

FACT SHEET

AUSTRALIAN COTTON - OUR WATER STORY



Cotton is a natural fibre grown within a number of water catchments in mainly NSW and Queensland. There are also very small areas of cotton in Victoria, the Northern Territory and Western Australia (under trial). Over 90% are owned by Australian families.

Water is a cotton farmer's most precious natural resource and the industry's greatest limiting factor. Good water stewardship and growing 'more crop per drop' has therefore been a focus of the Australian cotton industry for decades.

Without water crops will not grow, food and natural fibres would not be produced and regional communities could not thrive. Due to the unpredictable and complex workings of natural ecological systems and a variety of demands placed upon them by the community, governments and irrigators, the management of water can be complex and challenging.

This fact sheet aims to provide science-based information on the use and stewardship of water in the Australian cotton industry.



Over 90% of Australia's cotton farms are owned by Australian families.

10 KEY POINTS

1. Cotton is an ideal crop to grow in Australia because it's planted once a year, and is only planted when there's water available.
2. Cotton growers cannot take water whenever they need or want it. Water is allocated by State Governments to the environment first, then critical human needs are met, and lastly irrigation.
3. A water licence does not guarantee a specific volume of water, but a share of the water that's available that year.
4. When there's limited water, there's limited cotton. In the 2018-19 season, cotton farmers in northern NSW cotton valleys received 0% of their water allocation due to drought.
5. Farmers with a water licence can use their water to grow whatever they choose - many pick cotton because it gives them the best financial return per unit of water.
6. If we weren't to grow cotton in Australia there would be no more water in the system - farmers would use their water to grow the next most profitable crop.
7. Cotton uses about the same amount of water per hectare as fruit trees and other summer crops including soybeans and maize.
8. Prior to the Murray-Darling Basin Plan 58% of water was preserved for the environment. That number will increase to 66% when the plan is fully implemented.
9. Australian cotton growers produce yields three times the world average, making them the most water efficient producers of cotton globally.
10. The Australian cotton industry achieved a 40% water efficiency gain in the decade to 2012, with current data showing year on year improvement.



WHAT IS IRRIGATION?

Irrigation is the application of controlled amounts of water to plants like backyard lawns, cotton and many other crops. This is different to 'dryland' or 'rainfed' crops that rely entirely on natural rainfall. Irrigation enables a farmer to apply water to the crop when it needs it. When water storages have water available, this also allows farmers to plan ahead.

In the 2017-18 season, 82% of the Australian cotton crop was irrigated. This changes each year depending on how much natural rainfall is received across the cotton growing catchments. Cotton is a drought and heat tolerant crop, well suited to climates with low rainfall where it is grown successfully as a rain-fed crop. Irrigation is also used to optimise yield and quality and to provide greater production stability and income security for farmers.

In the case of cotton, irrigation water is usually drawn from rivers (either directly or from a public dam or weir), floodwaters or underground sources (bores). This water is often stored on the farm in dams until needed and water can be 'carried over' from year to year to reduce the impact of dry years.

WATER IN AUSTRALIA – A HIGHLY REGULATED RESOURCE

Water in Australia is a highly regulated natural resource managed primarily by State Governments. Since the Murray-Darling Basin Plan was launched in 2007, the Commonwealth's role has increased. As such no irrigator can take water whenever they need or want it.

All Australian water is technically owned by the Crown, with the vast majority governed by water licences issued by State Governments. The rules and terminology vary from State to State and between water catchments, however basic universal principles apply.

The most important is that the **basic needs of the environment and critical human requirements must be met before ANY water can be allocated to irrigators.**

Each water catchment has a localised plan that:

- > sets out how water will be shared in the catchment
- > determines priorities (ie who gets what)
- > provides rules for ensuring the environment gets its basic requirements first. ("Planned Environmental Water")



Irrigation is used to optimise yield and quality and provide stability for farmers.

Approximately 66% of all surface water inflows across the Murray-Darling Basin will be preserved for the environment once the plan is fully implemented. Prior to the Basin Plan approximately 58% was preserved for the environment.

HOW WATER IS PRIORITISED

- 1 | The environment/ environmental flows
- 2 | Town water and stock and domestic supplies
- 3 | Farmers holding irrigation licences



HOW DO GOVERNMENTS DECIDE HOW MUCH WATER TO ALLOCATE?

