



Advancing Australian Cotton

31-3-2017

Mr Rick Wilson, MP,
Chair,
Inquiry into Water Use Efficiency in Australian Agriculture,
Parliament House
Canberra

agriculture.reps@aph.gov.au

Inquiry into water use efficiency in Australian agriculture

Dear Mr Wilson and committee members,

Introduction

Cotton Australia is the key representative body for Australia's cotton growing industry. We represent approximately 1000 growers stretching from Swan Hill in North-West Victoria, through to Emerald in the Central Highlands of Queensland.

Annual production varies significantly, dependent largely on seasonal conditions, but the 2017 harvest is expected to produce in excess of 4.2 million bales, worth over \$2 billion (farmgate).

Typically production is two-thirds in New South Wales and one third in Queensland.

Cotton Australia is an active member of the National Farmers' Federation (NFF), National Irrigators' Council (NIC), Queensland Farmers' Federation (QFF), and New South Wales Irrigators' Council (NSWIC), it also has a close working relationship with a large number of regional irrigator organisations across NSW and Queensland.

Cotton Australia endorses the submissions of these organisations, but should there be any inconsistencies in the views expressed, then for clarity the position of Cotton Australia is that which is expressed in this submission.

We welcome the opportunity to speak on behalf of cotton growers on this issue, and are willing to assist the Inquiry in anyway, including helping to organise site visits.

Executive Summary

The success of the Australian cotton industry to date, and its future, is to a large extent dependent on continual improvement of water use efficiency (WUE).

As an industry we are focused on "More Crop Per Drop", and this is achieved through improved varieties, improved management and the adoption of cutting edge WUE techniques and technology

Cotton Australia is not critical of the current Federal Government WUE programs with the exception of the Commonwealth On-Farm Further Irrigation Efficiency Program (COFIE).



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However, Cotton Australia calls on the Federal Government to recognise that these programs are primarily about environmental water recovery, and not WUE aimed at boosting the overall productive performance of Australian agriculture.

COFIE should be seen to be unnecessary, and the focus on the Murray-Darling Basin Plan should move from environmental water recovery to the implementation of complementary measures which will deliver real and measurable environmental outcomes.

Cotton Australia calls on the Federal Government to support and fund WUE programmes that are driven by achieving efficiency that can be retained by the irrigator, with the resulting economic activity being shared by rural and regional Australia.

Finally, Cotton Australia calls on the government to recognise that there are no “Silver Bullet” WUE options, and it is very much ‘horses for courses’. However, it must also resolve the WUE/Energy nexus as it is a significant inhibitor to WUE adoption.

Cotton Australia recommends:

- **Recommendation 1:** That the Federal Government commits to the long-term maintenance of the RDC funding model, and extends and expands the Rural R&D for Profit program.
- **Recommendation 2:** That the Federal Government recognises that when environmental water recovery is deemed absolutely necessary, then the preferred way is through well-designed and well-funded on- and off-farm irrigation efficiency programs. However, it must also be recognised that many environmental outcomes can be best achieved through actions other than water acquisition, such as the implementation of complementary measures.
- **Recommendation 3:** That the Federal Government recognises the need for well-funded and designed WUE programs whose primary aim is improvement in WUE, where the gains are fully retained by productive agriculture, and the benefits flow through rural and regional communities. These schemes should be made available throughout Australia and not restricted to the Murray-Darling Basin.
- **Recommendation 4:** That the Federal Government immediately suspends the implementation of the Commonwealth On-Farm Further Irrigation Efficiency Program (COFIE), and all the focus shift from water entitlement acquisition to environmental gains achieved through the adoption of complementary measures.
- **Recommendation 5:** That the Federal Government establish new projects in line with Recommendation 3, with a base level of subsidisation of 25% of total costs.
- **Recommendation 6:** That Commonwealth-funded WUE programs allow the inclusion of energy efficiency or generation components as eligible components.



General Comments

On-going improvement in Water Use Efficiency (WUE) is one of the most important drivers for the Australian cotton industry.

Water is a scarce resource, and for the vast majority of cotton producers it is the single most important limiting factor. As a general rule, most growers have access to more land than they have water to service it. Further, water is often the single most valuable physical asset a cotton producer has. It is not unusual for the water to account for 60% to 80% of a cotton producer's combined land/water assets.

Given these facts, WUE efficiency is a "front and centre" issue for the Australian cotton industry, which has a proud history of seeking "More Crop per Drop".

