



# Irrigation benchmarking

**Benchmarking** is a process of collecting data to enable comparison. It allows an enterprise to strive for improvement by comparing current performance to appropriate internal or external performance measures.

Some benchmarking examples include:

- Comparing different farming enterprises, for example the growers in a local area.
- Compare the performance of a single field over a period of three seasons, to see if management changes are having a positive effect.
- Comparing the performance of your enterprise to industry targets.
- Comparing performance within a farm, for example between a number of adjacent fields to determine which need additional work to increase their performance.

Calculating recognised water use indices and irrigation efficiencies will give you a standard calculation which can be compared spatially (to another field, another farm, or another region) or over time (season, years).

**Using standard performance measures ensures meaningful comparisons.**

## Water Use Efficiency

Water Use Efficiency (WUE) is a generic term that covers a number of performance indicators including:

1. Water use indices (WUI) that relate production (yield, return, gross margin) to water use (irrigation water, total water, evapotranspiration).
2. Irrigation System Efficiencies that relate water inputs to water outputs at different locations to show the proportion of water that is lost.
3. Distribution Uniformity (DU) that measures the

evenness of the application of irrigation water.

## How are you performing?

NSW DPI has conducted three studies to benchmark irrigation water use efficiency from over 40 irrigators located from Central Queensland to Southern NSW. This work was funded by CRDC. The web-based benchmarking program WaterTrack Rapid™ was used each season to provide consistent benchmark calculations across the years.

Irrigation benchmarks have been calculated for the 2006-07 and 2008-09 seasons which were dry. Low water availability coupled with low cotton prices saw significantly reduced plantings of around 140,000ha. In contrast full storages and good allocations in the 2012-13 season resulted in record plantings of around 365,000ha.

The Australian Cotton Industry uses values of Gross Production Water Use Index ( $GPWUI_{farm, effective} = \text{total production (bales)} / \text{total water used on farm (ML)}$ ) to benchmark water use efficiency.

$GPWUI_{farm, effective}$  for 2006-07 and 2008-09 were 1.17 and 1.14 bales/ML. The  $GPWUI_{farm, effective}$  for 2012-13 was 1.12 bales/ML (Table 1). This industry average  $GPWUI_{farm, effective}$  can be used to compare to your current performance to enable continuous improvement.

You can also compare your yield, total water use (total available water), crop evapotranspiration and on-farm water losses, crop water use index (CWUI), irrigation water use index ( $IWUI_{farm}$ ) and gross production water use index ( $GPWUI_{farm, effective}$ ) to industry averages provided in Table 1.

Performance Indicators	2006-07*		2008-09		2012-13	
	Mean	Min Max	Mean	Min Max	Mean	Min Max
Yield (Bales/ha)	10.69	4.07 13.19	10.63	8.00 13.57	11.14	7.18 14.37
Total available water (ML/ha)	9.31	5.12 12.79	9.66	5.88 13.31	10.16	6.61 15.47
Crop evapotranspiration (ML/ha)	7.36	5.42 9.13	7.59	5.60 8.61	8.48	6.55 9.83
On-farm water losses (ML/ha)	1.95	-1.43 6.88	2.07	0.01 5.24	1.64	0.00 6.40
CWUI (bales/ML)	1.46	0.58 1.90	1.41	1.01 1.92	1.31	0.94 1.70
IWU <sub>farm</sub> (bales/ML)	1.40	0.80 2.78	1.99	0.82 5.75	1.41	0.76 3.01
GPWU <sub>farm, effective</sub> (bales/ML)	1.17	0.69 1.71	1.14	0.64 1.58	1.12	0.73 1.43

Table 1: Yield, total available water, crop evapotranspiration, on-farm water losses and water use indices established for 2006-07, 2008-09 and 2012-13 cotton seasons.

\*includes seven farms with negative on-farm water losses, which were excluded in Williams & Montgomery 2008.

Importantly, there continues to be a lot of variation in irrigation benchmarks between individual farms indicating room for improvement.

Figure 1 shows 46 farms ranked by their Total Water Loss per Hectare for the 2012-13 season. Each farm is represented in the same relative position for each grouping. Also shown are the corresponding Crop Yield (bales/Ha), Total Available Water (ML/Green Ha), Crop Evapotranspiration (ETc) (ML/Green Ha) and On-farm Water Loss.

WaterTrack Rapid™ combines all on-farm losses into a single figure and includes: seepage and evaporation from supply; drainage and tailwater systems; on-farm

storages; in-field losses such as deep drainage; and rainfall runoff that is not harvested.

The industry average cotton yield (based on 46 survey farms) in 2012-13 was 11.14 b/ha, ranging between 7.18 and 14.37 b/ha. On average the total amount of water available for use on farm (irrigation water + rainfall + soil moisture) to grow that crop was 10.16 ML/ha, ranging between 6.61 and 15.47 ML/ha.

The difference between the total available water and crop evapotranspiration provides an estimate of on-farm water losses, which averaged 1.64 ML/ha. This is around 15 per cent of water used on farm for the crop.

