LEAF APPEARANCE RATE OF NATIVE AND INTRODUCED GRASSES UNDER DIFFERENT INTENSITIES OF CONTINUOUS GRAZING (ARGENTINA).

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ABSTRACT

Results of two grazing experiments on the effect of maintaining contrasting sward states upon leaf appearance rate of individual tillers (LAR) and tiller density (D) are reported. The following species were evaluated: *Cynodon dactylon*(Cd), *Leersia hexandra*(Lh), y *Paspalum dilatatum*(Pd) in a natural grassland of the Flooding Pampa, and Festuca arundinacea in a sown pasture. Except for Pd, LAR decreased with the increment of sward surface height. The degree of this morphogenetic plasticity varied among species. Implications for the stability of grass populations under continuous grazing are suggested; the effect of sward state upon LAR may represent one alternative way of affecting D through the defoliation management.

KEYWORDS

Leaf appearance rate, continuous grazing, tall fescue, Flooding Pampa, natural grassland, sward state, tiller density

INTRODUCTION

Leaf appearance rate (LAR) is a key parameter for understanding interspecific variations in grass sward structure in terms of size and density of tillers. Except for temperature, LAR seems relatively insensible to environmental variations (Anslow, 1966). This suggests that the parameter would be fairly independent of sward structure and defoliation management. However, there is little evidence to be conclusive on the topic. This paper reports the results of two grazing experiments in which the effect of maintaining contrasting sward states upon LAR of individual tillers could be evaluated. The association between species LAR and tiller density was also described in order to evaluate the LAR contribution to tiller density variation and to discuss possible implications to the stability of grass populations under contrasting grazing managements. The pastures were a natural grassland of the Flooding Pampa and tall fescue (*Festuca arundinacea*) under field conditons, maintained at relatively constant sward surface heights (H) and biomass with variable instantaneous stocking rates by continuously grazing cattle (native grassland) or sheep (fescue).

MATERIALS AND METHODS

The experiments were carried out during 1994: Grassland, 4 to 23 April; Fescue, 20 September to 6 October (Period 1), and 6 December to 25 December (Period 2). Three treatments with two replicates were established for each pasture type, which were called low, intermediate and high sward states (SSL, SSM and SSH, respectively): - native grassland= 5, 13 and 25 cm (± 4) , 769, 989 and 1534 kg ha-1 DM (±328); fescue period 1 (FP1)= 6, 8 and 13 cm (±1.4), 1038, 1185 and 1636 kg ha-1 DM (±298); fescue period 2 (FP2)= 3, 7 and 19 cm(±1.0), 720, 1226 and 1997 kg ha-1 DM (±347).

Ten 0.1 m2 quadrats per paddock were cut to ground level. The material was separated into its botanical components and tiller density (D) was estimated for each species. Individual tillers were permanently marked in the field: natural grassland= 30 tillers per species and paddock; fescue= 100 tillers per paddock. The appearance of leaves was registered twice a week during the experimental periods (21 days), and species LAR per treatment was estimated. The species studied in the natural grassland were: Cynodon dactylon(Cd), Leersia hexandra(Lh), y Paspalum dilatatum(Pd). The ratio between LAR, D and H and the maximum value of the variables within each treatment were calculated for each species (LARi/LARmax, Di/Dmax and Hi/Hmax). Regression analyses were performed on the data, and Dummy variables were used for slope comparisons.

RESULTS AND DISCUSSION

Average LAR and D for the different species and treatments are presented in Table 1. Simple regressions on LARi/LARmax - Hi/Hmax generally accounted for a high proportion of data variation (Cd: 71.4%, Lh: 85.6%, Pd: 64.5%, FP1: 40%, FP2: 0.99%). With the exception of Pd, the rest of the species showed decreasing LAR with H increments (Fig.1). This indicates that LAR can be affected by sward state and therefore by grazing management. The more rapid LAR observed for Cd, Lh and F on the more closely grazed swards coincides with results reported elsewhere for continuously grazed *Lolium perenne* (Grant et al., 1981).