Every year State Government regulators assess how much water is available in the system. Rainfall, dam levels and inflows, evaporation rates and 'Planned Environmental Water' is all taken into account and used to determine how much water is available to be allocated to individual water licences.

A water allocation licence (there are many different types) does not guarantee a specific volume of water, but a share of what is available in any one year. The share is normally expressed on the licence in megalitres. All irrigators pay for water.






- > One megalitre (ML) = one million litres
- > One gigalitre (GL) = one thousand ML = one billion litres
- > It is generally estimated that Sydney Harbour holds about 500GL
- > An Olympic size swimming pool holds about 2.5ML
- > A hectare is about the size of a football field

METERING AND MEASURING

All irrigation water use within the Murray-Darling Basin must be metered or measured and this has long been a requirement within the Murray-Darling Basin.

Both NSW and Queensland are currently reforming and improving metering standards. While many cotton growers are already using this technology the new rules will mean the vast majority of water will have to be metered with meters that are:

-  > accurate to + or - 5%
-  > tamper proof
-  > capable of transmitting metering data by telemetry

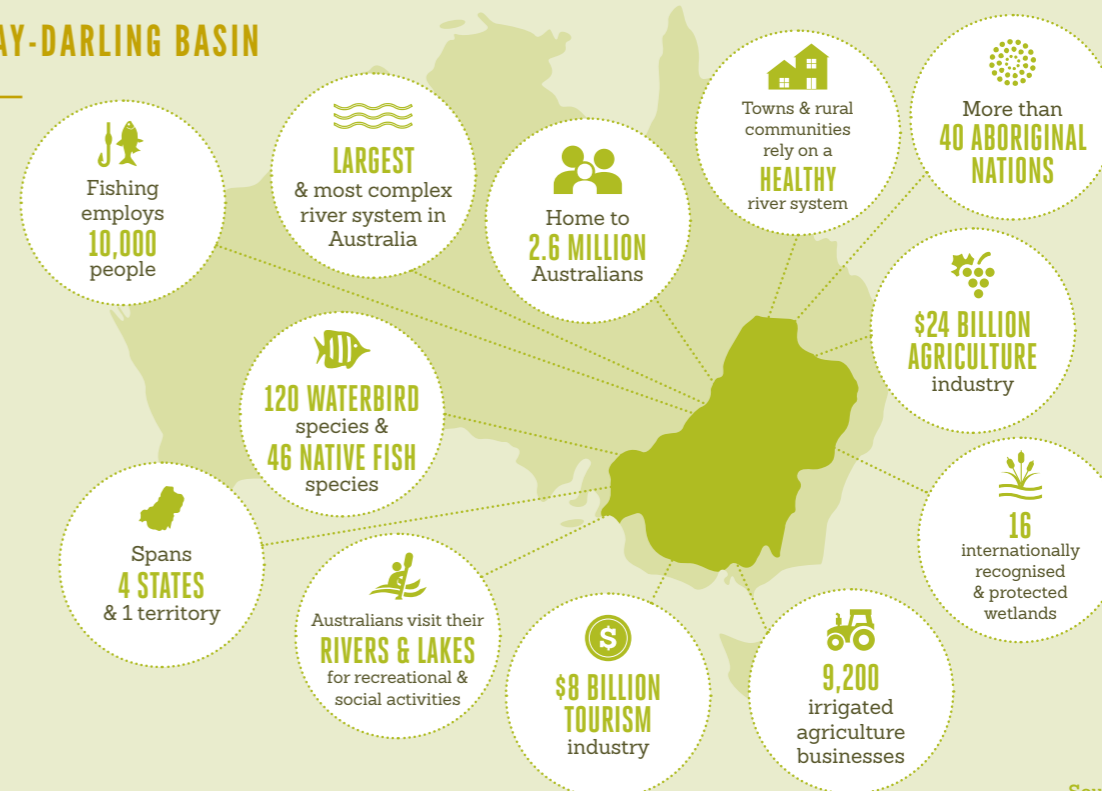
Where precise metering is not possible, alternative, approved forms of measurement must be used and recorded.

IMPACT OF THE CURRENT NSW DROUGHT

Record low inflows into northern NSW rivers resulted in many waterways ceasing to flow, and dams reduced to very low levels. This simply meant very little water to share, impacting all those reliant on the river: the environment, communities and agricultural industries like cotton.

