

'THE AUSTRALIAN COTTON WATER STORY'

NARRABRI, 10 & 11 AUGUST 2011

Science Panel Recommendation &

Individual Panel Members' Comments on the Terms of Reference

Science Panel members:

- Chair - Dr Gerrit Schrale, ex SARDI
- Joe Robinson, Cotton grower
- Richard Moxham, MDBA
- Prof Ian Falconer, Water Specialist
- Prof Peter Gregg, Cotton CRC
- Dr Des Whitfield, Vic DPI

The science panel used the following information:

- Background papers distributed before the Forum
- A brief field excursion on 10 August
- Forum presentations and printed abstracts
- Forum discussions
- Prior knowledge

Recommendation:

Term of Reference 1: Progress of cotton water research to desired economic, environmental and social outcomes since 2005

Economic:

- Breeding and agronomic progress resulting in higher WUE per bale (1.1 to 1.6 bales/MI)
- Improved fibre quality for premium export markets
- Reduced use of agricultural chemicals: lower cost and less off-site impact
- Improved spray schedules and a system of disease alerts
- Field evaluation of surface irrigation systems
- Crop management and irrigation technology advances have been readily adopted by leading growers
- Limited adoption of pressurised irrigation: pivots & lateral moves
- Better understanding of surface irrigation design criteria
- Apart from the Namoi and Condamine catchments, groundwater research & planning in the other cotton catchments is in an early stage

Environmental:

- Emerging awareness and care for the catchment environment: riparian buffers, water course stabilisation & pest plant control
- Increasing communication between cotton growers and CMA staff on ecological issues

Socio-economic:

- Research in options to increase the resilience of the cotton community to reduced and highly variable water diversions is very timely
- In times of drought, accessible groundwater resources of suitable quality have been found to underpin the resilience of remote towns, farm businesses and service industries

Term of Reference 2: Assess strength of cotton water story

- Major advances in crop agronomy and irrigation technology
- Some high quality research outcomes published in peer reviewed journals
- Inclusive cotton community (as we saw on the awards night)
- Rapid uptake of advances in crop agronomy and irrigation technology by early adopters
- Profitable industry with a potential contribution of \$1-2 billion/year export earnings
- Resilient industry and community to cope with extended droughts and floods.
- Emerging grower awareness/responsibility for the ecology of their catchments
- Contribution of irrigated cotton & other crops to regional economies needs further clarification, particularly in relation to the emerging coal seam gas & coal mining developments

Term of Reference 3: Identify opportunities for improvements

- Increase uptake of advanced irrigation technology beyond the early adopters
- Introduce a package of whole farm planning to achieve better outcomes on-farm and less off-site impacts. Another option is to explore the implementation of Water Stewardship as proposed by the former MDBC (Andrews et al, 2007, and Spencer Consulting Group, 2008)
- Transparent rationale of hydrological and ecological benchmarks for timing and extent of overland flow and river flow harvesting, consistent in Queensland & NSW
- Explore opportunities for 'win-win' water sharing whereby water is used for environmental benefit in the upper catchment and then used for consumptive purposes further downstream at times of floods and droughts
- Groundwater research for the catchments, including its connectivity with the hydrology of the base rock formations in which coal seam mining is proposed
- Establish an ongoing dialogue between all stakeholders that results in endorsed catchment and farm initiatives as a consequence of R & D:
 - Ecological catchment plans that also reflect the community values for the ecology of the catchment
 - Better planning and priority setting for ecological research in the catchment: riparian zones, water course stabilisation and wetlands
 - Pro-active industry & community participation in the planning & implementation of 'water for the environment' initiatives

Term of Reference 4: Publication avenues for scientific and other target groups

- While the crop researchers have a good track record for peer reviewed publications in credible journals, there seems to be scope to increase the awareness and skills of the growers and their staff through easy-to read, targeted publications with case studies
- An extension bulletin on principles of good farm layout and water management

