international symposium on insect-plant	CS26C	85/1041
Identification of sex pheromones of two cotton pests	CS28C	86/0945
Response of the cotton crop to damage	CS30C	86/0939
Comparison of field with laboratory resistance of Heliothis Armi	CS31C	86/0948
Improved cotton growing systems of harvesting equipment	CS32C	86/0950
A nitrogen management model for cotton	CS33C	86/0952
Purchase and operation of a new greenhouse	CS34C	86/0954
Climatic data recording equipment for cultivar trial sites in NSW	CS35C	86/0955
Cotton tissue-culture and genetic transformation	CS36C	86/0956
Distribution and properties of cracking clay soils in Namoi Valley	CS37C	86/0959
Software engineering of SIRATAC	CS38C	86/0961

PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Research computing-graphics equipment	CS39C	86/0965
Dr J Daly attend Australian Entomological meeting	CS40C	86/1225
Dr Quiesenberry to co-operate with Australian researchers	CS41C	86/0967
Accommodation for CSIRO Cotton Research Unit-Narrabri	CS42C	86/2191
Classification of irrigated cotton soils according to susceptibility	CS44C	87/0600
Education in the use of new software	CS48C	87/0606
Modification of climatic data recording equipment for an Australian (CS40C)	CS49C	87/0608
Travel grant to attend Annual Cotton Research Meeting, Narrabri	CS52C	87/0617
DR J Daly to attend Annual Cotton Research Meeting, Narrabri	CS53C	87/0618
Dr J Daly Attend the Australian Cotton Conference 1988-89	CS67C	88/1249
Travel	CS70C	89/0035
Dr B Lyon Travel to attend the 4th Australian Cotton Conference	CS71C	88/1269
Precipitation enhancement feasibility study in aid of cotton irrigation	CSA1C	91/0217
Ecological genetics of pesticide resistance in Heliothis armigera	CSE01C	85/1018
Reproductive development fecundity & longevity Heliothis adults	CSE02C	88/1261
Movement & colonisation of cotton crops by adult Heliothis	CSE03C	88/1260
Siratac sampling for insect pests of cotton (CS64C & CSP4C)	CSE04C	88/1259
Development of Heliothis population dynamics model	CSE05C	89/1227
Development of a Heliothis identification kit (CS78)	CSE06C	89/1226
Quantifying regional and local movements of adult Heliothis int	CSE07C	89/1225
Control of Heliothis using monoclonal antibodies	CSE16C	90/1234
Development of resistance to insects in Australian cotton varieties	CSE17C	90/1233
Ecological genetics of pesticide resistance to insects in Australian cotton varieties	CSE18C	90/1236
Travel - Dr G.P. Fitt	CSE27C	91/0358
Purchase of High Performance Liquid Chromatography for Narrabri Research Station	CSE30C	92/0420
Pre Commercial development of a Heliothis ID Kit	CSE32C	92/0392
Second Canberra Bt Meeting	CSE35C	93/0009
Travel - Martin Dillon Attend the International Congress on Modelling and Simulation, Perth	CSE39C	93/0040
Travel - Dr Peter Christian Research for CSE29C, Columbia Missouri	CSE40C	93/0041
Travel - Dr Joanne Daly Attend the International Congress of Genetics, Birmingham	CSE41C	93/0042