- > In 2016-17 inflows into the state's northern river systems was 7800GL
- > In 2017-18 those northern rivers received just 542GL, just 7 % of the previous year's total
- > In the first six months of 2018-19 these rivers received 30GL (NSW Water Jan 2019)
- > In the 2018-19 season, cotton farmers in northern NSW cotton valleys received 0% of their general security water allocation due to drought.
- > The 2018-19 cotton crop was less than half that of the previous year due to drought.

THE MURRAY-DARLING BASIN



Source: MDBA



Water is stored in dams on the farm until needed.

MURRAY-DARLING BASIN PLAN EXPLAINED

On the eve of Australia Day 2007, then Prime Minister John Howard announced a "National Plan for Water Security" which led to the development of the Murray-Darling Basin Plan under Labor in late 2012.

In summary, the Plan further decreases the amount of water available for irrigation, primarily by transferring water entitlements from irrigators to the Commonwealth.

The Plan was designed to provide on average an additional 3,200GL of water each year for the environment making it more resilient when faced with inevitable droughts. Following some amendments that took into account new knowledge and some innovative solutions, the required recovery amount was reduced to 2,525GL of actual water, and a requirement to carry-out infrastructure works and rule changes, which will deliver environmental benefits equal to or greater than what could have been achieved through the acquisition of 605GL.

The water recovery is being achieved in two main ways:

- > Purchasing water licences at market price from irrigators that volunteer to sell
- > Funding more efficient irrigation infrastructure and water use efficiency projects

As of 30 September 2018 the Commonwealth had acquired or had contracted to acquire 2,118.4GL of water.

The Commonwealth Environmental Water Holder is now the biggest holder of water licences in Australia. These licence entitlements allow this body to release water from dams to achieve specific and optimal environmental outcomes.

Prior to the Murray-Darling Basin Plan 58% of water was preserved for the environment. That number will increase to 66% when the plan is fully implemented in 2024. As of January 2019, implementation had exceed two-thirds.

THE COTTON PLANT

Cotton is sometimes referred to as "thirsty", which is simply not the case. Cotton is a desert plant that requires similar amounts of water per hectare to other summer crops planted in the same regions. As a desert plant it is well-adapted to surviving and producing a crop in hot conditions.

Cotton is an ideal crop to grow in the boom and bust river systems found in Australia. That's because it's planted once a year, and is only planted when there's enough water available. Put simply, when there's limited water there's limited cotton. This is different to 'permanent' plantings such as grapes and fruit trees that need water to survive every year, whether it's available or not.

In years of drought like 2018-19 when there are no new water allocations, producers in some cases can still manage greatly reduced crops by utilising water that was allocated to them in previous years. This allows them to sustain their businesses, employees and communities longer during droughts.

Plants lose water through their leaves to keep cool (like perspiration in humans) and to move nutrients around. They need to absorb water from the soil to replace what they've lost. The requirement is greater over the hot summer months, as more than 95% of water used by the crop is for cooling itself. (WATERpak, CRDC 2012)

“ Cotton and rice are annual crops.

They lend themselves, given that nature, to much more frequent and flexible choices by the farmers as to whether to plant, how much to plant and when to plant. Adaptation to drought is achieved by such choices. Permanent plantings — vines, other tree fruits, nuts — are in a very much more vulnerable position, because their normal life-cycles are measured in years, sometimes decades. ”

- MURRAY-DARLING BASIN SA ROYAL COMMISSION REPORT 2019, PG 31

COTTON'S IRRIGATION REQUIREMENTS

Like all crops, the irrigation requirements of cotton in Australia vary depending on the region and the season. Temperature, relative humidity, wind and soil moisture all affect the plant's water needs at different times.

The adjacent table shows average volumes of water required by various crops commonly irrigated in the Murray-Darling Basin. As you can see cotton's water requirement is neither the highest or the lowest, and is not that different to many other crops.

Cotton Australia supports all farmer's right to choose the most appropriate crops to grow.

