Review of cotton disease research

11-21 February 2007

Australian Government
Cotton Research and Development Corporation

- **Panel members**

  Lester Burgess, Dallas Gibb, Eileen Scott, Bill Tyrwhitt, Ian Taylor

- **Research locations visited**
- University of Queensland, Brisbane
- QDPI, Toowoomba
- CSIRO Plant Industry and Australian National University, Canberra
- University of New England, Armidale
- ACRI, Narrabri
- University of Melbourne and Sydney teams

Context

- Drought - reduced funding
- Need to prioritise
- Staff resources
  - retirements, capacity retention, succession planning
  - winding up of CRC for Tropical Plant Protection
  - infrastructure issues
  - geographical constraints on research on Fusarium wilt

Recommendation 1

CRDC continue to support a portfolio of applied, strategic and basic research with industry benefit as a key criterion in assessing relevance of research proposals

Recommendation 2

CRDC give priority to research on the biology and ecology of Fusarium wilt and black root rot in relation to rotations and farming systems

- underpins integrated disease management strategies for soilborne diseases where only partial resistance (Fov) or no resistance (BRR) available

Recommendation 2 (cont'd)

Pathogen biology and ecology

- Pathogen load in response to:
  - rotation crops
  - cotton varieties (resistance status)
  - residue management and weather
- Role of phosphorus and mycorrhizas in disease development
- Research enhanced by:
  - quantitative, specific assays for pathogens
  - GFP-tagged strains of pathogen(s)

Recommendation 3

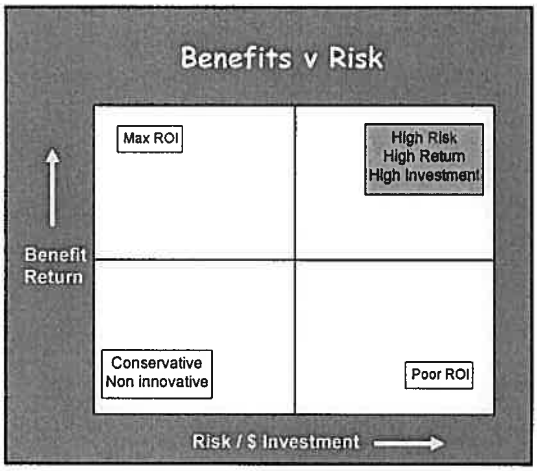
CRDC continue to support and facilitate the annual cotton disease surveys

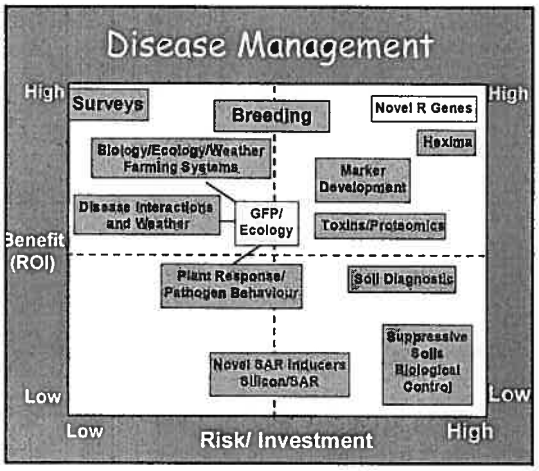
The panel considers that these surveys are crucial in that they:

- underpin all other research projects
- provide a scientific basis for prioritising research investment
- facilitate early detection of new strains of existing pathogens and quarantine incursions

Recommendation 4

- **CRDC transfer funding for field screening for resistance to Fov from Crop Protection to Breeding and biotechnology**
- CRDC also consider funding marker research through Breeding and biotechnology





Recommendation 5

CRDC encourage/assist researchers to maintain basic research through support from:

- ARC Linkage grants (with industry partners)
- ARC Discovery grants

For exotic pathogens (agency focus on developing countries)

- ACIAR (Australian Centre for International Agricultural Research)
- AusAID
- International funding agencies

Recommendation 6

CRDC foster and facilitate international collaboration, especially in areas of:

- Exotic, high risk pathogens
- Emerging local pathogens
- Novel chemicals and other strategies
- Genomic and proteomic research

Recommendation 7

CRDC maintain and strengthen its support for recruitment and training of:

- Undergraduate students
- Postgraduate students
- Postdoctoral researchers

To ensure adequate research capacity, succession planning and gender balance

Recommendation 7 - implementation

CRDC maintain and strengthen its support for recruitment and training

- From school student to postdoctoral scientist
- Establish and maintain active links with students
- Support participation in annual cotton conference and Fuscom
- Maintain gender balance and inclusive working environment

Recommendation 8

CRDC strengthen the dissemination of research findings to consultants and other extension personnel through:

