WATER REQUIREMENTS OF IRRIGATED PASTURES IN NORTHERN VICTORIA

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A simple, accurate model of plant water use would have many useful applications in the dairy industry of northern Victoria, including better irrigation scheduling, particularly of spray irrigation systems, and water budgeting. One of the simplest models of plant water use is the FAO 56 model (Allen et al. 1998) which can estimate daily water use from weather data. Our study aimed to determine the applicability of generic crop coefficients provided in FAO 56 for 7 irrigated pastures in northern Victoria. The model was then used to compare the daily water use of the pastures, develop annual water budgets and estimate the amount of deep drainage.

The experimental site at DPI Kyabram was sown in autumn 2004 to a range of annual and perennial pastures (see Table 1). All treatments were irrigated using border-check irrigation unless otherwise specified. The plots were 9 by 90 m. The pastures were grazed, irrigated and fertilised according to best management practices specific for each pasture system. Measurements included harvested dry matter, water use (irrigation, rainfall and runoff) and soil water content (neutron probe).

The modelling demonstrated good agreement between the measured and modelled soil water deficits for the perennial ryegrass/white clover, tall fescue/white clover (Figure 1) and double crop systems, and the productive periods of the Persian clover/Italian ryegrass (Figure 1) and subterranean clover/Italian ryegrass systems (both spray and border-check irrigated). This indicates that the crop coefficients used are appropriate for these pastures in northern Victoria.

The water balances for the pastures for 2005, calculated from the modelling, are shown in table 1. In 2006, water use (evapotranspiration) by the perennial pastures was about 100 mm higher than in 2005. The higher water use was associated not only with lower rainfall but also higher temperatures, and lower relative humidities, creating a higher evaporative demand. Irrigation water applied was about 50% higher in 2006 compared to 2005 for all pastures except both subterranean clover/Italian ryegrass pastures, which had the shortest cool season growing conditions.

Future work could provide year-to-year variations in forage water requirements using both historical weather data and climate change predictions. The average and extreme values of forage water requirements would provide a better understanding of the risks and uncertainties associated with each forage system and would be useful to farmers, water planners and policy makers. Temporal prediction of subsurface drainage may assist assessments of catchment health.

Table 1. Measured (m) and estimated (e) components of the water balance (mm) for each forage in 2005

		Perennial ryegrass/white clover	Tall fescue/ white clover	Lucerne	Double crop (Oats / millet)	Persian clover/ Italian ryegrass	Sub. clover/ Italian ryegrass	Spray-irrigated sub. clover/ Italian ryegrass
Start date		1 Jan	1 Jan	1 Jan	1 Jan	5 Feb	7 Mar	7 Mar
End date		31 Dec	31 Dec	31 Dec	31 Dec	24 Nov	11 Nov	11 Nov
Reference ET	m	1246	1246	1246	1246	804	584	584

Net rainfall	m	418	426	429	427	342	334	345
Net irrigation	m	805	835	646	727	441	335	299
Evaporation	e	*127*	*123*	*151*	*324*	*166*	*33*	28
Transpiration	e	*1066*	*1101*	*1010*	*843*	*613*	*570*	555
Evapotranspiration	e	1193	1224	1161	1167	779	603	583
Drainage below rootzone	e	50	57	25	29	29	10	5
Increase in SWC	e	-27	-24	-116	-25	-27	56	55

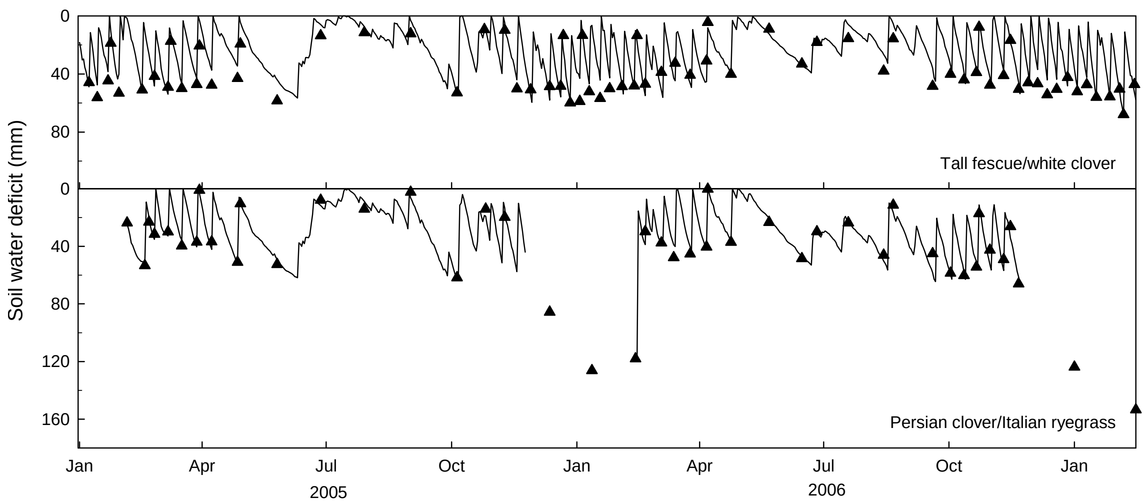

Figure 1. Modelled (—) and measured (Δ) soil water deficits for tall fescue/white clover and Persian clover/ Italian ryegrass. Soil water deficits for the non-growing, summer period were not modelled.

References

Allen RG, Pereira LS, Raes D, Smith M (1998) 'Crop Evapotranspiration: Guidelines for Computing Crop Water Requirements.' FAO Irrigation and Drainage Paper No. 56 (FAO: Rome)