Leaf extension rates of some native perennial grasses in early spring on the Southern Tablelands of New South Wales

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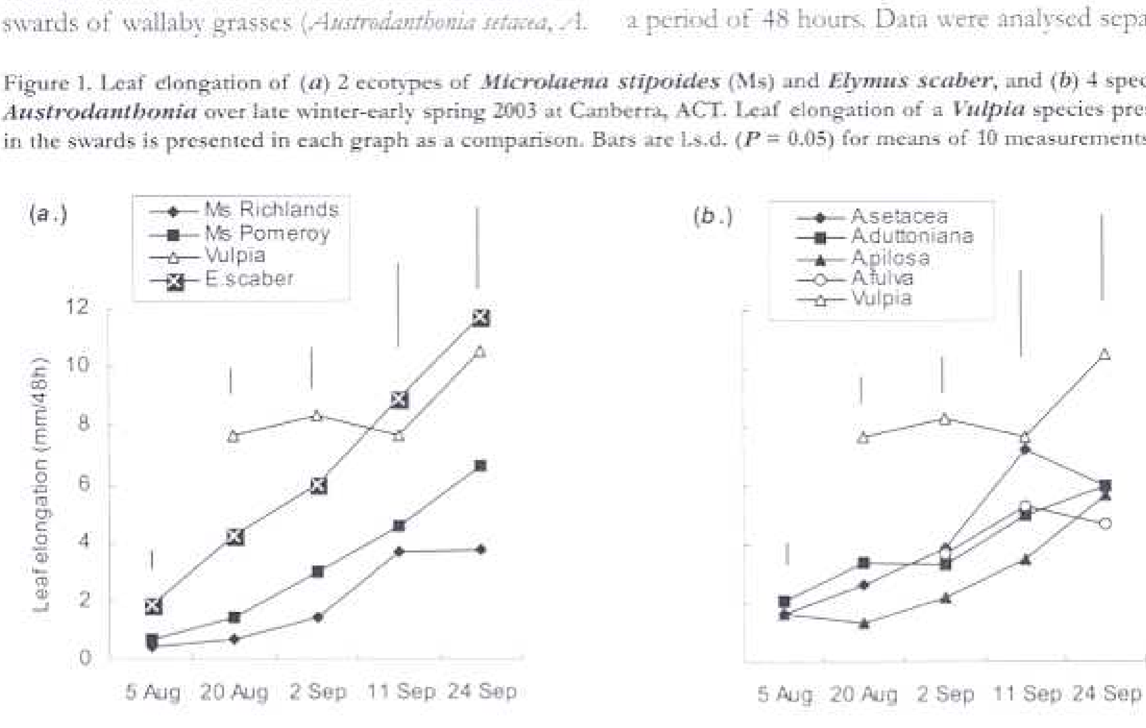
Native grasses are important components of pastures in NSW and have a role in achieving optimal economic returns for graziers and addressing environmental issues of erosion, acidification and salinisation (Lodge 1994). While the relative productivity of some of the native species has been documented in terms of yield and animal carrying capacity (e.g. Simpson 1993), and some investigations of underlying structural or physiological factors contributing to these differences have been undertaken (e.g. Rivelli *et al.* 2001), further ecophysiological studies have been advocated (Oram and Lodge 2003). For grasses, leaf elongation is a rapid means of assessing growth in controlled environment studies (e.g. Parsons and Robson 1980). Similar measurements under field conditions could be a valuable means of documenting growth pattern differences among species and the variation of populations within species.

