Level of Water Stress Substantially Affects Productivity and Water Use Efficiency of 30 Forages Used by the Australia Dairy Industry

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Introduction The recent droughts in Australia have highlighted to the Dairy Industry the importance of irrigation water . Fodder production for the dairy industry is the second largest user of irrigation water in Australia . There are numerous species which can be used as a source of fodder , although basic information on seasonal and annual water use , and nutrient characteristics are lacking for some forages .

Methods A field experiment was conducted on a brown dermosol at the University of Sydney , Camden (34°3′S , 150°39′E) , over three years to evaluate the dry matter yield (DMY) , water use efficiency (WUE) and nutrient content , of 30 forages under optimum and two levels of deficit irrigation .A neutron probe was used to determine irrigation scheduling requirements , as well as water extraction down the soil profile .At a 30mm soil water deficit , the optimum treatment was refilled to field capacity (100%) , while the two water deficit treatments received 33% and 66% , respectively , of the water applied to the optimum treatment .Each forage was harvested at the optimum stage of growth for determination of DMY and quality .Fertilizer was applied to replace nutrients removed at each harvest , except for legumes where no nitrogen was applied .Seasonal WUE was calculated by dividing dry matter produced , by the sum of rainfall , irrigation and change in soil moisture content .

Results and discussion Annual DMY ranged from 8 to 31t DM/ha , with maize (*Zea mays*) having the highest yield .The perennial grasses , tall fescue (*Festuca arundinacea*) , perennial ryegrass (*Lolium perenne*) , prairie grass (*Bromus wildenowii*) and kikuyu (*Pennisetum clandestinum*) had the next highest yields in the range of 27 to 28t DM/ha (Neal *et al* ., 2005) .During the summer , the DMY from maize was over four times that of perennial ryegrass or white clover (*Trifolium repens*) and WUE was almost three times higher (Figure 1) .While there was a significant decrease in dry matter production for all forages under deficit irrigation , WUE was not significantly affected for maize , kikuyu and lucerne (*Medicago sativa*) (Figure 1) , as the decrease in yield was directly proportional to water used . This highlights the need to select the correct forage species when a deficit irrigation strategy is likely .

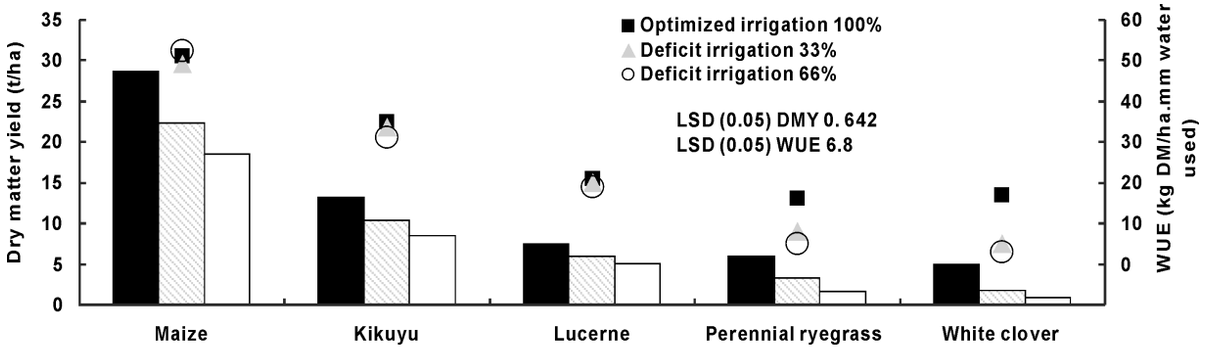

Figure 1 *Dry matter production (t/ha) (columns) and water use efficiency (kg DM/ha .mm water used) (symbols) of five selected forages*

Conclusions In the extremes of climate experienced in Australia , there is no single forage which provides an abundance of feed of sufficient quality throughout the year for dairy cows , and which is also WUE .Depending on rainfall , irrigation capacity and livestock requirements , a number of different forages can be used to fill the feed budget . Substantial savings in water can be achieved if the right species is selected for a particular season .However , in summer there is a tradeoff between WUE and nutritive value , with C4 forages (kikuyu , maize) generally having a lower nutritive value .

Reference

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