Identification and predictive classification of the Australian Heliothine moths xref CRDC104C	CSE45C	94/004
Quantification of Bacillus thuringiensis insecticidal crystal proteins in transgenic cotton	CSE46C	94/016
Travel - Karl Gordon attend International colloquium on Invertebrate Pathology & Microbial control (Montpellier) & International Workshop on the Molecular Biology & Genetics of Lepidoptera	CSE47C	94/030
Travel - Dr Ray Akhurst "Attend the International colloquium on Invertebrate Pathology & Second International Conference on Bacillus	CSE48C	94/031
The dynamics of beneficial insect communities in cotton agroecosystems and the role of alternative crops in producing natural enemies for cotton	CSE51C	95/001
Use of Bt for the management of Heliothis in cotton Part 3 - Resistance mechanisms, synergism with and complementation of Bt Toxin	CSE52C	95/002
Use of Bt for the management of Heliothis in cotton Part 4 - Potential for transgenic plants to select for resistance in helicoverpa armigera	CSE53C	95/003
Pre-emptive research into the bilogy & biological control of Bemisia tabaci biotype B	CSE60C	96/028
Quantification of bacillius thuringeiensis insecticidal crystal proteins for season-long monitoring of transgenic cotton field crops	CSE66C	97/022
Travel - Dr Peter Christian	CSE71C	97/027
Cotton Industry Development Award - Bruce Blunden, application of advanced soil bin techniques to measure stresses generated by wheels and tines with reference to the Australian Cotton Industry	CSO6C	94/026

PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Travel - Dr J.M. Kirby "Attend 2nd International Conference on Soil Dynamics, and visit labs in UK CSO7C	94/039	
Investigations of mite abundance economic injury and management (CSP1C) (L85/1305)	CSP01C	90/0434
Investigation of mite abundance, economic injury and management (L90/434)	CSP01C	85/1305
Hardware & software maintenance for Myall Vale vaxcluster facility	CSP02C	87/0605
Managing nitrogen for cotton	CSP03C	87/0609
Economic optimisation in SIRATAC (CS51)	CSP04C	87/0612
Development of improved cotton varieties (CS72)	CSP10C	89/1235
Plant Breeding Truck Transport (CS73)	CSP11C	89/1234
Purchase of a high clearance self propelled ground sprayer (CS	CSP12C	89/1233
Genetic transformation of cotton: Introduction of novel genes in	CSP13C	89/1231
Siratac plus field testing with lead users (CS81C/CSE15C)	CSP15C	89/1221
Enhancement of research computing (CS82C)	CSP16C	89/1219
Dr Lyons visit overseas laboratories (CS83)	CSP18C	89/1204
Measurement of complete water balance of a cotton field	CSP20C	90/1226
Ecology and management of spider mites on cotton (CSE17C/CSE21C)	CSP21C	90/1235
Mr PE Reid-study tour of US cotton research institutions and b	CSP24C	90/1247
Improved nitrogen management for cotton	CSP27C	91/0222
Development of the OZCOT cotton crop simulation model	CSP28C	91/0207
Development and field testing of micro-computer cotton management packages	CSP29C	91/0211