For over 50 years, the cotton industry has been at the forefront of irrigated agriculture, utilising research and technology to drive WUE improvements.

During the 1980's and 90's cotton producers led the adoption of laser-controlled land levelling, neutron probe moisture metering and similar technology. In the 2000s this moved to Capacitance Probe soil moisture monitoring, and the appropriate adoption of pressurised irrigation systems such as drip, lateral movers and centre pivots. Today, cutting edge technology includes automated furrow irrigation systems, in-crop canopy moisture sensors, variable rate water applicators, and the use of drones and satellites to gather data, and sophisticated programs and apps to deliver critical information to the irrigation manager.

Measuring Water Use Efficiency

Technology, management expertise and improved varieties offering higher yields have all combined to allow the Australian cotton industry to increase its water use efficiency by 40% in the decade leading up to 2012¹.

There are numerous indices for measuring Water Use Efficiency (WUE), and at the end of this submission is a link to a fact sheet that explains a number of them.

The cotton industry's preferred index is Gross Production Water Use Index (GPWUI).

This index calculates how many bales of cotton (227kg) are produced from each megalitre of water available to the crop.

It is preferred as it takes in to account all sources of water including rainfall, and therefore it is directly comparable across seasons and regions.

Farm scale GPWUI is calculated as follows:

Farm scale:

$$GPWUI_{farm} = \frac{\text{Total production for farm (bales)}}{\text{Total water used on farm (ML)}}$$

¹ Australian Cotton Water Story



According to the Australian Cotton Water Story the average GPWUI for the period from 2006 to 2011 was 1.1 bales/ML, up from .79 bales/ML which had been calculated by a study conducted by Tennakoon and Milroy, approximately a decade earlier.

It should be noted that accurately measuring Water Use Efficiency is a complex task, and the Australian cotton industry has over the years developed and employed sophisticated technology to carry-out this task.

One example is the suite of Watertrack tools and services - <http://www.watertrack.com.au/?menu=home> .

The key is to be able to accurately measure and record the movement of water around the farm, on and off fields, in and out of storages, taking into account such factors as evaporation losses, seepage losses, irrigation run-off and plant water use.

Water Investment is a Key Driver for WUE

As mentioned earlier, water is in almost all cases the limiting factor for production, and water entitlements represent a very significant investment by cotton growers.

The actual cost per megalitre of water entitlement varies from valley to valley, and is influenced by many factors including relative scarcity, reliability and yield, and production opportunities.

For example in the Gwydir Valley of NSW, a General Security entitlement (one that is serviced by water captured and stored in a head water storage), will cost approximately \$2,200 per megalitre.

This entitlement on average only yields .36 megalitres per year of actual water, and in the case of the Gwydir this yield is extremely variable. It is not uncommon to have successive years when yield is 0% or extremely low, and likewise there are times when yield exceeds 100%.

If you assume that an average cotton crop in the Gwydir requires six megalitres of applied irrigation water per hectare, and the farmer only had access to general security water, then to have an average yield of six megalitres per hectare, he or she would have to hold 16 megalitres of general security entitlement to on average have enough water for one hectare of cotton.

16 megalitres at an investment of \$2,200/megalitre would see a total investment in water entitlement per hectare in excess of \$35,000.

The reality is more complex, and irrigators normally have multiple sources of water which have different values and reliabilities, and their farming systems have been developed to manage highly variable annual water availabilities.

However, the point is that water entitlement represents a huge investment, and therefore cotton producers are highly incentivised to maximise their WUE.



Silver Bullets for WUE

It is essential that it is understood that there are no “Silver Bullets” for WUE. There is no “One Size Fits All Solutions”.

Irrigators utilise a whole suite of technologies and services to maximise their water use efficiency. These can range from simply estimating crop water requirements by digging a hole in a field with a shovel, and assessing the water capacity of the soil by look and feel, to employing highly sophisticated soil moisture readers, linked to satellite derived weather and plant water use data.

It can be an optimised furrow, gravity irrigation system, or pressurised drip or lateral move type systems.

It is improvement in yield from new varieties and better management techniques deriving from world class research.

It is minimising evaporation by maximising storage depth and minimising surface area.

It is the upskilling of labour from the most humble irrigators tasked with manually starting, managing and stopping thousands of syphons, to university trained irrigation managers analysing data from a whole range of sources, and making timely decisions that optimise plant growth.

It is most likely to be a combination of all of the above.

In 2008, with funding from the then National Water Commission (NWC), the Gwydir Valley Irrigators Association (GVIA) developed a side-by-side irrigation system comparison.