WATER REQUIREMENTS FOR VARIOUS IRRIGATED CROPS GROWN IN THE MURRAY-DARLING BASIN (MEGALITRES PER HECTARE)

Almonds *	14
Rice **	11.5
Mature citrus ***	10-12
Maize ****	8-9
Lucerne for Hay *****	8.8
Wine grapes *****	8.2
Cotton *****	6-7
Soybeans *****	6
Sorghum *****	5.2
Fruit trees, nut trees, plantation or berry fruits **	5.1
Grapevines **	4.3
Vegetables for human consumption **	4
Sunflowers *****	3.9
Summer Mungbeans *****	3.4

* Australian Almond Board, 2016
 ** Source: Water Use on Australian Farms, 2016-17 (NSW data)
 *** NSW Dept of Primary Industries 2018 (for Sunrasia and Riverland areas)
 **** GRDC Maize Grow Notes 2014
 ***** NSW DPI Farm Enterprise Budget Series, Central and Southern Zone 2012
 ***** Crop and Pasture Science 2013 (a peer-reviewed, 23 year review of cotton's seasonal water use)
 ***** Source: WATERpak — CRDC 2012
 ***** Assessing Yield Water Use Efficiency in the Murray Valley and Riverina Wine Regions 2012/13

“ The plan has had at least 35 reviews, 14 of which were independent, since its inception in 2012.

The plan has always been a compromise, despite this it should be implemented. This is a once in a generation reform that corrects 100 years of overuse, and will take a generation to achieve. ”

- NATIONAL FARMERS FEDERATION, 1 FEB 2019



Cotton is a desert plant that's planted once a year, and only when there's enough water available.

AGRICULTURAL WATER USE – WHY DOES IT APPEAR COTTON USES MORE?

The most recent data from the Australian Bureau of Statistics (Water Use on Australian Farms 2016-17) showed that all Australian agriculture increased its water use in 2016-17 due to higher rainfall across most of Australia. Conditions have critically worsened since the last report with severe drought gripping many rural areas, including most cotton production areas.

According to the ABS in 2016/17:

- > Of Australian agriculture's total water use, 91% was used for irrigation
- > Pasture, cereal and other crops for grazing accounted for the largest area of crops irrigated with 598,000 hectares
- > The total volume of area watered increased 4% to 2.2 million hectares. Increases to area watered for rice, cotton and pasture drove this national increase

The pie chart below shows water use by crop type for all of Australia in 2016/17. While this can change year to year, the latest data indicates that cotton used the biggest share of the water at around 28%, closely followed by grazing. But what it really shows is that lots of farmers with irrigation water licences chose to plant cotton in 2016/17 because it offered them the best financial return per unit of water.

This is the data often used to prove “cotton uses all the water” insinuating that without cotton there'd be more water available. In fact the data is actually showing that cotton is the most popular crop to grow. If cotton wasn't grown there would be no more water in the system – the farmer would simply use it to grow the next most profitable crop.

FARMERS CHOOSE COTTON BECAUSE IT DELIVERS THE BEST RETURN ON THEIR WATER

Boyce Chartered Accountants produce an Australian cotton crop analysis to track the economic performance of cotton farmers. For a 10 bale/ha crop at \$450/bale, the return is \$692/ML. This is considerably higher than returns for other broadacre irrigated crops.

MORE CROP PER DROP: WATER USE EFFICIENCY IN AUSTRALIAN COTTON

Water use efficiency (WUE) is defined as the cotton crop's capacity to convert water into yield. Australian cotton growers produce yields three times the world average, making them the most water efficient producers of cotton globally.

Cotton growers are highly motivated to conserve water wherever possible due to:

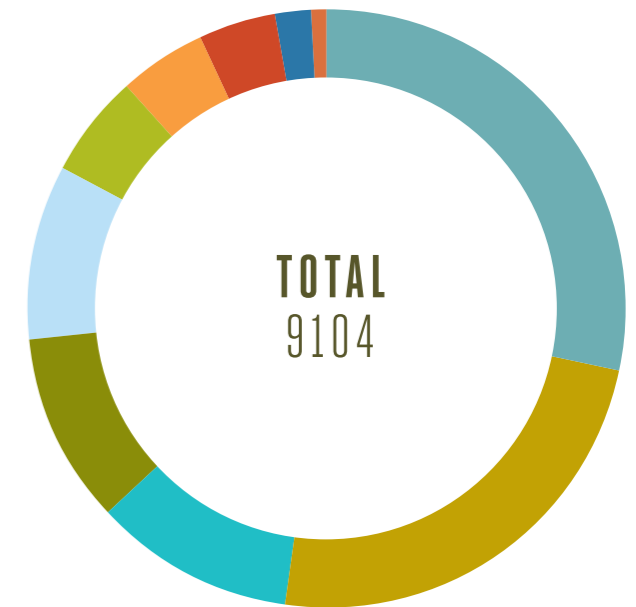
- > Water being the farmer's most precious natural resource
- > Its unreliability from year to year
- > The high cost of water

The Australian cotton industry achieved a 40% increase in water efficiencies in the decade to 2013. In other words, 40% less water was needed in 2013 to grow one tonne of cotton lint, compared to 2003. Australian cotton growers almost doubled their irrigation water use index from 1.1 bales/megalitre in 2000-01 to 1.9 bales/megalitre in 2009-10.