Breeding vericillium tolerant cottons and Bt transgenic cottons	CSP30C	91/0227
Analysis of the sensitivity of cotton cultivars to increased ultraviolet-B radiation	CSP32C	91/0229
Collection and multiplication of germplasm of wild Gossypium species	CSP33C	91/0232
Field experiments with cotton at Myall Vale	CSP34C	91/0233
National facility for assessment of cotton fibre quality	CSP35C	91/0234
Cotton Pest Management	CSP39C	92/0408
Breeding improved cotton varieties	CSP40C	92/0415
Collection of germplasm of wil Gossypium strurtianum in south eastern Australia and its multiplication	CSP41C	92/0416
Travel - Helen McFadden Attend International Congress of Molecular Biology	CSP44C	93/0001
Improved pest management for mites and thrips on cotton	CSP46C	93/0012
Development of hybrid cotton germplasm with glandless seed and other valuable traits from wild cotton	CSP47C	93/0022
Upgrade and maintenance of cotton industry weather station network	CSP48C	93/0027
Development and field testing of micro-computer cotton management packages	CSP53C	94/008
Nitrogen conservation alternative for cotton	CSP54C	94/010
Improving water use efficiency of cotton	CSP55C	94/015
Australian Cotto Research Institute Plant Breeding Fibre Quality Laboratory	CSP56C	94/018
Field experiments with cotton at Myall Vale	CSP59C	94/023
Glasshouse construction	CSP62C	93/0120
Purchase of DEC2100	CSP65C	93/0137
Development of management options for dry season cotton production in NW Australia	CSP66C	95/023
Risk analysis and recommendations for managing nitrogen, water, sowing date and variety selection	CSP67C	05/024
Breeding improved cotton varieties	CSP70C	95/027
Genetic engineering of cotton	CSP71C	95/028
Management of mites and early season sucking pests on transgenic cotton	CSP74C	96/033

PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Collection of wild gossypium australe, G.bickii, B.nelsonii, & G. sturtianum in the Australian eastern arid zone	CSP76C	96/043
ACRI computer network support	CSP77C	96/049
Evaluation of disease tolerance of transgenic cotton lines containing genes for putative antifungal proteins	CSP86C	97/037
Field experiments with cotton at Myall Vale	CSP89C	97/040
Maintenance of cotton industry weather station network	CSP91C	97/042
Travel - Helen McFadden	CSP92C	97/043
Replacement of ACRI Computer file Server (TOOLMAN)	CSP99C	98/070
Construction of glasshouse for research into plant/herbivore interactions & functional responses of predatory insects of Helicoverpa spp. on cotton	CSP100C	98/072
Expansion of drying facilities at ACRI	CSP101C	98/073
Purchase of a Portable Photosynthesis System	CSP107C	
A Novel Application of the Sirolan-Laserscan to independently measure cotton fibre fineness and maturity	CWT01C	97/081
Travel - Dr. Geoff Naylor to Beltwide Cotton Conference January 1999	CWT02C	
Cotton growth development physiology	DAN02C	85/1028
Cotton waterlogging in cracking clay	DAN03C	85/1004