- A glossy publication to raise the community awareness of the ecological assets of in-stream processes, wetlands and riparian zones; this should also explain the relationship with ecological assets and the role of environmental flows
- Education targeted publications regarding the insights of irrigated agriculture and its ecological impacts for primary and secondary schools, including the role of 'my BMP' and 'Water Stewardship' that are aimed at minimising the risk of ecological impacts
- A popular publication on groundwater research outcomes and their implications for ground water management in the catchment

Term of Reference 5: Assess quality of research

- Most of the irrigation research is published in peer reviewed publications, but there is more opportunity for peer reviewed publications.
- From the presentations we concluded that the research outcomes are well focussed towards industry needs
- The panel did not examine the methods nor techniques applied in the individual research projects due to the brevity of presentations.
- Groundwater research for basin management is still in its infancy. The outcomes have not been presented to the general public though there have been several workshops with local grower groups
It is noted that the Namoi basin groundwater research was undertaken by Uni. of NSW, and has been published (Kelly et al, 2009). The groundwater research on the Condamine basin was done by Queensland Dept of Environment and Resource Management, and reported in August 2008

Term of Reference 6: Consider extent for collaboration and value adding

- Opportunities for collaboration in some areas (eg crop physiology and irrigation) have been limited in recent years by staff turnover and reductions in research capacity associated with drought and the termination of CRC - Irrigation Futures
- In collaboration with the CMAs and support from the NSW & Qld Governments, the proposed next CRC to research:
 - quantify the on-farm processes to off-site impacts of cotton growing
 - determine the research priorities for the wetlands in the catchments
 - explore opportunities for reducing or modifying the land use practices to reduce the critical off-site impacts
- More value adding seems to be possible by information transfer of the research outcomes e.g. the practical methods of assessing dam evaporation and seepage
- Extension of groundwater research outcomes to the catchment communities

Term of Reference 7: Assess whether outputs meet end user needs

- From the information available to us, we conclude that the research outcomes are well focussed towards industry needs
- While genuine extension efforts are made to transfer the research outcomes, perhaps there is also scope to include the delivery of education packages and short courses on irrigation technology for skill development of hands-on growers and their key staff
- Groundwater research outcomes that underpin basin management in the catchments needs to be conveyed to the irrigators and wider community
- An integrated program for ecological research be developed by all stakeholders and be adequately funded to meet the needs of industry and the community
- Hold annual forum(s) where stakeholders and partners are able to discuss research outcomes and extension activities

Term of Reference 8: Identify priority R & D and adoption gaps

- An analysis of the economic and environmental costs & benefits of pressurised irrigation versus improved surface irrigation
- Develop and implement practical 'rules of thumb' indicators to guide industry practice (e.g. dam evaporation losses (ML/day/ha, ML/year/ha))
- Identify on-farm measures that are most consistent with a 'clean & green' industry image, and negotiated catchment/environmental outcomes
- In collaboration with the CMAs and relevant state government agencies, determine the ecological research priorities for wetlands in the catchments
- Identify those critical factors impacting on wetland ecology that are caused by cotton growing practices

References

Andrew M., Jarvis T., Howard, B., McLeod, G., Robinson, S., Standen, R., Toohey, D. and Williams, A (2007). The Environmental Stewardship (ESS): a generic system of assuring rural environmental performance. *Aust J of ExpAgric* Vol 47: 245-259

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Kelly B.F.J., Allen D., Ye K., Dahlin, T. (2009). Continuous Electrical Imaging for Mapping Aquifer Recharge Along Reaches of the Namoi River in Australia. *Near Surface Geophysics*, Volume: 7 Issue: 4 Pages: 259-270.

Spencer Consulting Group, One World Standards, Pinnacle Consulting and SGS in association with the Water Stewardship Initiative(2009).A project to test the concept with cotton growers – evaluation and business case. Report to MDBA.

APPENDIX:

SEQUENTIAL COMMENTS BY INDIVIDUAL PANEL MEMBERS AFTER THE 'COTTON STORY' FORUM

1. Gerrit Schrale:

Besides from the background papers and presentations, what did we learn at the 'Cotton Story' forum?