Almost 10 years on, data due for release soon shows this number is much higher again. Australia is now the most water efficient producer of cotton in the world and this performance continues to improve year on year.

WATER USE ON AUSTRALIAN FARMS 2016-17 – VOLUME OF WATER APPLIED (ML '000)

- 2566 Cotton
- 2180 Pasture, cereals and other crops grown for grazing, cut for hay and silage
- 974 Sugar cane
- 940 Rice
- 836 Fruit and nut trees and berries
- 502 Other cereals for grain or seed
- 436 Grapevines
- 386 Vegetables
- 167 Other broadacre crops
- 61 Nurseries, cut flowers and turf





This lateral move watering system uses less water, and is becoming more commonplace on our cotton farms.

GROWER PRACTICES AND IMPACT

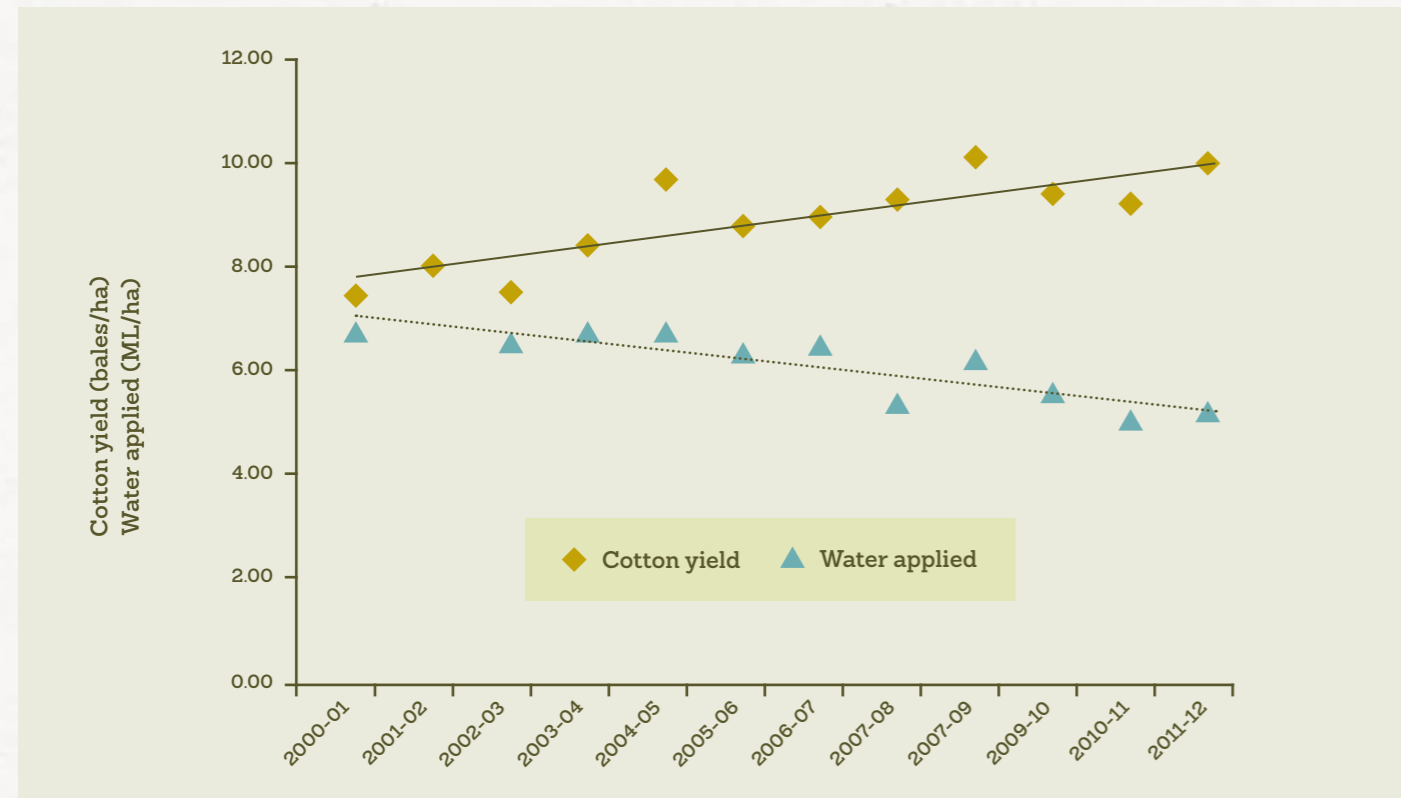
Underpinned by millions of dollars in research, cotton growers have continuously improved on-farm water management for decades. They have changed farming practices, using water technology and innovation to grow 'more crop per drop'.