The degree of plasticity was different among species. The greatest decrease was estimated for Lh (slope= -0.69), it being significantly different from Pd (slope= 0,00, $P < 0.05$). Both Cd and F showed intermediate rates (mean slope=-0.44), but no significant differences with the extremes were detected. According to the "site filling" concept, the potencial tillering of a species is proportional to its LAR (Davies, 1974). Even though many factors may cause a site to fail to bear a tiller, a direct influence of LAR on D might be expected (Chapman and Lemaire, 1993). Results obtained by regressing D/Dmax on LAR/LARmax (all species included) suggest a possible direct relationship between these variables (R= 0.67, slope= 1±0.20).

The results obtained could have implications regarding the stability of grass populations under continuous grazing conditions. The effect of sward state upon LAR may represent a way through which the defoliation management might control D. However, account must be taken of the consequences that H variation might have had on the light environment and therefore on tiller initiation within the swards (Deregibus et al., 1983). The proposed path, which is additional to those considered by Chapman and Lemaire (1994), would affect the probability of tillering of the different species by influencing the size of the pool of axillary buds available in the sward to be stimulated and developed into tillers. The contrasting degrees of LAR sensibility to sward state variation between species, and its proportionality with D, suggest that this morphogenetic plasticity may be a factor determining species balance in multispecific pastures.

REFERENCES

Anslow, R.C. 1966. The rate of appearance of leaves on tillers of the graminae. Herb. Abst. **3:** 150-155.

Chapman, D. and G.Lemaire. 1993. Morphogenetic and structural determinants of plant regrowth after defoliation. Proc.XVII Int.Grassl.Congr. 95-104.

Davies, A. 1974. Leaf tissue remaining after cutting and regrowth in perennial ryegrass. J. Agric.Sci. **82:** 165-172.

Deregibus V.A., R.A. Sanchez and J.J. Casal. 1983. Effects of light quality on tiller production in Lolium sp. Pl.Physiol. **72:** 900-912.

Grant, S.A.; G.T.Barthram and L.Torvell, L. 1981. Components of regrowth in grazed and cut *Lolium perenne* swards. Grass and Forage Science. **36:** 155-168.

Figure 1
Relationship between leaf appearance rate (LAR) and sward surface height (H).
Cd, Lh, Pd and FP1-2 denote *Cynodon dactylon* (Cd), *Leersia hexandra* (Lh), y *Paspalum dilatatum* (Pd) and *Festuca arundinacea* during sampling periods 1 and 2.
LARi/LARmax and Hi/Hmax denote the value of the variable relative to its maximum.

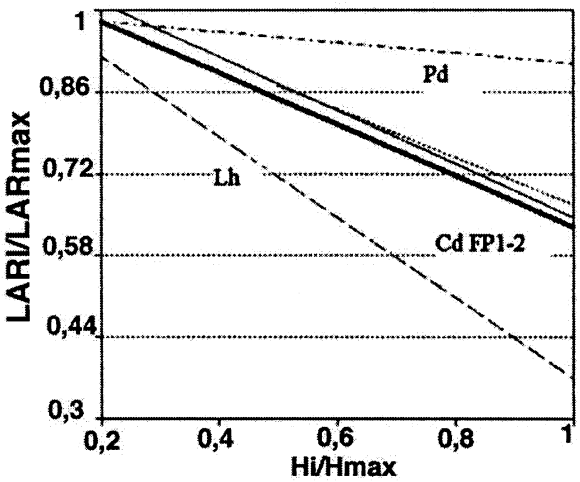

Table 1
Leaf appearance rate (LAR) and tiller density (D) under different sward states.

	LAR				D			
	SSL	SSM	SSH	s.e.m	SSL	SSM	SSH	s.e.m.
Cd	0.129	0.137	0.082	0.025	900	920	579	247
Lh	0.062	0.035	0.041	0.017	317	141	88	112
Pd	0.087	0.080	0.079	0.009	579	344	517	100
FP1	0.058	0.039	0.041	0.009	3228	3861	2709	475
FP2	0.064	0.059	0.041	0.011	1812	1906	1082	370

SSL, SSM and SSH denote low, intermediate and high LAI. Cd, Lh, Pd and FP1-2 denote *Cynodon dactylon* (Cd), *Leersia hexandra* (Lh), y *Paspalum dilatatum* (Pd) and *Festuca arundinacea* during sampling periods 1 and 2.