

Leaf growth and senescence rates in brown-back wallaby grass, *Rytidosperma duttonianum*

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Key Words

Modelling, pasture growth, curing

Introduction

Knowledge of leaf turnover in grasses is necessary to model curing (the accumulation of dead material in the sward) which is not well represented in current pasture growth models, nor for many Australian native species. Leaf turnover begins with the appearance of successive leaves, which elongate until typically, a leaf ligule develops to indicate a mature fully expanded length. Green leaf life span extends from appearance to the beginning of senescence, which ultimately leads to death (Figure 1). Here, the individual rates of leaf growth and senescence for the Australian native brown-back wallaby grass, *Rytidosperma duttonianum* (Cashmore) Connor & Edgar, over the whole life cycle, are reported.

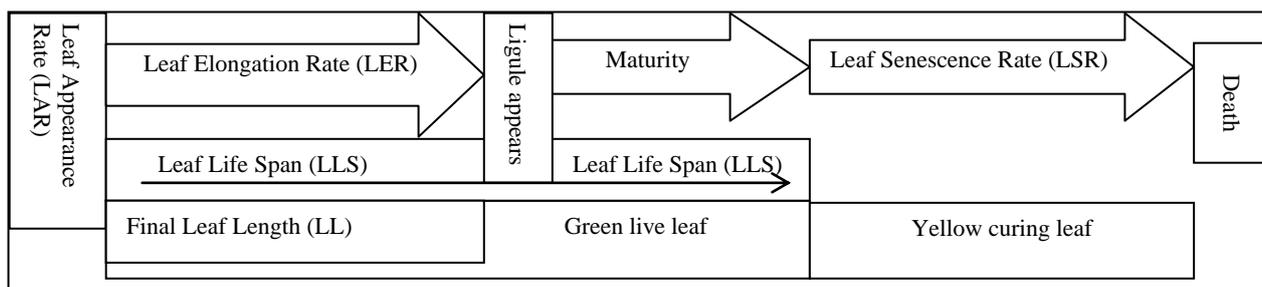


Figure 1. Leaf growth processes and visible characteristics expressed during the life of a grass leaf.

Methods

Plants were grown under optimal conditions (night/day temperature 16°C/22°C; 15 hour photoperiod; adequate nutrition and water) in a glasshouse at the South Australian Research and Development Institute's Plant Research Centre at Waite Campus, Adelaide. Plants were checked twice-weekly, or daily when possible. Leaves on the main stem were numbered acropetally and counted and designated as live, mature or dead. Leaf length (LL) (mm) and the length of green and senesced leaf tissue was measured and rates of leaf appearance (LAR), leaf elongation (LER) and leaf senescence (LSR) were calculated (Thomas 1980; Lemaire and Agnusdei 2000) in terms of unit length per unit of thermal time, and leaf life span (LLS) in thermal time. SAS Version 9.2 (SAS Institute Inc., 2002-3) was used to analyse the data. PROC MIXED was used for LAR and LLS, PROC NLMIXED for LER and LSR and PROC NLIN for LL using leaf position on the plant as the explanatory variable (Wilson 1976; Duru and Ducrocq 2000).

Results

The relationships between the leaf rates and leaf position proved to be linear for LAR and non-linear for LER, FLL, LLS and LSR (Figure 2).

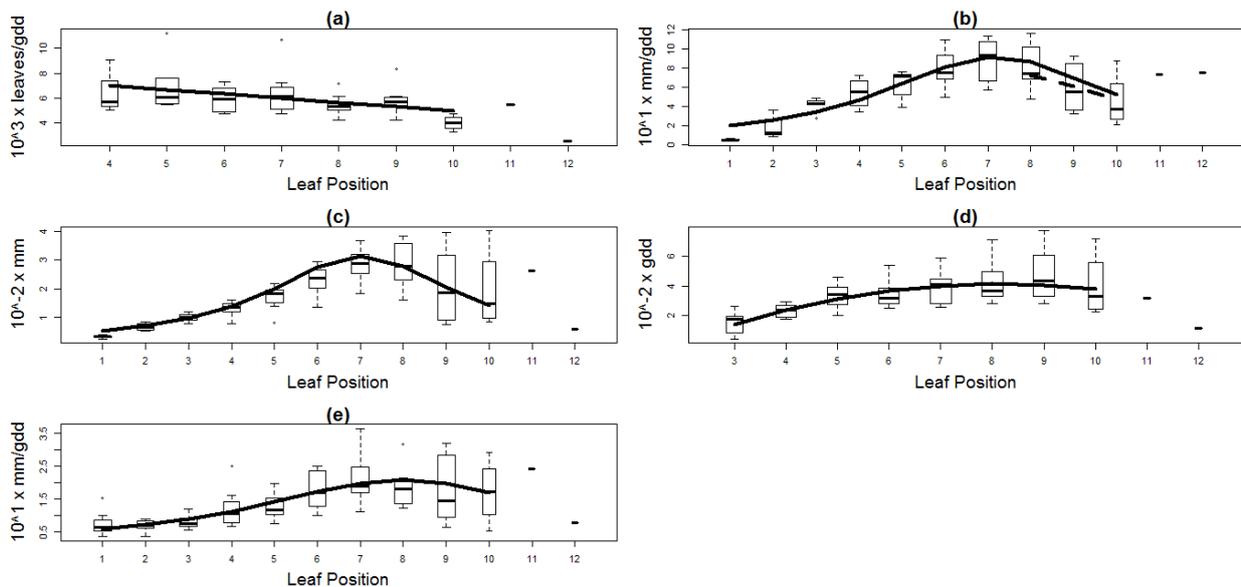


Figure 2. Observed (boxplot) and modelled (line) of leaf rates with leaf position for wallaby grass: a) LAR ($10^3 \times$ leaves/gdd); b) LER ($10^1 \times$ mm/gdd); c) LL ($10^{-2} \times$ mm); d) LLS ($10^{-2} \times$ gdd); e) LSR ($10^1 \times$ mm/gdd). Thermal time (gdd) was calculated using $T_{base} = 0^\circ\text{C}$. Observed data are presented in box-and-whisker (boxplot) plots, where the upper, internal and lower bounds of each box correspond to the 75th, 50th and 25th percentiles, respectively. Upper and lower whiskers represent the nominal data range, which extends the upper and lower quartiles by 1.5 times the interquartile range. Open circles indicate samples which lie outside the nominal data range, and are considered outliers. Models are presented only for leaf positions where data was collected. In b) solid line represents vegetative model where tillers were vegetative throughout leaf elongation; dashed line represents maturity model where tillers were reproductive at leaf appearance and progressed towards maturity.

Conclusion

The recorded number of leaves on a related species (*R. caespitosum*) were fewer than for *R. duttonianum*, but both displayed a small decrease in LL in the penultimate and flag leaves (Hodgkinson and Quinn 1976). In this experiment *R. duttonianum* had longer leaves than for five other wallaby grass species (Waters 2007) which may be a result of both genetic and environmental differences. This research has provided new information on the other leaf turnover rates, which are the first reported for wallaby grass, an important component of SE Australian natural and semi-improved pasture. This information will improve models of curing rates for natural pastures and will provide greater understanding of the impacts of grazing management and the future selection of productive cultivars.

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