Common on-farm practices include:

- > Efficient watering systems such as lateral move sprinklers, automated irrigation and bankless channels
- > Water budgeting and in-field soil moisture probes and canopy sensors to ensure plants are only watered when needed

- > Recycling systems to collect and re-use water
- > Mulching and stubble retention to retain soil moisture
- > Deepening storages and other methods to reduce evaporation
- > Thermal imaging and electromagnetic surveys to identify leaks in dams, pipes and channels for repair

Cotton growers also contribute to water stewardship outcomes for their broader catchments, for example by managing and restoring wetlands, maintaining riparian zones and controlling invasive species to improve the condition and health of cotton water catchments.



Irrigated cotton yields and irrigation water applied in Australia, 2001-12 (1 bale - 227kg)

Source: Water-use efficiency and productivity trends in Australian irrigated cotton: a review (2013)

myBMP – WATER STEWARDSHIP AND RIVERINE HEALTH

myBMP is the Australian cotton industry's Best Management Practices program. It began in 1997 and over time has been improved to become one of the most comprehensive cotton sustainability programs in the world.

myBMP is available to every Australian cotton grower and provides self-assessment mechanisms, practical tools and independent auditing to continually improve cotton production. Around 80 percent of cotton growers are registered and participating in the program. myBMP consists of 10 modules and over 400 checklist items.

The Water Management module includes 70 checklist items and brings together the latest research and knowledge on water use to assist cotton growers to manage water more responsibly and efficiently.

In addition the Sustainable Natural Landscape, Soil Health and Petrochemical Storage and Handling Modules contain standards for managing natural assets, ensuring riverine and soil health and improving water quality.

In 2018 more than 20% of Australia's cotton was produced from fully accredited myBMP farms. These are certified by qualified independent auditors that meet the Exemplar Global Environmental Management Systems Auditor Standards.

Certified myBMP farms have achieved the following benchmarks:

- > Compliance with water access legislative requirements
- > Used tools to schedule irrigations and monitor soil water levels
- > Estimated soils capacity to hold and store water for each field and soil type
- > Estimated losses from storages and channels
- > Maintained storages to minimise leaks and seepage
- > Maximised crop yields by understanding and managing underground water quality
- > Calculated and recorded the farm's irrigation water use index
- > Identified problem areas in irrigation fields and addressed them
- > Matched flow rates to soil, slope and run length so furrows come out evenly
- > Where established, planned for and installed pressurized irrigation systems with a professional so they work effectively, and ensured drip irrigation systems are operating effectively



Peter, Diana and Andrew French of "Nandina" are part of the 20% of Australian cotton farms fully accredited in myBMP.

WATER RESEARCH AND DEVELOPMENT

In the past two decades, the Cotton Research and Development Corporation (CRDC) has invested millions of dollars in water use efficiency and this continues to be a focus of industry R&D.

Key areas of focus include:

- > Alternative, more efficient irrigation systems and technologies
- > Maximising the efficiency of dams and channels
- > More efficient ways to deliver water to the crop
- > Achieving uniform application of water to cotton plants
- > Monitoring water use and getting the timing of irrigations right
- > Promoting investment in water-smart infrastructure

The industry has also contributed significantly to knowledge, management and improvements in regards to the water catchments in which cotton is grown. Cotton water research, development and extension has led to improvements in understanding of groundwater resources, improved resource condition and wetland ecology.

MANAGING WATER IN A CLIMATE OF CHANGE

The Australian climate can be extreme, and farmers must deal with variables ranging from damaging frosts and floods, to heatwave events and droughts that may last many years.

Climate change is intensifying these extremes even further. The country is experiencing hotter temperatures and rainfall events that are less frequent, but more intense. Established climate patterns that have long allowed farmers to plan their seasons with some reliability are now becoming less predictable.