- ***Industry profile:***
 - Mainly located in the eastern upper river catchments of the MDB, in eastern NSW and south-west Queensland
 - In a normal climatic year the value of cotton export was about \$ 1 billion per year, rising to \$2 billion when water is not limiting.
 - industry liaison across the state borders
 - Relatively wide age profile of growers with a higher education standard compared to other agricultural industries
 - A relatively young, modern and progressive sector of Australia's agriculture
 - Farm size of about 500 – 5000 ha; there are a number of larger farming enterprises
 - Mixed farm enterprises: irrigated cotton and dry-land crops and some livestock
 - Irrigation with surface water harvested in ring dams and supplemented with groundwater of appropriate quality, where available
 - Cotton growing underpinned by high quality agronomic and irrigation technology research
 - Now 98% of GM cotton crops resulting in less farm chemical use
 - Irrigators increasingly recognise that their farming activities impact on the ecological health of their catchment
 - Scope for establishing a pro-active working relationship with the CMAs (one for each catchment?)

- ***Cotton agronomic & irrigation research delivery:***
 - Three collaborating industry bodies: Cotton Australia (industry advocacy), CRDC (RD&E priority setting), Cotton CRC (research contractor & delivery)
 - Cotton CRC undertakes the agronomic research and information transfer but has also an extension role in NRM management
 - USQ at Toowoomba undertakes most of the irrigation technology research
 - The 20% evaporation loss from water storages needs to be reduced through group extension
 - Commercial irrigation consultants deliver mainly the information transfer to the leading growers but they identified a slow adoption in the remainder (bulk) of the irrigators

- ***Cotton CRC rebid***
 - Cotton Catchment Communities CRC at Narrabri is now in its 2nd 7 year term and scheduled to close in 2012.
 - Planning a bid for an extension to the 3rd round. Draft extension plan with 4 priority areas circulated:
 - Regional people; water; energy & carbon and green GM farming
 - If unsuccessful, should explore other RD & E models of operandi (See Ian's comment), besides those listed in the draft strategic plan

- ***Catchment Management Authorities:***

- Queensland got 'Alliances' which are equivalent to CMAs
 - Perhaps CMAs raise also levies from land holders and irrigators?
 - CMA income mainly from NSW Government; on-ground works are funded in partnership with growers
 - CMAs have some liaison with Cotton CRC
 - Cotton CRC & Namoi CMA have released glossy publications on biodiversity, birds, grazing pastures, fish and lippia management on cotton farms
 - Encourage, but can CMA (comprising a balanced membership representing all stakeholders) enforce improved NRM management with a sound research base?
 - CMA funds a wide program_of (76!) projects: NRM research & investigations with strong emphasis on ecology, and information provision to the communities
- **Groundwater Management:**
 - Department of Water seems to undertake the groundwater management and investigations in the NSW upper catchments
 - Has the CMA a pro-active role in influencing the agenda & priorities for groundwater management?
 - The Namoi River basin is severely overdrawn and licences have been reduced
 - The Namoi Basin has been modelled; modelling of the other basins is in an early stage
 - Deep drainage from irrigated cotton not yet well understood by most growers
 - Coal seam gas mining (causing major water extraction from the rock basin) may have a major impact on the yield of the groundwater in the overlying strata
- **Socio-economic research:**
 - Judith Stubbs Consultancy report, related to water allocation reduction is the main work undertaken. Report has strong emphasis on the employment impact from the anticipated reduction in irrigation water availability in the (soon to be released) draft MDBA catchment plan
 - Factual knowledge about the resilience of the cotton community may assist to predict the impact of changes to water availability through MDBA measures and climate change

2. Peter Gregg, additional comment:

There has already been a partnership between Namoi CMA, the CRC and growers of just the type you recommend. CMA funds were applied to assisting growers to adopt irrigation and environmental BMPs developed from CRC research. Jane Macfarlane can give you precise details, but I know that several thousand hectares and about 20 km of riverfront were involved. Of course, there are opportunities for similar partnerships in other catchments that have not yet been realised.