The trial has compared the performance of an optimised gravity furrow irrigation system, with a drip system, a lateral mover and a bankless channel gravity system.

The trial, which now has four seasons of data (cotton is only grown every second year in the trial), is now supported with funding from the Cotton Research and Development Corporation and the Federal Government's Smarter Irrigation program.

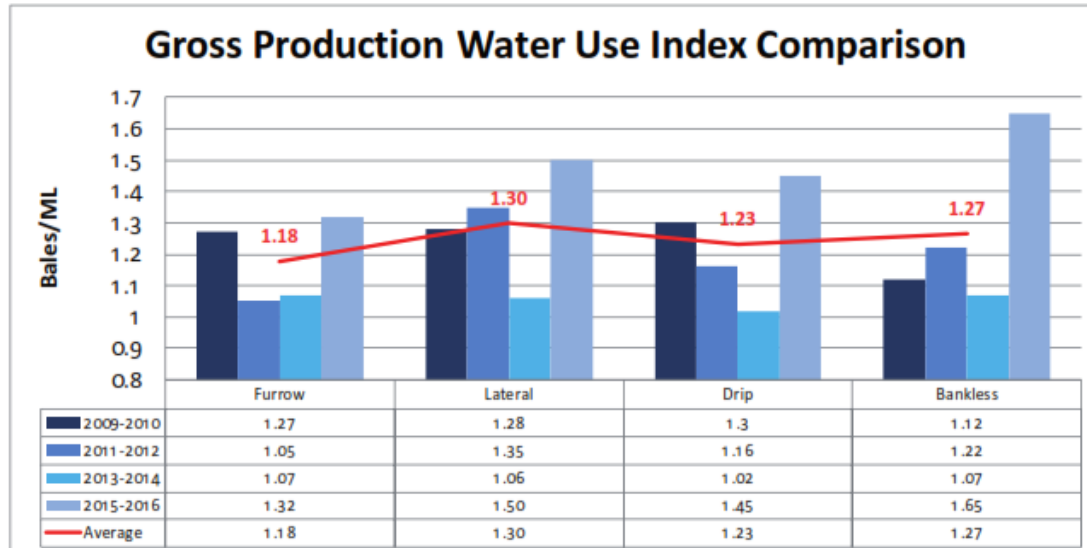
Fuel details of the results can be found here -

<http://www.gvia.org.au/documents/GVIAComparisonBrochureJULY2016.pdf>

However, there are some key takeaways from the story told by the GPWUI measurements.



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The key messages from this trial at this location are:

1. WUE varied significantly from system to system, year to year.
2. While the lateral mover on average had a slightly better GPWUI than the other systems, it would be extremely difficult to justify the capital investment in the system, and the additional energy costs to pressurise the system, on the basis of the higher GPWUI.

However, while in the GVIA trial results there appears to be little evidence that would support investment in pressurised systems, Cotton Australia readily acknowledges that in different climate, soil and crop production systems, these technologies can offer significant benefits.

Benefits include, but are not limited to, being able to apply precise amounts of water to establish and finish crops, and allow the better management of soil moisture content so as to optimise the capture and use of rainfall.

There is a very instructive video that discusses the many factors that go into WUE here -

<https://vimeo.com/174306570>

In particular it discusses such issues as the energy/water efficiency nexus, labour issues, capital costs, depreciating assets, maintenance and the like. All key factors for irrigators to consider when investing in WUE infrastructure.



Examples of WUE Practices undertaken by the Australian Cotton Industry

The Australian Grown Cotton Sustainability Report 2014 showed that cotton growers are using a range of techniques to constantly improve water use efficiency:

- 70 percent of farmers use soil moisture probes, up from 40 percent in 2006 (highest of all agriculture industries in Australia)
- 96 percent of irrigators have improved their furrow irrigation system or changed to an alternate irrigation system
- 49 percent of irrigators had made changes to the flow or size of their siphons
- 35 percent have redesigned fields. For example, growers use laser-levelling to ensure uniform, well drained fields using GPS guidance equipment and position storage dams closer to cotton fields to reduce evaporation losses
- Other practices include irrigating to deficits, using drip and overhead sprinkler systems, better accounting of soil variations, changed bed shapes, using irrigation scheduling probes, furrow irrigation system optimisation evaluations, pump optimisation and reducing distribution losses²

Additional water use efficiency driving practices include:

- Before planting their crop, cotton growers use sophisticated weather forecasting software to predict how much crop can be sustained before planting. Zero and minimum till farming is also used to help retain soil moisture
- Growers use information and technology (including soil moisture probes, satellites and drones) so they water only when and how much is needed
- Irrigation channels that pump water to the fields are lined to reduce loss through seepage
- Adhering to the Australian cotton industry's environmental management program – myBMP. myBMP includes a water management module covering water quality, efficiency of storage and distribution for both dryland and irrigated farming practices to improve farming practices and carefully manage our natural resources
- Farmers are changing to alternative irrigation systems such as centre pivots and lateral move systems and it is expected there will be an increasing number of these machines in the future. These systems can achieve labour savings and with some soil types, water savings (about 30 percent), but have significantly higher energy costs associated with water pumping and machine operation
- Mobile electromagnetic meters are used for easy and rapid assessment of soils for their suitability for irrigation
- Tail water recycling systems are implemented so that water is reused
- Covering storages to minimise evaporation
- Reducing evaporation by shortening row lengths
- Avoiding unnecessary water storage on farm by only purchasing water as it is needed and not putting water directly into dry storages which soak up water
- Growers are lining storages and channels with clay or non-porous materials to avoid seepage. Thermal imaging and electromagnetic surveys can be used to identify "leaky" dams, pipes and channels so they can be repaired
- Mulching and stubble retention helps to retain soil moisture, reducing the need for irrigations
- Permanent wheel beds to reduce soil compaction and increase water infiltration
- Implementing software packages such as Water Track (<http://www.watertrack.com.au>)

² The Australia Grown Cotton Sustainability Report 2014



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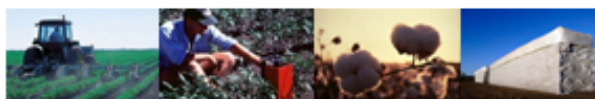
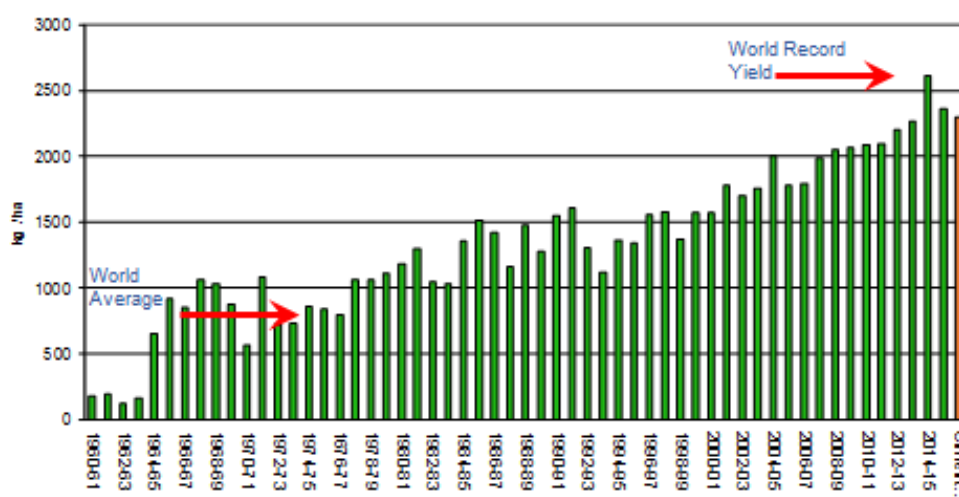
Research and Yield Improvement

As mentioned above, one of the key drivers for improved water use efficiency (especially when looked from the maxim of “More Crop Per Drop”), is yield improvement either through varietal advancements or better management through the adoption of research learnings.

The Australian cotton industry has been able to drive average yield improvement by approximately three percent per annum, with about half of this improvement assigned to improved varieties and half to improved management.

Australia’s cotton yields are world leading, some three to four times the world average.³

Yield Record in Australia (over 3 times the global average)



Cotton Australia wishes to draw to the attention of the Inquiry the absolute importance of ongoing agricultural research to improving WUE, and commends both the long-running compulsory research levy matched by Federal funding managed by the Rural Research and Development Corporations (RDCs) such as the Cotton Research and Development Corporation and the more recent Rural R&D for Profit program.

These programs have delivered an enviable return on investment, greatly assisting all facets of our industry, and undoubtedly playing an extremely part in our WUE story.

³ Cotton Australia



Recommendation 1: That the Federal Government commits to the long-term maintenance of the RDC funding model, and extends and expands the Rural R&D for Profit programme.