The cotton industry is investing in both climate adaptation and climate mitigation research. Research being conducted in climate - controlled chambers is aiming to identify the best management options for growing cotton under increased temperatures and CO² levels.

As well as its continued focus on improving water use efficiency, the industry has on-going work to improve nitrogen use efficiency and energy use efficiency as part of reducing the industry's GHG emissions and helping cotton farmers to prepare for the future.



Cotton researcher Katie Broughton is growing cotton in climate controlled chambers to see how it responds under various temperature and CO² levels.

WATER R&D IN THE PIPELINE



Cotton plant varieties that use less water



A biodegradable polymer that can be applied to the soil that reduces evaporation by 77%



Real-time monitoring of soil-water content



Cotton researcher Rose Broderick is investigating how the temperature of the cotton crop canopy can help predict the plant's water needs.

COTTON AUSTRALIA'S WATER POLICY POSITIONS

Murray-Darling Basin Plan

Cotton Australia:

- > supports the full implementation of the Murray-Darling Basin Plan, with complementary measures to drive real environmental outcomes.
- > believes all stakeholders should work together to focus on optimising environmental outcomes, while minimising the social and economic impacts of the Plan.

Water Theft

Cotton Australia:

- > has zero tolerance for water theft, or any illegal activity by any cotton grower and believes offenders should face the full force of the law.
- > believes water theft is unacceptable as it is essentially stealing from fellow farmers, the community and the environment.
- > prioritises and promotes compliance with all laws related to cotton production
- > supports growers through the myBMP (Best Management Practices) program that sets high standards for growers, above and beyond legal obligations.
- > acknowledges that three recent cases of malpractice ('water theft') have unfortunately tarnished the reputation of thousands of honest irrigators and believes we must acknowledge the vast majority do the right thing.
- > does not comment on ongoing legal proceedings. The judicial process must be allowed to run its course, free from commentary and prejudice.

Water Compliance

Cotton Australia:

- > supports robust and transparent compliance with water licencing rules in a manner that protects the rights of the environment, irrigators and other water users.
- > acknowledges that compliance systems have been found inadequate and that reforms were needed.
- > strongly supports reforms announced by the Australian, NSW, and Queensland Governments since theft allegations were made public in mid-2017.
- > strongly supports efforts to ensure that compliance is transparent, effective, and cost effective.

Water Rights

Cotton Australia:

- > believes farmers who buy or lease water entitlements/licenses should be free to use that water to grow whichever crop they choose.
- > does not support compulsory acquisition of water licences and believes that where water needs to be acquired for environmental purposes, this should only be obtained from farmers willing to sell.
- > believes where water licences are acquired, full and fair compensation should be made.
- > supports investment in on and off-farm infrastructure projects to improve water efficiencies, where they are recognised by entitlement holders as offering good value for money and where participation is entirely voluntary.

Bird numbers are one great indicator of water quality and quantity on Australian cotton farms



LINKS TO FURTHER READING/LISTENING

Cotton Australia website

www.cottonaustralia.com.au

2012 Australian Cotton Water Story

<https://www.crdc.com.au/publications/australian-cotton-water-story>

WATERpak, cotton grower irrigation management guide

<http://www.cottoninfo.com.au/sites/default/files/documents/WATERpak.pdf>

FAQ about Fish Deaths from National Farmers Federation

<https://farmers.org.au/news/5-faqs-about-the-fishdeaths/?sfns=cl>

Australian cotton water management TripleM interview

<https://omny.fm/shows/australia-by-night-with-stephen-cenatiempo/adam-kay-ceo-cotton-australia>

NSW water allocations

<https://www.industry.nsw.gov.au/water/allocations-availability/allocations/summary>

Queensland water allocations

<http://www.sunwater.com.au/latest-news/sunwater-announces-water-allocations-for-2018-19>

Murray-Darling Basin Plan

<https://www.mdba.gov.au/basin-plan/plan-murray-darling-basin>

Commonwealth Government progress on recovering water for the Murray-Darling Basin

<https://www.mdba.gov.au/progress-water-recovery>

Water-use efficiency and productivity trends in Australian irrigated cotton: a review

<https://www.publish.csiro.au/cp/pdf/CP13315>

Murray Darling Basin SA Royal Commission Report 2019

<https://www.mdbrc.sa.gov.au/sites/default/files/murray-darling-basin-royal-commission-report.pdf?v=1548898371>



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