Ian, the idea of better research co-ordination between Cotton Australia, CRDC, CSIRO, the CRC and government agencies raises some interesting possibilities. However, Cotton Australia is not a major player in research - they are primarily an industry advocacy and lobby group. They fund very little research directly, but what used to be the Australian Cotton Grower's Research Organisation, which provided grower input into the decisions of CRDC, is now part of Cotton Australia. So they have a significant advisory role through CRDC, but not a direct role in research. They are also a partner in the consortium, including CRDC and the CRC, which operates the myBMP system.

3. Des Whitfield:

I've managed to clear up my understanding of the role of water balance calculations and Irrimate evaluations in cotton WUE bench marking by accessing some of the publications on the web. Having done that, I am happy to reiterate that I believe the cotton industry is well served by the quality of the science that underpins on-farm water management and evaluation approaches. I am not so sure that the industry is recognised for those efforts.

Whilst the science for Irrimate and HydroLogic is sound, I am not convinced that there is widespread adoption and implementation of tools by industry. In that context, I think that the industry has much to gain from partnerships with CMA's where CMA's are prepared to support and/or endorse whole-farm management plans based on the hydrologic outcomes of the CRC. The plans would necessarily include rules/guidelines for:

- the optimal siting and design of storage dams in the landscape
- the optimal layout and management of irrigated fields on the farm (length of run, head provisions, taking account of slope, soil type etc)
- the optimal siting and layout of surface drains on farms
- optimal fencing and other strategies that support the quality of riparian and wet land areas
- optimal management of the yield and quality of ground water resources (see below)

In my experience, industry partnerships with CMA's successfully serve the needs of both parties. Scientists, in particular, see the results of their work contributing to industry and catchment outcomes, and the industry gains credit through widely recognised contributions to the management of riparian areas and flood plains. Formal accreditation processes ensure that industry recognises environmental requirements.

I too observe that not enough is known about ground water processes and amounts in the industry. TOOLS are urgently required that contribute to understanding of processes affecting both the amount and quality of the ground-water resource. Monitoring tools/approaches are needed to underpin rules/guidelines for the optimal use of the ground-water resource at farm and regional scales.

4. Ian Falconer:

I was impressed with the scope, focus and quality of the research that was presented to us. There were a few points that can perhaps be extended from our present notes.

The first is the important role of groundwater to the cotton industry. In all three major cotton growing areas groundwater is extensively used, and is likely to be unsustainable. We saw a map of the depression in water tables in the Condamine Basin, in the Namoi I have heard growers describe drops in tens of metres, and the Lachlan is in a similar position. It is noted that also significant water level recoveries have been reported in recent years following high river flows and rainfall – at least in some areas.

While the NSW water resource plans have cut use in the Namoi to-in one case at least- 28% of the original licence, the Basin Plan is also now going to make some changes to use in critical areas.

To best handle reductions in groundwater availability and extraction, and to get accurate data on recharge, is going to take focussed research in collaboration with State and Basin agencies. The cotton industry is vitally involved, and whether there is a CRC or not, someone has to fund and promote the research.

The second point is that the ecological context of the cotton industry needs recognition and attention. The cooperation between CMA's and the industry is vital, and the ecological outcomes need to be set out clearly. Riparian zone and floodplain management are important, and much of the areas involved are on, or boundaries of, cotton farms. We saw at

Moolee Station that one landowner-the Norries- had fenced out the riparian zone and replanted on their side of the Namoi, while the landholder on the other had done nothing in fencing or weed control.

The actual rivers are important, as well as the wetlands, and to have healthy rivers riparian zone management is essential. Major, productive, and normally highly profitable industries need to recognise their responsibility for the environment, and the cotton industry can usefully have a significant program to this end.

