



University of Kentucky  
UKnowledge

---

International Grassland Congress Proceedings

XXI International Grassland Congress / VIII  
International Rangeland Congress

---

## Growth and Water Use of Perennial Ryegrass and Tall Fescue under Different Irrigation Treatments

R. J. Martin

*Crop & Food Research Limited, New Zealand*

Trevor L. Knight

*AgResearch, New Zealand*

R. N. Gillespie

*Crop & Food Research Limited, New Zealand*

M. U. Riddle

*Crop & Food Research Limited, New Zealand*

Tom J. Fraser

*AgResearch, New Zealand*

Follow this and additional works at: <https://uknowledge.uky.edu/igc>



Part of the [Plant Sciences Commons](#), and the [Soil Science Commons](#)

This document is available at <https://uknowledge.uky.edu/igc/21/7-1/18>

The XXI International Grassland Congress / VIII 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

---

This Event is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in International Grassland Congress Proceedings by an authorized administrator of UKnowledge. For more information, please contact [UKnowledge@lsv.uky.edu](mailto:UKnowledge@lsv.uky.edu).

## Growth and water use of perennial ryegrass and tall fescue under different irrigation treatments

R .J .Martin<sup>1</sup> , T .L .Knight<sup>2</sup> , R .N .Gillespie<sup>1</sup> , M .U .Riddle<sup>1</sup> and T .J .Fraser<sup>2</sup>

<sup>1</sup>Crop & Food Research Limited , Private Bag 4704 , Christchurch , New Zealand

<sup>2</sup>AgResearch Lincoln , Private Bag 4749 , Christchurch , New Zealand . E-mail : martind@crop.cri.nz

Key words : *Lolium perenne* , *Festuca arundinacea* , water use efficiency , drought , yield

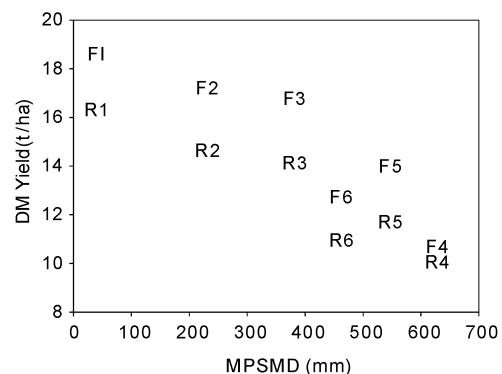
**Introduction** New Zealand pastures are predominantly perennial ryegrass (*Lolium perenne* L .) , which is susceptible to drought . Tall fescue (*Festuca arundinacea* Shreb .) has been shown to be more drought tolerant (Garwood et al . , 1979) . To quantify drought stress effects and determine irrigation requirements of these two grasses , we carried out an experiment in a rainshelter where rainfall was excluded from trial plots otherwise exposed to normal weather (Martin et al . , 1990) .

**Materials and methods** Grasslands Samson' perennial ryegrass and Grasslands Advance' tall fescue were sown in the rainshelter on 11 November 2004 in a randomised block design , with 2 replicates and 6 irrigation treatments : (1) full irrigation weekly , adding the weekly Penman potential evapotranspiration each time ; irrigated (2) 2 weeks in every 3 , (3) every 2 weeks , and (4) every 4 weeks with the same amount of water as (1) that week ; (5) no irrigation from 1 August to 8 January to harvest than as (1) ; and (6) irrigation as (1) to 4 December then no irrigation to 12 March than as (4) . Each 5 m × 3 m plot had its own trickle irrigation supply , and each treatment was mown down to 5 cm every time the pasture mass reached 2 ,500 kg/ha . Data reported here were collected from 1 August 2006 to 31 July 2007 .

**Results** Tall fescue produced 16% more dry matter , but only used 6 % more water than perennial ryegrass (Table 1) . Treatments (1) and (2) had highest yields , but also highest water use . Treatments (2)-(5) had the highest water use efficiency . Yields decreased at around 12 kg/mm of maximum potential soil moisture deficit (MPSMD) (French & Legg 1971) experienced by the pasture through the year (Figure 1) , but tall fescue produced higher yields for a given MPSMD than perennial ryegrass .

**Table 1** Fescue and Ryegrass dry matter production (t/ha) , water use (mm) and kg DM/mm water used .

Species	DM (t/ha)	WU (mm)	DM/mm WU
Ryegrass	12.9	727	18.5
Fescue	15.0	769	19.9
LSD(5%)	0.89	25.2	1.83
Tmt 1	17.4	1142	15.3
2	15.9	824	19.3
3	15.4	706	21.8
4	10.3	524	20.0
5	12.8	565	22.7
6	11.8	727	16.3
LSD(5%)	1.54	43.7	3.17



**Figure 1** Total pasture dry matter yield v . MPSMD .  
F Fescue , R ryegrass . Numbers are irrigation treatments .

**Conclusions** Tall fescue produced more dry matter , and more dry matter/mm of water used , than perennial ryegrass . Water stress at any time reduced both ryegrass and fescue pasture yields by about 12 kg /mm MPSMD , but autumn stress appeared to reduce production more than spring stress . Reducing the highest water use by nearly 40% only reduced yield by 11% .

### References

- French , B .K . , Legg , B .J . 1979 . Rothamsted Irrigation . *Journal of Agricultural Science* 92 , 15-37 .  
 Garwood , E .A . ; Tyson , K .C . ; Sinclair , J . 1979 . Use of water by six grass species . 1 . Dry-matter yields and response to irrigation . *Journal of Agricultural Science* 93 , 13-24 .  
 Martin , R .J . , Jamieson , P .D . , Wilson , D .R . , Francis , G .S . 1990 . The use of a rainshelter to determine yield responses of Russet Burbank potatoes to soil water deficit . *Proceedings Agronomy Society of New Zealand* 20 , 99-101 .