



Water Use Efficiency : Citrus

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This article is to be read in conjunction with the 'Water Restriction in Sunraysia 2003-2004' document.



Water stress can affect citrus at each development stage. In general, water stress in the early fruit development stage will have a greater effect on decreasing fruit size than at the later stages of growth and development.

Citrus growth stages

- Flower bud induction
- Flowering and fruit set (cell division)
- Cell expansion
- Ripening



Bud Induction (June – July)

Higher levels of water stress could increase the level of flowering. Growers in some countries use this technique to induce out of season flowering.

Flowering and fruit Set (Cell Division) (Late September – December)

Fruit size will largely be determined during this critical stage. Water stress during this period can cause fruit drop and reduce fruit size. During this stage it can be difficult to accurately schedule irrigations due to the highly variable and changing daily climatic conditions.



Cell expansion (January – May)

Minor water stress can have little effect on reducing fruit size. However, prolonged water stress will reduce fruit size. It may also increase the acid content of fruit and induce a slightly earlier maturity.

Fruit ripening (May – June)

Water stress may have a minor effect on fruit size, however, it may increase the incidence of stem end rind breakdown and reduce the shelf life of fruit.

Citrus Water Budget

The following graph represents average water use by mature citrus based on long-term average water use data at Dareton in the southwest of NSW. The graph can be used as a guide to budget water for the oncoming season. An Excel water budget spreadsheet for Dareton and Griffith is available from the Australian Citrus Growers "season update" "factsheet" web page (www.austcitrus.org.au/season).

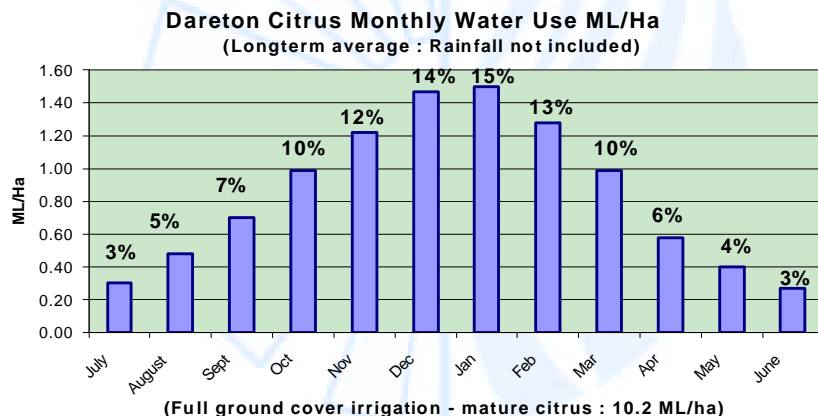


Figure 1. Long-term average water use of mature citrus with full ground cover irrigation and monthly percentage values at Dareton



Strategy Options

The following options are only a guide and can be used to develop a strategy that suits your own situation (climate, soil type, irrigation system, varieties, etc). Drip irrigation is generally more water efficient than full ground cover application systems with experience showing that mature age citrus able to be grown with 7-8 megalitres of water per hectare. Mandarins have a greater water demand than oranges so an irrigation management strategy needs to take into account the varietal differences on a property. Some of the strategies involve pruning or hedging. Pruning or hedging is best conducted in spring to reduce the impact of sunburn of the limbs.



20% water reduction

This level of water reduction could be managed with minimal effects on yield or production. However, if inefficient irrigation systems or poor scheduling practices are used production losses may occur.

- Use efficient irrigation and scheduling practices.
- Do not let trees set a heavy crop load : (undertake crop thinning using hedging or chemical thinning agents).



20 to 40% water reduction

Reductions of canopy and crop load may need to occur to maintain a crop of acceptable fruit size. Some crop loss will probably occur.

- Light or medium hedging/topping to reduce tree size and crop load.
- Paint exposed limbs with white wash.



40 to 75% water reduction

Significant crop reduction will occur. Depending on the severity of water reduction fruit may be too small for marketing. Significant canopy and crop size reduction will need to be undertaken.

- remove the eastern side of the tree.
- white wash exposed limbs.

More than 75% water reduction

Total crop loss would be expected. The main goal is to keep the trees alive. Significant canopy and crop reduction would be needed to maintain tree health.

- cut back or skeletonise trees - best conducted in early spring.
- white wash exposed limbs.
- manage regrowth with summer pruning and select out the best positioned shoots to regrow the tree.



Young trees

Recent irrigation studies on young citrus plantings, that are correctly monitored and scheduled, has shown a water use of 2-5 megalitres per hectare annually. Water savings are possible if irrigations can be allocated to similar units of production such as young trees or reworked sections of a property. Some modification to the irrigation delivery infrastructure (valves) or irrigation schedule may be necessary to take advantage of this low water requirement.

The main strategy is to ensure that water is not applied beyond the rootzone.

- Install sprinkler heads that have a small throw pattern.
- Build a small basin around the tree to contain water.

Fertiliser Application

Adjust fertiliser applications to suit the tree canopy size and vegetative growth. A heavily pruned tree will require less fertiliser, however as the tree regrows the amount of fertiliser applied should increase. Foliar nutrient sprays may be required to supplement the nutrition program. When needed, appropriate micronutrient sprays should be applied to new vegetative growth.



Northwest NSW Experience.

Citrus growers using drip irrigation in the Bourke region of northwest New South Wales have already experienced severe water restrictions and these are their experiences. Fourteen-year-old mandarin trees which had the eastern side of the tree removed were kept alive with 2.2 megalitres of water per hectare applied from July 2002 to April 2003. A reasonable crop of Leng navels was harvested from a grove watered with 7 megalitres of water per hectare. A block of three-year-old navel orange trees receiving 1.5 megalitres per hectare of 1500 - 2000 EC irrigation water were severely stressed during summer 2003. As a consequence the navel trees, and adjacent casuarina windbreak row, heavily defoliated because of combined water and salt stress. However, the trees recovered well with autumn irrigation and rainfall. It should be noted that northwest New South Wales experience warmer climatic conditions, and have a higher water use than the traditional southern citrus growing districts.

The long-term effects of combined water and salt stress, for one season, on citrus trees are not known in Australia. The recovery period for tree health, growth rate and productivity may take several years once normal irrigation volume and quality return. Unfortunately, a second season of water shortage is expected this season in this area of NSW.

References and Information Sources:

- Irrigation of citrus in reference to water shortages and water quality. Tiene Du Preez (Agricultural Consultants International).
- Fruit Size Extension Committee: – Sandra Hardy, Steve Falivene, Peter Melville, Ken Bevington (NSW Agriculture), Kym Thiel (CGSA), Peter Morrish (MVCMB), Dominic Nardi, Domenic Mancini (Riverina Citrus) and John Chavarria (MFC).
- Jeremy Giddings : Irrigation Officer, NSW Agriculture, Dareton.

