# Modelling Deficit Irrigation Strategies for Dairy Regions of Australia

Richard P. Rawnsley
*University of Tasmania, Australia*

Brendan R. Cullen
*University of Melbourne, Australia*

L. R. Turner
*University of Tasmania, Australia*

Karen Christie
*University of Tasmania, Australia*



**The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.**

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

# Modelling deficit irrigation strategies for dairy regions of Australia

*R .P Rawnsley*[1] ** ,B .R Cullen*[2] *, L .R .Turner*[1] *and K .Christie*[1]
[1] *Tasmanian Institute of Agricultural Research , University of Tasmania , Burnie Tasmania* [2] *Faculty of Land and Food Resources , University of Melbourne , Victoria*
** Corresponding author E-mail : Richard .Rawnsley@utas .edu .au*

**Key words :** Irrigation , efficiency , perennial ryegrass , dairy

**Introduction** The seasonal differences between daily rainfall and evapotranspiration in temperate regions of Australia emphasises the reliance on irrigation to support pasture growth in these regions (Rawnsley *et al* ., 2007) . Water scarcity and or increase costs are placing significant demands on irrigators to improve their return for each mm of water applied .This modelling study examines deficit irrigation strategies to provide recommendations for farmers to improve irrigation use efficiency .

**Materials and methods** Monthly pasture cuts of perennial ryegrass (*Lolium perenne* L .) were simulated using the biophysical pasture model DairyMod (Johnson *et al* ., 2003) at two sites ; Elliott (northwest Tasmania ; 41°06′S , 145°46′E) , and Kerang (northern 0 , 10 , 15 , 20 , 25 , 30 , 35 or 40 mm of irrigation was applied . Simulations were run for 46 years (1960-2006) , with median data for the last 40 years presented .

**Results and discussion** The marginal irrigation water use index (marginal pasture production due to irrigation/irrigation water applied (kg DM/mm) ; MIWUI) increased with decreasing irrigation application depths at both sites , indicating that a deficit irrigation strategy can increase the amount of pasture grown per mm of applied water (Table 1) .A higher MIWUI for these perennial ryegrass pastures was found in the cool temperate climate of Tasmania than in the warmer climate of northern Victoria . The MIWUI for each irrigation application depth in Tasmania was substantially greater than 10 .0 kg DM/mm , a figure that is often quoted as industry average .In contrast , in northern Victoria the MIWUI was below 10 .0 kg DM/mm for each irrigation application depth , indicating that climate significantly influences the response of perennial ryegrass to irrigation .

**Table 1** *The median annual perennial ryegrass pasture yield , irrigation water applied and MIWUI from differing irrigation application depths in Tasmania and northern Victoria over forty years (1967-2006) .*

| | Elliott (Tasmania) | | | Kerang (Northern Victoria) | | |
|---|---|---|---|---|---|---|
| Application depth | Yield (t DM/ha) | Irrigation applied (mm) | MIWUI (kg DM/mm) | Yield (t DM/ha) | Irrigation applied (mm) | MIWUI (kg DM/mm) |
| 0 mm | 15 .4 | 0 .0 | n .a | 4 .2 | 0 .0 | n .a |
| 10 mm | 20 .9 | 130 .0 | 41 .6 | 7 .1 | 370 .0 | 7 .8 |
| 15 mm | 23 .7 | 195 .0 | 39 .5 | 9 .4 | 555 .0 | 8 .6 |
| 20 mm | 25 .3 | 260 .0 | 35 .5 | 9 .9 | 740 .0 | 6 .3 |
| 25 mm | 25 .3 | 325 .0 | 28 .6 | 9 .8 | 925 .0 | 5 .0 |
| 30 mm | 25 .3 | 390 .0 | 23 .7 | 9 .8 | 1110 .0 | 4 .2 |
| 35 mm | 25 .3 | 455 .0 | 20 .3 | 9 .8 | 1295 .0 | 3 .6 |
| 40 mm | 25 .3 | 520 .0 | 17 .7 | 9 .8 | 1480 .0 | 3 .1 |

**Conclusions** The results of this study indicate that a deficit irrigation strategy can significantly improve the return of pasture grown for each mm of water applied .In addition , the use of irrigation water in warmer climatic regions to grow perennial ryegrass is potentially unsustainable due to the high level of water required and the low (< 10 .0 kg DM/mm) marginal response to these applications .

**References**

Johnson , I .R . , Chapman , D .F . , Parsons , A .J . , Eckard , R .J . , Fulkerson , W .J . , 2003 .DairyMod : A biophysical model of the Australian dairy system .Proceedings of the Australian Farming Systems Conference , Toowoomba , September 2003 (www .afsa .asn .au/)

Rawnsley , R .P . , Donaghy , D .J . , Stevens , D .R . , 2007 .What is limiting production and consumption of perennial ryegrass in temperate dairy regions of Australia and New Zealand ? *Proceedings of the 3rd Dairy Science Symposium* , University of Melbourne , Victoria , Australia , 3 , 256-276 .