Water Use Indices of Tropical Perennial Grasses in a Temperate Environment

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Introduction The North-West Slopes of New South Wales (NSW) is classed as a temperate environment, but it has warm to hot summers and a summer dominant rainfall distribution. This environment may suit perennial grasses that have C4 photosynthetic growth, such as tropical perennial grasses, because their pattern of seasonal growth is well matched to rainfall distribution. While some endemic perennial grasses are C4, their water use index tends to be low (e.g. 3.6-4.9 kg DM/ha.mm, Murphy 2002). As demand for increased production efficiency per unit of rainfall is promoted by the livestock industry to satisfy sustainability requirements, improved estimates of efficiency are required to better evaluate options for producers.

Materials and methods An experimental site was established on a red chromosol on the North-West Slopes of NSW (31°16′S, 150°52′E, 490 m alt., 671 mm AAR) to compare the water use index of some introduced and endemic perennial grasses. Four treatments of three tropical species (*Digitaria eriantha* cv. Premier; *Chloris gayana* cv. Katambora; *Bothriochloa bladii* cv. Swann) and a mix of native species (*Austrodanthonia bipartita* cv. Bunderra; *B. macra*; *Dicanthium sericeum*; *C. truncata*) were randomly allocated to plots (6×9 m) across three replicates. Treatments were established in December 2005 by seeding at a rate of 2 kg/ha of germinable seed into a prepared bed at a depth of 10 mm. Treatments were allowed to establish and set seed during summer 2005-06 before water use indices were estimated in 2006-07. A calibrated neutron moisture meter was used to measure profile volumetric soil water content of each plot, to a maximum depth of 1.7 m, at sowing and thereafter at 3-week intervals. Herbage mass (kg DM/ha) was estimated at 6-week intervals from 20 September 2006 to 31 May 2007 using a comparative yield method (Haydock and Shaw 1975). Plots were mown to a height of 0.1 m after each assessment. A water use index (kg DM/ha.mm) was calculated for each 6-week interval by dividing herbage mass by the sum of rainfall received (mm) and soil drying created by the grasses (mm) and values were accumulated for the season.

Results and discussion Native perennial grasses showed less soil drying (39 mm) compared with the tropical grasses (119-149 mm, Table 1). Premier accumulated the highest herbage mass of all species (16,157 kg DM/ha), and the native grasses the least (2,689 kg DM/ha, Table 1). Similarly, Premier (32.4 kg DM/ha.mm) had the highest efficiency compared with all other species (Table 1). Water use indices for the tropical grasses were 2 to 5 times greater than for the native grasses (Table 1). Such indices provide a framework to compare the production performance of a range of grasses under controlled conditions. These results are for the first season of production after grasses were established, indicating their potential. Further measurements will be taken in later seasons as the grasses mature.

Table 1 *Rainfall, soil drying, herbage mass and water use index data for* 2006-07.

Species	Rainfall (mm)	Soil drying (mm)	Herbage mass (kg DM/ha)	Water use index (kg DM/ha.mm)
Premier	364	137a	16,157a	32.4a
Katambora	364	149a	11,516b	22.3b
Swann	364	119a	6,893c	13.7c
Native grasses	364	39b	2,689d	6.5d
LSD ($P<0.05$)	-	40	3,460	6.6

Conclusions In the temperate environment of the North-West Slopes of NSW, three introduced tropical grasses had higher water use indices in the first season of production after establishment compared with a mix of endemic native grasses, indicating that the tropical species can achieve high levels of efficiency in this environment.

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