- Annual update meetings on key diseases and other findings

Utilise such meetings to identify new issues/challenges and obtain feedback

Recommendation 9

a. For purposes of funding and project management, CRDC recognise three nodes for cotton disease research

- Toowoomba: QDPI and University of Southern Queensland
  - for Fusarium wilt research and disease interactions
- Narrabri: ACRI and Armidale: University of New England
  - for black root rot research and breeding
- Canberra: CSIRO
  - for breeding and genetic resources

Subject to regular review, active collaboration and involvement of other universities for training as needed

Recommendation 9a - implementation

For purposes of funding and project management, CRDC recognise three nodes for cotton disease research

To avoid complacency and competition, it is recommended that there be:

- Agreed performance targets/criteria
- Infrastructure provision
- Measures of active collaboration and cross-acknowledgement of contributions
- Adjunct/honorary appointments and secondments

Recommendation 9 (cont'd)

b. CRDC ensure:

- Succession plan in place at each node
- Program to develop the skill base at each node
- A mentoring program for early career researchers
  - assume leadership responsibilities
  - opportunities to interact with industry groups
- Appropriate infra-structure is in place

Recommendation 10

10a. 'Fuscom' be formally recognised as the Cotton Disease Advisory Committee

- Independent chair
- Advise CRDC on:
  - research priorities and gaps
  - emergency or emerging issues
  - integrated disease management strategies
  - training and extension matters
- Meet annually or as required to respond to emergency issues

Recommendation 10

10b. Cotton disease research projects be coordinated within two broad areas (sub-committees)

- Fusarium wilt and disease interactions
- Black root rot and preparedness for exotic, emergency and other diseases
- Both areas to be active in extension and education at all levels

Recommendation 10b - implementation

Cotton disease research projects be coordinated within two broad areas

- Each area to be coordinated by an experienced pathologist, assisted by an early career researcher to facilitate succession
- Identification of future research leaders with attention to gender balance and equal opportunity

Acknowledgements

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Appendix slides

Recommendation 3

a. Managing disease/farming systems

High benefit, low/medium risk, strongly collaborative

Disease surveys

- all regions, findings shared
- underpin all disease-related research
- preparedness for threats (new strains, exotic pathogens)
- provide a scientific basis for prioritising research investment

Recommendation 3 (contd)

b. Managing disease/farming systems

Low benefit, medium/high risk

"Alternative" disease management practices

Inconsistent results to date

- Biofumigation
- Decoy cropping
- Novel chemicals to induce resistance (SAR, ISR)
  - Funding by chemical industry (ARC linkage?)
- "Suppressive" soils
  - Monitor research outcomes elsewhere (other RDCs)

Recommendation 3 (contd)

c. Strategic research – 10-year horizon

High benefit, medium/high risk

Black root rot

- Pathogen diversity (PhD thesis delayed)
  - information essential for study of pathogen biology, host-pathogen interaction, crop rotation
- Cotton-pathogen interaction
  - Disease severity on cotton varieties and other hosts
  - Basis for host specificity
  - Information to underpin breeding and crop rotation

Fusarium wilt

- Resistance mechanisms in relation to source
  - pathology, genetics, chemistry, molecular biology, anatomy

Recommendation 3 (contd)

d. Strategic research – 10-year horizon

Medium/high benefit, high risk

Cotton molecular markers

- Need for more QTL (quantitative trait locus) markers
- Challenges of cotton genome

Novel resistance genes in cotton

Novel resistance genes from other hosts

Recommendation 3 (cont'd)

d. Strategic research – 10-year horizon

Medium/high benefit, high risk

Cotton molecular markers

- Need for more QTL (quantitative trait locus) markers
- Challenges of cotton genome

Novel resistance genes in cotton

Novel resistance genes from other hosts

7. Education: school to undergraduate

- Visit schools in cotton growing areas to foster interest in science and cotton
  - e.g. presentations, exhibits, model experiments for science classes
- Continue to offer summer scholarships
- Undergraduate scholarships for promising students
  - Financial incentives to perform well
  - Maintain contact between student and industry representatives (and local postgraduates)
  - Opportunity to attend annual cotton conference

7. Education: postgraduate

- Recruit from undergraduate scholarship holders and from agriculture and general science graduates
- Foster links with industry
  - Relevance of research
  - Empathy with growers
  - Present research at "FUSCOM" if appropriate
- Half-day workshop at annual cotton conference – skills development, networking
- Financial incentive for timely submission of thesis and acceptance of papers

7. Education: postdoctoral

- Recruit from postgraduate scholarship holders and from agriculture and general science postgraduates
- Assign mentor to assist with skills development in industry context
- Identify postdocs with leadership potential
  - Candidates to work closely with team leader to facilitate succession planning
- Continue to foster an inclusive working environment