Monitoring resistance levels in heliothis SPP	DAN04C	85/1006
Improved irrigation techniques in Macquarie Valley	DAN06C	85/1003
Sustainable weed management for cotton on permanent beds	DAN97C	95/010
Conservation and utilisation of beneficial insects in the cotton agroecosystem for integrated pest management in conventional, transgenic and organic cotton	DAN98C	95/011
Post-Doctoral - David Nehl "Detection, distribution and control of early season growth disorder of cotton"	DAN100C	95/013
Operational costs for cotton experiments - II	DAN101C	95/0104
Role of conventional insecticides in integrated pest management in cotton	DAN105C	96/024
Drip irrigation evaluation for cotton production	DAN010C	85/0994
Travel - Dr David Nehl	DAN115C	97/029
Purchase of auto sampler and software for the Atomic Absorption Spectrophotometer	DAN126C	98/074
Soil structure resaturation in cracking clays	DAN013C	85/0992
Resistant Heliothis Armiger Namoi Gwydir	DAN014C	85/0984
Machinery for soil profile and physiological studies	DAN020C	85/1043
Addition of temperature control to a glasshouse	DAN022C	85/1069
Additional terminals vax 11 750 computer	DAN023C	85/1070
Upgrading computer room environment Narrabri	DAN024C	85/0929
Effects of tillage practice on nitrogen fertilizer strategy	DAN025C	86/0951
Diseases of cotton	DAN026C	86/0957
Bathurst Burr	DAN027C	91/0384
Cultivation equipment	DAN028C	86/0960
Improving adoption of SIRATIC	DAN029C	86/0943
N Forrester attendance 17th international congress of entomology	DAN031C	86/1228
Improving soil aeration for cotton	DAN032C	87/0596
Insecticide resistance in Heliothis SPP	DAN033C	87/0602
Fire protection for computer facilities	DAN034C	87/0607
Pyrethroid and endosulfan resistance	DAN035C	87/0601
Resistance of synthetic pyrethroids in Heliothis Armigera	DAN036C	87/0604
Weed control in cotton	DAN039C	88/1256

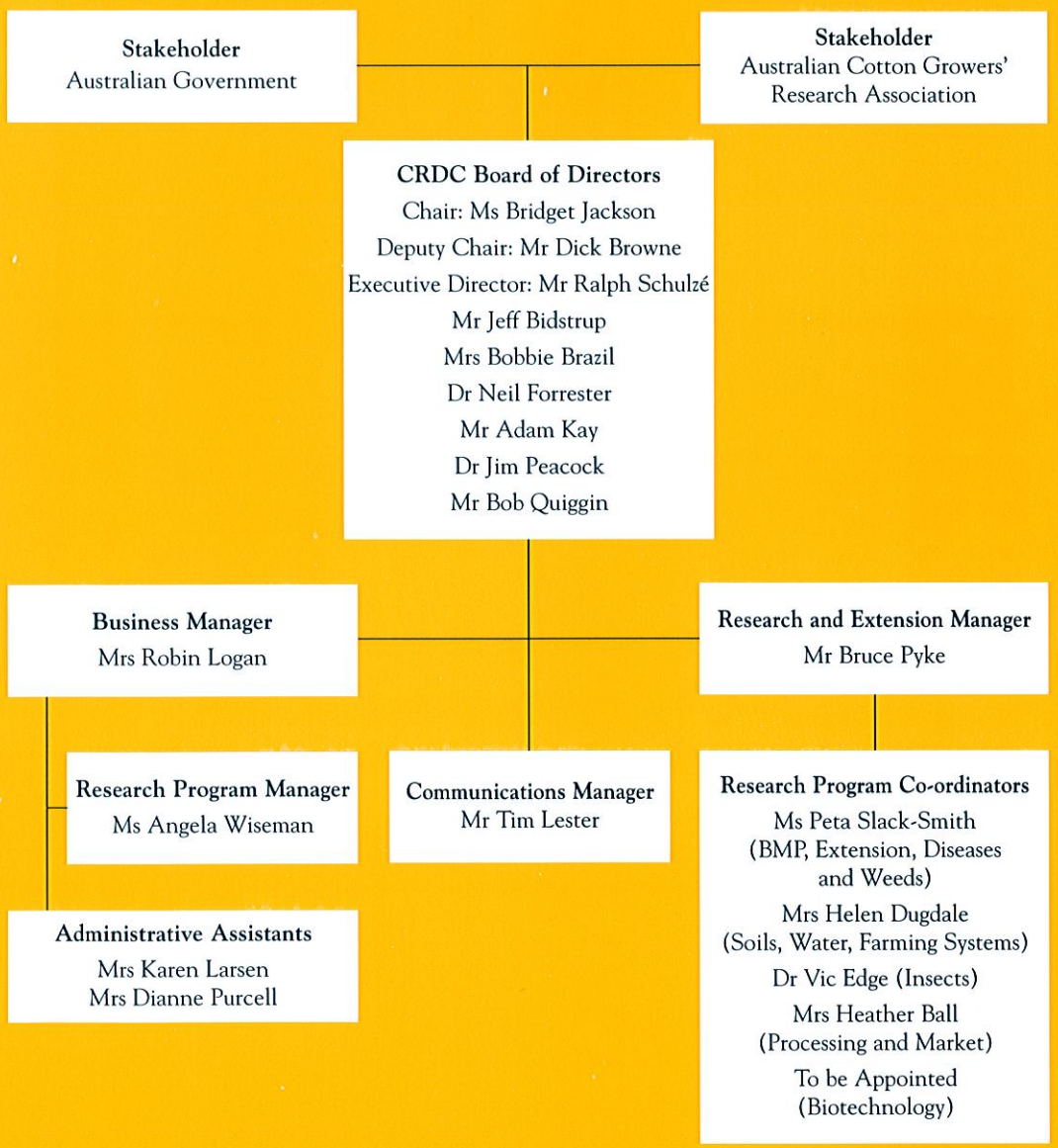
PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Evaluation of Pix in cotton	DAN040C	88/1255
Support system for soil management	DAN041C	88/1253
Cr McRae 5th international congress of plant pathology	DAN043C	88/1250
Soil management training for advisors to cotton growers	DAN045C	88/2536
Evaluation of soil physical conditions for cotton production	DAN046C	88/2532
High yield packages for cotton	DAN047C	89/1230
Disease of cotton	DAN048C	89/1223
Travel N.W. Forrester	DAN049C	89/1206
Refinement of soil physical assessment procedures	DAN050C	90/1225
Biochemical mechanisms of insecticide resistance in Helicoverpa Armigera	DAN051C	90/1229
Evaluation of the Insecticide resistance management strategy	DAN052C	90/1237
Construction of Industry Conference Facility	DAN053C	90/1238
Mr D.C. McKenzie attend 14th international congress on soil science	DAN054C	90/1246
Anhydrous ammonia application equipment investigation	DAN055C	90/2209
Construction of a portable weighing machine	DAN056C	90/2203
G.A. Constable travel application	DAN057C	90/2210