Response to the Specific Questions Raised in the Terms of Reference

- Adequacy and efficacy of current programs in achieving irrigation water use efficiencies***

Cotton Australia is most familiar with two of the on-farm irrigation efficiency programs offered as part of the Murray-Darling Basin Plan Water Recovery effort, and aware of some of the other on-farm and off-farm programs that form part of this effort.

The two that Cotton Australia has been most involved with are the Qld Healthy Headwater Water Use Efficiency (HHWUE) project and the NSW Governments Irrigated Farm Modernisation (STBIFM) Programme.

Cotton Australia is also reasonably familiar with the New South Wales Private Irrigation Infrastructure Operators Program (PIIOP).

What needs to be understood is that these programmes are first and foremost about recovering water for the environment. The efficiency angle is secondary.

In all these cases the irrigation entitlement holders have had to return significant quantities of water entitlement as part of the program.

Cotton Australia believes that if actual water entitlement must be recovered to meet environment objectives, then a voluntary participation model such as these is probably the least worst option.

Individual irrigators hold a range of opinions regarding the adequacy of the funding under these programmes, and their terms and conditions. This is evidenced by a lack of universal take-up of these programs.

However, Cotton Australia readily acknowledges that many participants have been very pleased with the scheme and there has been significant investment in storage reconfiguration and irrigation infrastructure.

There is no doubt that by “sharing” in the savings the social and economic impacts of the water recovery are minimised, but not eliminated.

While Murray-Darling Basin Authority social and economic research may show an improvement in employment levels in communities that have embraced these water recovery models, Cotton Australia is gravely concerned that this might be a “sugar fix” effect, and once the initial follow-through positive effect of the investment spending dissipates, the loss of the original entitlement levels will lead to a drop in employment levels.

Cotton Australia, along with many groups closely associated with irrigation communities, strongly argue that much more can be done for the river environment by adopting other measures than simply water acquisition.

For example, in the recent submissions to the Murray Darling Basin Plan Northern Review, these groups comprehensively argued the case for complementary measures – actions and infrastructure upgrades that would leverage significant environmental outcomes without the need for further water acquisitions.



These include mitigating the effect of cold water pollution from headwater storages, improving fish passage, controlling feral animals in riparian and wetland areas, removing carp from our waterways, and properly managing significant wetlands.

As an initial step the Commonwealth should immediately suspend the Commonwealth On-Farm Further Irrigation Efficiency COFIE (Program), and focus the remaining MDB Plan efforts on the implementation of complementary measures rather than further water recovery.

So in considering the adequacy of these programs Cotton Australia submits that the Inquiry should formally recognise that the key driver of current Commonwealth programs is water recovery for the environment, with WUE being a welcome but secondary outcome. Further, Cotton Australia calls on the Inquiry to recognise the legitimate need for Commonwealth programs to champion and encourage WUE adoption for the sake of that efficiency and the flow on effects to the community.

For example during a recent visit to Tasmania, which has been the recipient of significant Federal funding for irrigation scheme development, the National Irrigators Council was told that for every dollar of Government funding, irrigators spent a further \$2-\$5 on developing their properties for irrigation. On top of this the additional revenue from irrigation production has flowed through the communities and generated significant direct and indirect taxation revenues for Government.

Recommendation 2: That the Federal Government recognises that when environmental water recovery is deemed absolutely necessary, then the preferred way is through well-designed and well-funded on- and off-farm irrigation efficiency programs. However, it must also be recognised that many environmental outcomes can be best achieved through actions other than water acquisition, such as the implementation of complementary measures.

Recommendation 3: That the Federal Government recognises the need for well-funded and designed WUE programs whose primary aim is improvement in WUE, where the gains are fully retained by productive agriculture, and the benefits flow through rural and regional communities. These schemes should be made available throughout Australia and not restricted to the Murray-Darling Basin.

Recommendation 4: That the Australian government immediately suspends the implementation of the Commonwealth On-Farm Further Irrigation Efficiency Program (COFIE), and all the focus shift from water entitlement acquisition to environmental gains achieved through the adoption of complementary measures.

- ***How existing expenditure provides value for money for the Commonwealth***

Cotton Australia was greatly disturbed by a recent article in the Journal of Water Economics and Policy where Australian National University Professor Quentin Grafton claimed that there was little evidence to show that Australia's expenditure on WUE Programs to recover water for the Murray-Darling Basin Plan represented value for money.

In the article he based this claim on the "fact" that the numbers did not indicate either a reduction in total water use, or a reduction in water applied per hectare.