The last point, which derives from the Strategic Plan which we were given, is that there are too many uncoordinated players in cotton research. It appears to me that the big player is Cotton Australia, but I did not hear that it is the driving force for industry research that one may expect. The CRC, CRDC,CSIRO,Cotton Australia and State Govt research arms can usefully be integrated in the manner set out in the Strategic Plan, but unless this has some strength it will be just a discussion forum.

An alternative and more powerful structure is to set up an industry research, development and extension body which is funded by the industry, CSIRO and Govts, which sets its own research goals and research management and funding structure. All parties can be Board members, but the organisation itself is responsible for research direction. Such an organisation is the Water Quality Research Association , which last year carried out \$60million of research with only \$6million of its own funding, the rest coming from interested parties. It has a benchmark multiplier of 5x, which it doubled.

5. Peter Gregg:

My thoughts from the summing up session on Thursday:

1. The panel recognized the high quality of the science in a broad range of water-related research, including on-farm water use efficiency, seepage mitigation and whole farm water balance studies, groundwater modeling and surface-groundwater connectivity, and ecological impacts of environmental water releases.
2. The panel recognized the complex and site-specific nature of some of these ecosystems, notably groundwater aquifers and wetlands. There is much work that remains to be done in areas other than those covered in this CRC: the Namoi (groundwater) and Gwydir (wetlands) The resources available to the CRC have not been sufficient to expand this work to new areas within the life of this CRC. Many techniques developed (eg 3D modeling of aquifers) are transferable to other catchments, but the biophysical details will differ, and this could be a priority for future work in an extended CRC or elsewhere.
3. While there has been good communication of on-farm WUE work to industry, and good linkages of some environmental work to CMAs and other regulatory authorities, much remains to be done in communicating the research findings to a wider audience, and ensuring that they inform government policy. This includes greater efforts to publish in peer-reviewed journals, outreach to the wider community including city audiences, and working with relevant government agencies (see Richard's comments below).

6. Richard Moxham:

Here are my thoughts for the afternoon session on Friday:

- Better understanding of the social and economic impacts of cotton production and access to irrigation water will support future decision making. This work should be independent and peer reviewed as well as long term in its nature to provide and insight into trends and impacts of climate.
- Tools like myBMP and water stewardship certification provide incentives for growers and confidence by regulatory authorities that processes are being adopted which address many of the concerns of community and society around private access to natural resources. These should form part of the mix in any future research plan.

And my comments at the panel summing up as you requested:

- Change is inevitable and these will come from external drivers such as CSG, Carbon tax, Basin Planning, Climate Change. The Cotton Industry will need to be prepared to work towards well researched solutions that are built around their future needs.
- Partnerships with govts, other industry and community can support the future action to resolve challenges. Previous broad based approaches by the CCC CRC have shown production based research can fit with social and economic impacts from the wider community
- Ecological outcomes for rivers, floodplains and wetlands should be part of the integrated mix of farm planning activities. CMA and appropriate State govt agencies need to provide strategic input and support the industry to work towards ecological goals. It is not enough for this work to occur without these industry and community linkages and participation.
- Systems thinking should be applied to future CRC investments in an attempt to bring a better understanding of the linkages and impacts of research to other parts of the industry.

Panel's summary of findings after the presentations on 11 August:

- Develop a transparent rationale for future sharing of water savings resulting from infrastructure improvements funded between irrigator(s) and Government
 - Promote the dam evaporation package to reduce the 20% water loss from on-farm storages
 - Develop a regulatory approval procedure for new dam selection to minimize seepage losses and downstream impacts
 - Cotton industry to use well-defined terminology for farm WUE efficiency, crop water use efficiency e.g. bales/MI or tonnes/ha/mm evapotranspiration
 - Groundwater management needs urgent attention:
 - requires a hydro-geological assessment and full stakeholder participation to achieve sustainable use;
 - interim adaptive management where aquifer is overdrawn to avoid irreversible damage
 - The disposal of large volumes of moderately saline water from coal seam gas mining is an issue for State Government agencies; perhaps opportunity to use desalinated water for cotton irrigation?
 - GM crops offer increased yields and less pesticide use, hence less risk of offsite impacts. GM cotton should perhaps a 1st step for community acceptance of GM crops
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- | • R D & E capability for cotton agronomy needs to be retained to achieve premium products by the Australian cotton industry.
 - Irrigation technology at USQ Toowoomba needs to be stronger synchronized with the crop agronomy research at Narrabri