Travel to UK by Mr Forrester	DAN058C	91/0298
Weed control in cotton	DAN060C	91/0206
Involvement of phytotoxin(s), probably herbicide(s), in the Galathera Syndrome	DAN061C	91/0226
Purchase of implement guidance system	DAN062C	91/0224
Upgrade Narrabri Research Facilities	DAN063C	91/0238
Soil management training for advisors to cotton growers	DAN064C	91/0239
Dr SJ Allen to visit US laboratories and attend Cotton Prod Research Conferences Jan 1992	DAN065C	91/0243
Ms S Greenhalgh to attend ASSSI National Soils Conference in Adelaide April 1992	DAN066C	91/0244
Travel - Dr Neil Forrester	DAN067C	91/0368
Optimal early season insect control strategies.	DAN068C	92/0396
Diseases of cotton	DAN069C	92/0401
Biological control of Verticillium Wilt and seedling disease of cotton	DAN070C	92/0402
Global positioning system for cotton research	DAN072C	92/0422
Operational costs for cotton experiments	DAN073C	92/0423
Mr D.C. McKenzie to attend 9th International Working meeting on soil Micromorphology in Townsville	DAN074C	92/0428
Advisory officer training in pesticide application technology	DAN075C	92/0432
Rotopak - Developing rotations to overcome soil degradation for irrigated cotton systems	DAN076C	92/0434
Resistance monitoring in H.armigera in the Macquarie Valley	DAN078C	92/0471
Travel N. Gould Attend American Society of Agricultural Engineers Summer Meeting, Washington	DAN079C	92/0506
Travel - F.J. Byrnes to attend WCRC-1	DAN084C	93/0070
Travel - N.R. Hullugalle "Attend & present paper at 13th Conference of International Soil Tillage Research Organisation".	DAN088C	94/038
Pest Management in Organic Cotton	DAN089C	94/042
Travel - Kim Fraser "Attend 1995 Beltwide Conference"	DAN091C	94/064
Travel - Stephen Allen "Sixth International Verticillium Symposium"	DAN090C	93/0127
Distribution of and insecticidal resistance in Australian B-type Bemisia Tabaci	DAN092C	94/89
Insecticide resistance in cotton Aphid	DAN093C	94/90
Organophosphate & cabamate resistance management in helicoverpa armigera	DAN104C	96/023
Role of conventional insecticides in integrated pest management in cotton	DAN105C	96/024
Insecticide resistance management in Bemisia tabaci	DAN106C	96/027

PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Insecticide resistance in field-collected cotton aphid	DAN117C	97/048
ACRI Breeder/pathology lab	DAN129C	
Travel - David Nehl to examine Black Root rot in USA	DAN136C	
IPM in Cotton: Semiochemicals of cotton plant surfaces & pest management	DAN142	
Cotton breeding in QLD	DAQ05C	85/1055
Irrigation management for efficient water use	DAQ07C	85/1053
Irrigation and nitrogen management	DAQ09C	85/1033
Commercial management of new cotton cultivars	DAQ10C	85/1032
Plant stress role in development of bacterial blight	DAQ11C	85/1030
Provision of shed for ginning and storage of seed cotton	DAQ14C	83/0176
Climatic data recording equipment purchase	DAQ18C	85/1046
Computer link to Narrabri computer	DAQ19C	85/1023
