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

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

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

R .J .Martin[1] , T .L .Knight[2] , R .N .Gillespie[1] , M .U .Riddle[1] and T .J .Fraser[2]
[1] Crop & Food Research Limited , Private Bag 4704 , Christchurch , New Zealand
[2] 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

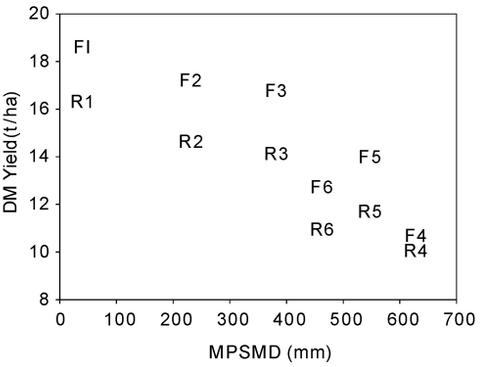

Figure 1 *Total pasture dry matter yield v . MPSMD .*
F Fescue , R ryegrass . Numbers are irrigation treatments .

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 .