- Ag chemical kits are very suitable for use by authorized officers of CMA and NRM Boards
- Wetland management planning needs to be inclusive of all stakeholders: National, State, CMA, landholders and wider community in the catchment:
 - What are the objectives and the community values for wetland management?
 - Management strategy to be underpinned by targeted science
- Socio-economic research needed to predict the impacts of reducing or transfer of irrigation water allocations to develop sound rural community policies

Jane Macfarlane:

Summary of Audience Feedback collated on 11 August

What's Next

- Coal seam gas
 - groundwater implications
 - potential uses of CSG water
- Commercially available effective, cost effective monolayer product
- Uptake of research by decision
 - to manage system losses
 - to manage groundwater (especially CSG)
- Sharing data and knowledge
 - community publications
- Increasing water management and data sets
- Government investment in groundwater resources including connectivity with surface water – to be incorporated into sustainable policy
- Groundwater – managed aquifer recharge
- Understand future science needs of NSW Office of Water
- Major NMD Basin research monitoring of rivers – is this beyond the scope of the CRC
 - Developing standards for desired environmental outcomes

- continue working on effects of water flows
- how do we engage cotton industry in long term environmental/water research
- conversation on what success looks like in relation to delivering environmental water
- optimisation of environmental water costs and benefits
- Grower forum – with growers talking on their topics
- Standards and capability of utilisation of CSG water
- Research in precision irrigation
 - eg automated furrow irrigation
- Strategies for more cotton with less water in various seasons

Breakthroughs

- Capacity to do whole farm water balances
- Quantification of system losses
- Improved understanding of groundwater systems
 - Understanding the connectivity of groundwater and surface water
 - 3D mapping of groundwater aquifers and lithology
 - Understanding complex hydro-geological situation
 - 3D aquifer mapping at catchment scale
- Measurement of deep drainage and irrigation efficiency
- Relationship between water flow and environmental response beginning to be observed
- Development of herbicide quick test for diuron
- Stronger links between industry, science and management stakeholder sectors
- Boosted research capacity
- Plant breeding developments in cotton
- Timing of environmental flows
 - Can increase weed problems
 - How to get the most out of them

Missing

- Considerable variation in WUE measurement
- Communication
 - Journal publication of science
 - eg system losses and seasonal and farm impacts on farm water balance
 - Industry publication
 - eg info on options and costs to address system losses
 - to water managers
 - eg MDBA, CMAs
 - CRC Canberra expose
- Growers placing financial value on water management and willingness to pay
- Where is the salt going and how to manage it
- An overall conceptual map of how research programs fit together
- Insufficient ecosystem research to understand the balance required between production and its environmental support system
- Big questions remain regarding environmental watering
 - What are the targets/goals
 - What is the best timing and quantity of flows
 - Efficiency
- The benefit that people with knowledge give to increase the resilience of an environment
- Uptake of WaterTrack Divider and collation of this information
- Benefit/Cost analysis of various irrigation systems
- In relation to alternative irrigation systems what is “front of mind” to growers

Terms of Reference for Science Panel:

1. Progress of cotton water research to desired economic, environmental and social outcomes since 2005
2. Assess strength of cotton water story
3. Identify opportunities for improvements
4. Publication avenues for scientific and other target groups
5. Assess quality of research
6. Consider extent for collaboration and value adding
7. Assess whether outputs meet end user needs
8. Identify priority R & D and adoption gaps

Output sought from Science Panel:

Prepare a recommendation to be delivered to Jane Macfarlane by 26 August 2011