Genotype X environment interaction	DAQ20C	85/1048
Population dynamics of Heliothis	DAQ21C	85/1038
Egg parasites for control of Heliothis	DAQ22C	85/1039
Screening technique for cotton plant resistance to heliothis SPP	DAQ26C	86/0936
Chemical techniques for determining age of adult pests of cotton	DAQ27C	86/0935
Cotton strain and cultivator testing	DAQ28C	86/0953
Improved water scheduling and crop nutrition	DAQ29C	86/0949
Breeding cotton cultivators	DAQ30C	86/0941
Dr P Twine attendance at 2nd international symposium on trichogramma	DAQ32C	86/0963
Chemical techniques determining age of adult pests of cotton	DAQ36C	87/0598
Access to computing facilities Toowoomba	DAQ38C	87/0613
Cotton germplasm maintenance	DAQ40C	88/1245
Dr R.E. Teakle study insect pathology Microbial control in USA	DAQ42C	88/1252
Cotton strain and cultivator testing QLD	DAQ43C	89/1232
Acquisition of new small plot planter	DAQ47C	90/1223
Evaluation of microplitis for biological control	DAQ48C	90/1231
Assessment of the potential for community-based education	DAQ51C	90/1239
Mr Dah Murray travel to USA to examine development of biocontrol	DAQ53C	90/1249
Population dynamics and migration of Heliothis species	DAQ55C	90/2040
Towards more field efficient soil conservation layouts	DAQ56C	91/0218
St George Heliothis Monitoring Programme	DAQ57C	91/0299
St George Heliothis Monitoring Programme	DAQ59C	92/0393
Soil compaction control and repair practices for cropping lands in the Sub-Tropics: Dryland controlled traffic systems	DAQ62C	92/0412
Cotton extension/development program - South Qld	DAQ64C	92/0424
Travel - Graeme Harden Attend 12th International Plant Nutrition Colloquium & International Symposium on Zinc in Soils and Plants	DAQ67C	93/039
Making farming systems trials on dryland cotton more applicable	DAQ69C	94/009
Travel - Brad Scholz "Present paper at Fourth International Symposium on Trichogramma and other egg parasitoids" Cairo, Egypt	DAQ71C	94/036
Toward sustainable mirid management in cotton	DAQ72C	95/017
Cotton strain and cultivar testing in Qld	DAQ74C	95/019
Ecology & management of fusarium wilt in cotton	DAQ76C	96/031
Optimising management strategies for profitable cotton production in water limited environments	DAQ77C	96/036

PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Seasonal phenology, hosts and natural enemies of the silverleaf whitefly in cotton areas of Qld	DAQ79C	96/085
Entomology and pest management of transgenic (INGARD) cotton in Central Qld	DAQ81C	96/097
Travel - Phil Goyne to Beltwide Cotton Conference, USA January 99	DAQ91C	
Travel - David Kelly Overseas study tour 1999	DAQ94C	
Monitoring and modelling the plant environment	DDI1C	89/1228
Heliothis Armigera Mating Disruption Trial	DI1C	90/2413
Sustainable and moisture conservation	ICM1C	89/1105
Improving cotton return per megalitre in the Callide Valley	ICM2C	91/0221
Cotton Marketing Study - Macquarie Agribusiness	MA1C	90/2139