Methods

Measurements of leaf extension were undertaken on swards of wallaby grasses (*Austrodanthonia setacea*, *A. duttoniana*, *A. pilosa*, *A. fulva*), weeping grass (*Microlaena stipoides* ecotypes "Richlands" and "Pomeroy") and wheatgrass (*Elymus scaber*) from late winter to early spring 2003 at Canberra, ACT. Swards were sown in 1994 for seed production purposes, and maintained as relatively pure stands by mowing, use of herbicides, hand weeding and occasional moderate applications of fertiliser (Multigrow, 10% N, 3.4% P, 5.6% K, 15.5% S). Originally seed came from the Southern Tablelands of NSW, except for *A. setacea* (Victoria) and *E. scaber* (Boorowa, NSW). "Richlands and "Pomeroy" represented populations of *M. stipoides* derived from seed harvested from 2 localities near Taralga and Goulburn, NSW, respectively. Measurements were also made of a *Vulpia* species, which was a component of these swards.

Leaf elongation measurements were taken on 5 occasions at approximately 2-week intervals from 5 August to 24 September 2003. On each occasion, the length (mm) of the youngest expanding leaf on 10 randomly selected tillers per plot was recorded. Measurements were repeated on the same leaf after a period of 48 hours. Data were analysed separately

Figure 1. Leaf elongation of (*a*) 2 ecotypes of ***Microlaena stipoides*** (Ms) and ***Elymus scaber***, and (*b*) 4 species of ***Austrodanthonia*** over late winter-early spring 2003 at Canberra, ACT. Leaf elongation of a ***Vulpia*** species present in the swards is presented in each graph as a comparison. Bars are l.s.d. ($P = 0.05$) for means of 10 measurements.



each time to determine differences among species, using the 10 measurements per plot to estimate variation among plants within a species. The uniformity of soil and relief at the site was considered sufficient to obviate the need for replication of the species plots.

Results

Over the period of the study, the weekly mean temperatures ranged from -6.0 to -2.1°C (minimum) and 16.4 to 21.3°C (maximum) with weekly mean 24 h temperatures ranging from 4.1 to 9.5°C. Between 1 July and 31 September 2003, 178 mm of rain was recorded, slightly above the long-term average.

There was a linear increase in mean leaf elongation over the 5 times of measurement, ranging from 1.4 mm in early August to 6.6 mm in late September (Fig. 1). It was notable that even when day-time temperatures reached 16-21°C the differential response of leaf elongation between species was more closely related to minimum temperature (r = 0.77) than it was to the maximum temperature (r = 0.45) over the period of measurement. At each time of measurement there were significant differences ($P<0.001$) in leaf extension among species. Until early September, *Vulpia* had significantly higher leaf elongation than any of the native species. *E. scaber* had significantly higher ($P<0.05$) leaf elongation than the *Austrodanthonia* species and the *Microlaena* ecotypes, and was similar to *Vulpia* at the last 2 times of measurement. The "Pomeroy" ecotype of *M. stipoides* had consistently higher leaf elongation than "Richlands" (mean leaf elongation over the period 3.3 *vs.* 1.9 mm; $P<0.05$). There were few differences among the *Austrodanthonia* species, although mean leaf elongation over time was significantly lower ($P<0.05$) for *A. pilosa* than *A. setacea* and *A. duttoniana*.

Discussion

The main findings of this study were that the early spring growth of *E. scaber* was associated with higher rates of leaf elongation compared with other native grass species. This is consistent with the observation that this species generally has more rapid cool-season growth than other native grasses (Eddy *et al.* 1998). Also, there was evidence of an ecotypic difference in leaf elongation between populations of *M. stipoides*. Differences in leaf elongation among *Austrodanthonia* species were not as large. However, the lower growth rate of *A. pilosa* may be characteristic of a more stress-tolerant species and is consistent with survey results (Dowling *et al.* 1996) on the NSW Southern Tablelands which showed that *A. pilosa* was twice as frequent on acid soil sites (pH<4.2) than *A. duttoniana*. Leaf elongation rates of these native grasses were approximately half those of exotic pasture grasses measured over the same period (Kelman 2004). However, it should be noted that comparisons between these groups are not strictly valid, as the exotic species were newly sown and received higher fertiliser applications. Also, there is a wider range of *Austrodanthonia* species than those examined in the present study and with some evidence of ecotypic variation within species (Waters *et al.* 2002), there may be value in testing a wider range of populations using this technique.

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