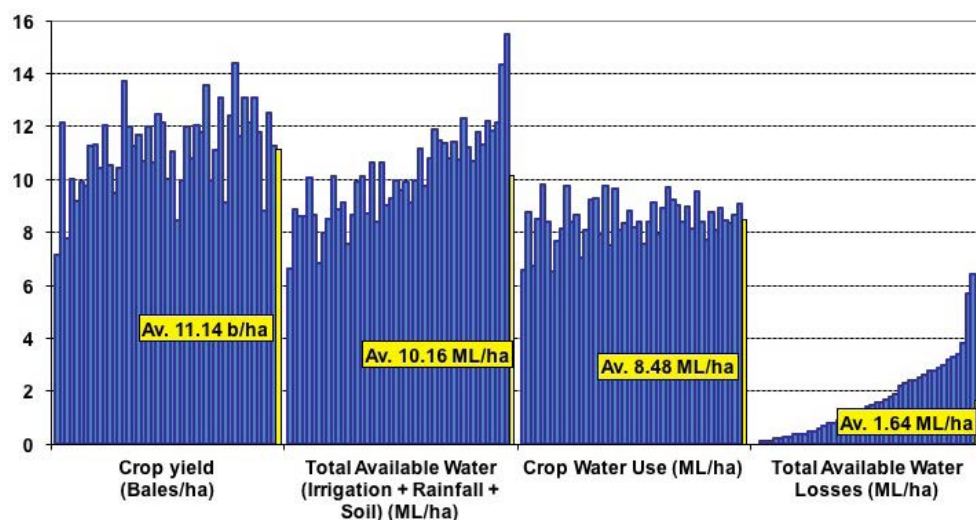


Figure 1: Variation in Total Available Water Loss compared to Yield, Total Available Water (includes irrigation water, rainfall and soil water) and Crop Evapotranspiration (ETc) (2012-13).



Three water use indices, Crop Water Use Index ( $CWUI_{farm}$ ), Irrigation Water Use Index ( $IWUI_{farm}$ ) and Gross Production Water Use Index ( $GPWUI_{farm}$ ) were calculated for each farm for the 2012-13 study and the results are presented in Figure 2.

The data collected from individual farms shows a wide range of irrigation performance. The average  $CWUI_{farm}$  which relates total production to the amount

of water consumed by the crop (ETc) was 1.31 b/ML, ranging between 0.94 and 1.70 b/ML.

$IWUI_{farm}$  related total production to the amount of irrigation water supplied. The average  $IWUI_{farm}$  was 1.41 b/ML ranging between 0.76 and 3.01 b/ML. The average  $GPWUI_{farm, effective}$  for 2012-13 was 1.12 bales/ML, ranging between 0.73 and 1.43 bales/ML.

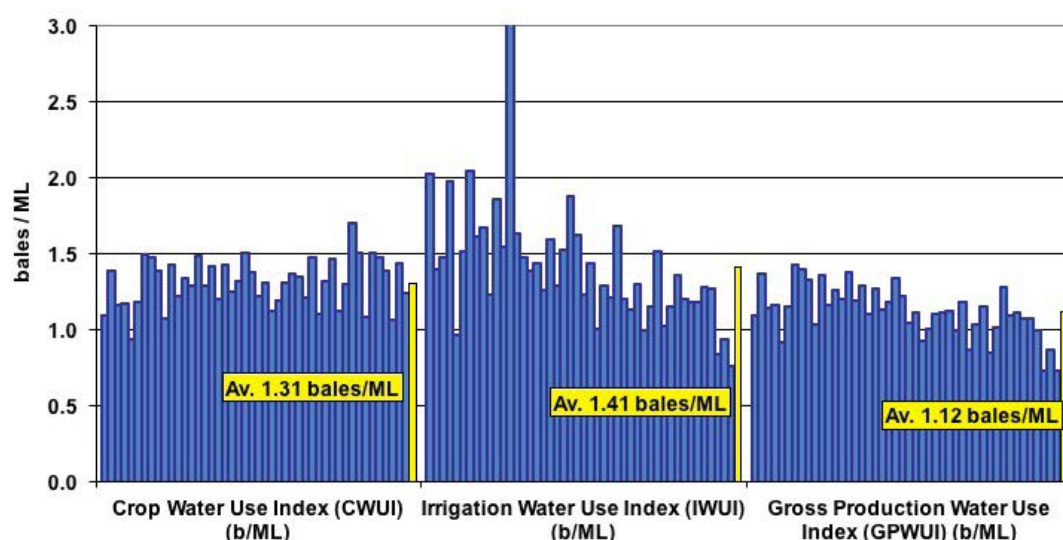


Figure 2: Variation in Water Use Indices (2012-13)

### For more information:

#### Contact:

- Janelle Montgomery, CottonInfo Technical Specialist Water Use Efficiency (NSW)  
Ph: 0428 640 990  
Em: [janelle.montgomery@dpi.nsw.gov.au](mailto:janelle.montgomery@dpi.nsw.gov.au)

#### Information for this fact sheet has been sourced from:

- Waterpak 2013 [www.cottoninfo.com.au/publications/waterpak](http://www.cottoninfo.com.au/publications/waterpak)
- Montgomery, J., Hoogers, R., Bray, S & Shephard, K. 2014 "Water Use in the Australian Cotton Industry", Paper presented at the 17th Australian Conference, Gold Coast. [www.australiancottonconference.com.au/2014-presentations-papers/montgomery-janelle-hoogers-robert-shepherd-kieran-bray-stewart](http://www.australiancottonconference.com.au/2014-presentations-papers/montgomery-janelle-hoogers-robert-shepherd-kieran-bray-stewart)

#### For further information:

Roth G, Harris G, Gillies M, Montgomery J and Wigginton DW, 2013. "A review of water use efficiency and productivity trends in Australian irrigated cotton", Journal of Crop and Pasture Science, 64,1033-1048. [http://eprints.usq.edu.au/25000/1/Roth\\_Harris\\_Gillies\\_Montgomery\\_Wigginton\\_CPS\\_2013\\_PV.pdf](http://eprints.usq.edu.au/25000/1/Roth_Harris_Gillies_Montgomery_Wigginton_CPS_2013_PV.pdf)