Soil Management Training Courses - Walgett and Bourke	MCK2C	
Worker exposure to pesticides in cotton fields with reference to Cotton Chippers	MH1C	91/0215
Travel - Louise Faulkner "Study Tour" - Stockholm	MH3C	93/0126
Condensed tannin content of cottonseed meal and its effect upon nutritive value	MNZ1C	91/0236
Development of a ground vehicle for use as an alternative to aerial spraying of cotton	MP1C	91/0205
Use of Bt for the management of Heliothis in cotton	NCQ1C	92/0390
The research & development of a module moisture scanner	NEA1C	96/048
Aerial application of LV insecticides	QAC1C	86/0938
SIRATE management system development	SIR1C	85/1067
Analysis of gene expression during cotton fibre development	UA1C	91/0231
Travel - Sharon Orford "Present paper at International Conference - USA	UA2C	94/91
Measurement and control of fibre properties	ULA1C	89/1217
Assessment of genetic differentiation among Australian populations of Helicoverpa	ULA2C	91/0210
Physical and chemical studies of cotton fibre maturity	ULA4C	92/0419
Postdoctoral - Roland Chung "The structure and sites of biochemical action of cotton defensive proteins and secondary metabolites	ULA5C	94/92
Travel Grant - Dr Rosemary White	UMON3C	
Assessing the latest molecular genetic markers for detecting population structure and movement in Helicoverpa	UMON3C	93/004
Seed Bed Preparation Methods	UNE01C	85/1008
Ecology of heliothis SPP	UNE02C	85/1066
Soil factors affecting irrigated cotton production	UNE03C	87/0599
Flight & migratory potential of Heliothis	UNE04C	88/1247
Monitoring Heliothis population in non cropping areas	UNE05C	88/1246
Dr T. Batey travel to Australia assist with soilpak 1990/91 Annual R & D Program	UNE06C	90/0441
Influence of vesicular arvuscular mycorrhizas	UNE07C	90/1227
Mr M Coombs present paper to scientific conference of Aust ent	UNE09C	90/1251
Postgrad research fellowship Mr G. Walker	UNE10C	90/1243
Improved systems for on-farm water sensing and soil quality prediction	UNE11C	91/0216
Assessing the effectiveness of predators of Heliothis spp.	UNE13C	92/0397
Postgrad - David Nehl "Influence of vesicular-arbuscular mycorrhizas on growth, dev' & yield of cotton". In conj with UNE7C.	UNE17C	92/0487
Travel - John Brown Attend 9th Australasian Plant Pathology Conference, Hobart	UNE24C	93/038
Travel - David Hawkey field work	UNE25C	94/018
Pinkspotted bollworm	UQ07C	85/1007
compaction properties of cotton soils	UQ08C	85/1047
Push pull heliothis	UQ09C	85/1829

PROJECT TITLE	PROJECT NUMBER	FILE NUMBER
Control of pink spotted bollworm by mating disruption	UQ09C	88/1262
Attendance at entomological society annual meeting P Walker	UQ12C	86/1223
Travel PW Walker	UQ12C	89/0566
Sampling and control measures for mirids in cotton. In conj with UQ20C.	UQ15C	90/1228
Dr MP Zaluki travel to Adelaide to analyse lighttrap data	UQ17C	90/1244
Structural regeneration of compacted cracking clays - wet/dry cycles and rotation crops. In conj with UQ19C.	UQ18C	91/0220