These are two very flawed metrics.

As explained earlier in this submission the amount of water applied per hectare is irrelevant. The measure must be: what production is being achieved per megalitre of water? As also demonstrated above, the Australian cotton industry can show a 40% improvement in WUE over the past decade.



Secondly, the amount of total water applied in any one year is largely driven by climatic conditions. When water is plentiful, normally more will be used, either in that year or in the years following, similarly a dry sequence will reduce total water use. The Professor's short-term snapshot was insufficient to overcome these variations.

What is completely and undeniably true is that the Commonwealth purchased and WUE programs have as of now collectively reduced the amount of water available to agriculture on average by 2000GL.

That represents an annual on-farm loss of approximately \$1 billion to local communities (this is based on one megalitre of water generating approximately \$500 of farm-gate value).

Further, the MDBA's own social and economic assessment has shown that the negative impacts of water recovery are less in communities where significant water recovery is achieved through WUE programs rather than straight buy-back.

There is no doubt that WUE programs as tools for water recovery have a significantly higher upfront cost than direct buyback, but their value to the ongoing social and economic health of impacted communities should not be underestimated.

However, as Cotton Australia has submitted earlier, the focus on Commonwealth WUE programmes should turn away from water recovery, and focus on WUE for its own sake. Given that a program along these lines would not require the return of entitlement to the Commonwealth, there would be no expectation that they would require the same degree of financial input from the Commonwealth.

Cotton Australia submits that it would be reasonable for the Commonwealth to provide a direct subsidy in the order of 25% on WUE expenditure.

- **possible improvements to programs, their administration and delivery**

Cotton Australia believes that the current versions of WUE programs associated with the Murray-Darling Basin Plan (with the expectation of COFIE) are reasonable programmes, but again stresses that they are primarily designed for water recovery, and therefore their adoption while significant has been limited.

Cotton Australia would welcome the introduction of funded WUE programmes that are designed solely to enhance and accelerate the adoption of WUE.

The scope should include funding of energy efficiency or generation capacity as a way of helping irrigators manage the WUE/Energy nexus.

In some case WUE achievement comes at the cost of needing to pressurise water. Increasing energy costs have in some cases completely negated the WUE gains. This is a matter that needs to be addressed urgently.

Recommendation 5: That the Commonwealth Government establish new projects in line with Recommendation 3, with a base level of subsidisation of 25% of total costs.

Recommendation 6: That Commonwealth funded WUE programmes allow the inclusion of energy efficiency or generation components as eligible components.



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- ***Other matters, including, but not limited to, maintaining or increasing agriculture production, consideration of environmental flows, and adoption of world's best practice.***

The Australian Cotton Industry has an enviable reputation as a leader in both yield and WUE. However, its continued existence will rely on sustaining this position and continual improvement. Trading off WUE gains for environmental water is a short term gain. Businesses that are basically producers of commodities that are subject to world pricing rely on efficiencies in all aspects of their businesses to remain competitive.

They cannot afford to trade those efficiencies away, they must be retained and used by their business.

A modest investment in WUE by the Federal Government will help to underpin the long-term competitiveness of irrigated agriculture inside and outside of the Murray-Darling Basin.

Cotton Australia looks forward to working with your committee and in particular this Inquiry to improve on our industry's record in WUE.

Cotton Australia would welcome an opportunity to provide further information on its position. For more information contact Michael Murray, General Manager, on

Yours sincerely,

Michael Murray,
General Manager,
Cotton Australia

Useful Links

Calculating Water Use Indices to benchmark Water Use Efficiency -

<http://www.cottoninfo.com.au/sites/default/files/documents/Calculating%20water%20use%20fact%20sheet%20-%20May%202016.pdf>

Irrigation Benchmarking -

<http://www.cottoninfo.com.au/sites/default/files/documents/Irrigation%20benchmarking%20fact%20sheet%20-%20May%202016.pdf>

Cotton industry YouTube Irrigation videos - <https://www.youtube.com/playlist?list=PLQy8KAPn-DyrDdVd-pzHPRBqMFa8Qnrv>

Rural R&D for Profit project - Smarter Irrigation - <http://www.cottoninfo.com.au/publications/water-smarter-irrigation-profit-projects>

Australia Cotton Water Story - <http://www.crdc.com.au/publications/australian-cotton-water-story>

The Australian Grown Cotton Sustainability Report 2014 - <http://www.crdc.com.au/publications/australian-grown-cotton-sustainability-report>