Postgrad - A.K. Sarmah "Structural regeneration of compacted cracking clay using wet/dry cycles & rotation crops. In conj UQ18C	UQ19C	92/0485
Travel M.Miles Attend Australian Entomological Conference, Cairns	UQ21C	92/505
Population Genetics of heliothis migration and recruitment to support a regional management strategy	UQ25C	98/033
Reducing pesticide persistence in Agricultural soils	US01C	87/0615
The fate of endosulfan sprayed on cotton for insect control	US02C	90/1230
Industry development award Mr T. Guerin (Biodegradation of endosulfan)	US03C	90/1242
Partial funding of gas chromatograph/mass spectrometer	US04C	91/0212
Spatial distribution of soil properties relevant to sustainable cotton production	US05C	91/0219
Stimulation of embryogenesis in cotton tissue cultures	US06C	91/0230
J Triantafilis - Postgrad fellowship in con with ULA1C	US07C	91/0241
Management of Va Mycorrhizal fungi for sustainable production of cotton	US09C	92/0410
Postgrad - Stephen Kimber "The fate of endosulfan sprayed on cotton for insect control" In conj with US2C	US15C	92/0486
Postgrad - Karyn Ridgway "Identification of genes involved in the est' and maintenance of a ves'r arbus' mycor' assoc' with cotton"	US19C	03/033
Travel - Alex McBratney Attend Soil Science Society of America Conference, Milwuakee	US20C	93/037
Understanding the salinity threat in the irrigated cotton growing areas of northern NSW	US22C	94/012
Travel - Dr Ivan Kennedy "Attend 8th International Congress on Pesticide Chemistry"	US25C	94/032
Travel - Stephen Kimber "Attend 8th international Congress on Pesticides Chemistry"	US26C	94/033
Travel - Sebastian Southan "Attend 8th International Congress on Pesticide Chemistry"	US27C	94/034
Travel - Elizabeth Roesner "Present paper at International Congress of Soil Science" Acupulco, Mexico	US28C	94/037
Induced resistance to cotton diseases as part of integrated pest and disease management	US37C	97/044
Quantification of VAM fungi in soils for sustainable production of cotton	US38C	97/045
Travel - Mona Akbari - Attend Plant & Animal Genome VII Conference	US46C	98/081
Ecological Risk Assessment	US49	
Endosulfan Residues in Cattle	US50C	
Environmental fate of endosulfan: Review data on the role of sediments and drift onto pasture at Emerald	US51C	
Pilot study for proposed digging machine and spray projects	USQ1C	90/1224
Design and commissioning of a vision based guidance system	USQ4C	93/0021
Machinery Development - Cotton Industry	USQ7C	96/075
Effects of endosulfan and Lagoon habitats of N.S.W	UTE1C	90/2258
Relationships between populations of selected macroinvetebrates and pestices in the Namoi River	UTS1C	97/052
Molecular biology techniques for the identification of genes for resistance to pyrethoids	UWA1C	91/0245

Corporate Structure



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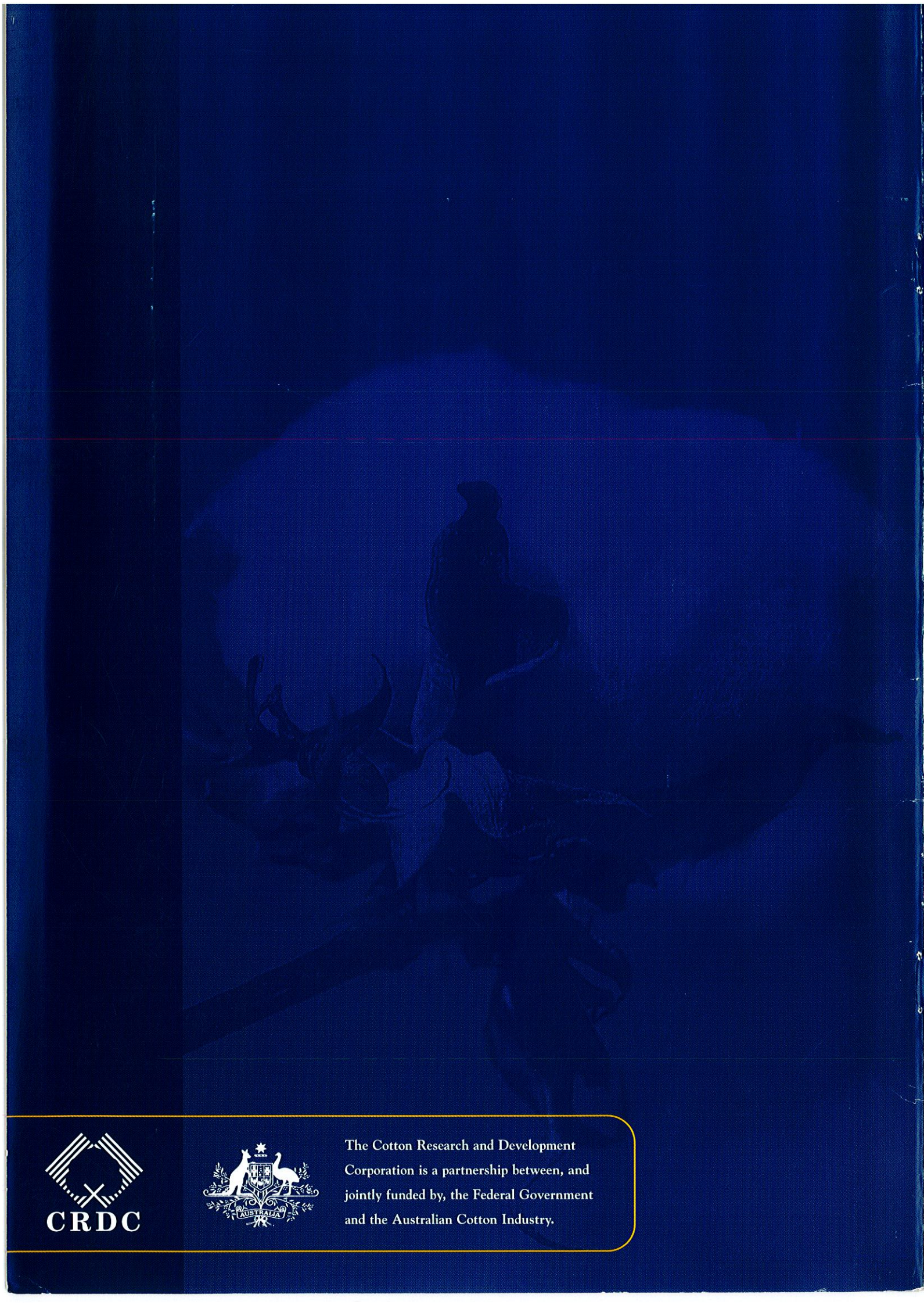

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