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Forage quality and defoliation interval in tall fescue cultivars

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Introduction

Past research has shown digestibility decreases along leaf lifespan (LLS) in several grasses (*i.e.* Groot and Neuteboom 1997; Insúa *et al.* 2013; Agnusdei *et al.* 2012). This phenomenon has not yet been quantified in tall fescue (*Festuca arundinacea* Schreb.). Therefore, additional knowledge on the dynamics of leaf quality decline along LLS is necessary to verify the proper defoliation window necessary to optimize forage quality and production (Fulkerson and Donaghy 2001; Lemaire *et al.* 2009) in tall fescue. Further, this window might differ between old and new types (*i.e.* softer vs rough-leaved). The objectives of the study were: (1) to compare leaf quality dynamics of two tall fescue cultivars differing in leaf softness as related to leaf turnover; and (2) to determine the defoliation regime that enables to obtain similar forage quality between cultivars.

Materials and methods

The study was carried out from 8/12/09 to 15/03/10 (summer; daily average temperature $21 \pm 2.8^\circ\text{C}$) at Balcarce ($37^\circ 45'\text{S}$; $58^\circ 18'\text{W}$, Argentina) under natural field conditions. Tall fescue cvs El Palenque Plus^{INTA} (rough-leaved, EP) and Grasslands Advance (soft-leaved, A) were sown in 500 pots (200 x 400 mm diameter/depth) completely randomised with 3 replicates. Individual tillers (~800) were sequentially harvested along 3 leaf appearance intervals (L1, L2, L3) according to Groot and Neuteboom (1997) at 6 leaf age categories: growing, just expanded, adult, pre-senescent (end of LLS), 50% senescent and completely senescent. Additionally, 15 undisturbed marked tillers/cultivar were monitored for number of living leaves (NLL), LLS and senescence rate. Neutral detergent fibre (NDF, ANKOM²⁰⁰ fibre analyser), NDF digestibility (DNDF-24h, DaisyII ANKOM) and dry matter digestibility (DMD) of leaf blades were determined. ANOVA PROC-MIXED (Tukey, $P < 0.05$), lineal functions and dummy variables comparison were used for data analysis (SAS).

Results and discussion

LLS and NLL were lower in A than in EP [490 and 632 growing degree days (GDD, base temperature 4°C), and 2.5 and 3.3 leaves/tiller, respectively]. Cultivars did not differ in NDF content, which remained stable throughout LLS

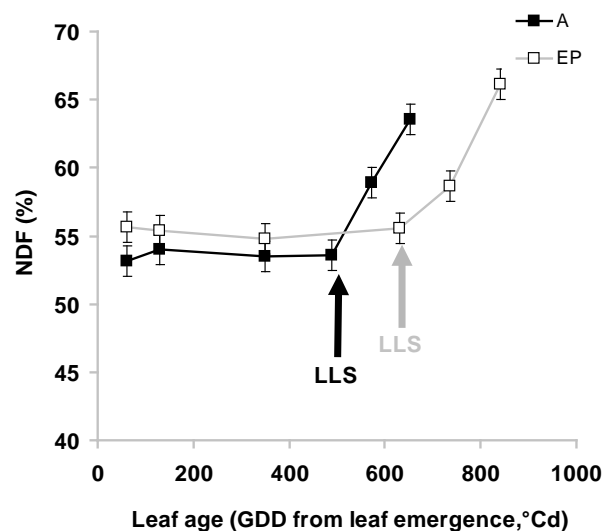


Figure 1. NDF content with leaf age during a regrowth of tall fescue cv. Grasslands Advance (A) and “EL Palenque Plus” (EP). Arrows indicate LLS and senescence onset. Bars indicate s.e.m.

(~55 %) and increased during senescence (up to ~65%) (Fig. 1; X axis indicates leaf age). NDFD (from ~36 to 11%) and DMD also declined sharply during senescence (Fig. 2). These results support the principles behind the leaf stage concept that indicate the need to set a maximum defoliation interval by the onset of senescence (Fulkerson and Donaghy 2001; Donaghy *et al.* 2008).

Conversely, DFDN and DMD declined with leaf age in both cultivars during LLS [~60 to 40% and ~70 to 60%, respectively (Fig. 2 for DMD; Y axis indicates accumulated GDD along regrowth)] but at a higher rate in A than in EP (Fig.2). However, the shorter LLS of A led to a quicker succession of leaf age categories than in EP. This phenomenon determined a more accelerated decline in forage quality with time, and the anticipation of senescence and NDF increase (Fig. 1). During this phase the decline in NDFD and DMD of the softer cultivar ~ two folded the rate observed in the rough one (Fig. 2).

Results reveal that the forage quality of A was lower than EP during a major part of its LLS (~60%). From a management point of view, our data suggest that the upper limit to defoliation interval in A should be anticipated ~145 GDD relative to EP (arrows in Fig. 1 and 2) in order to

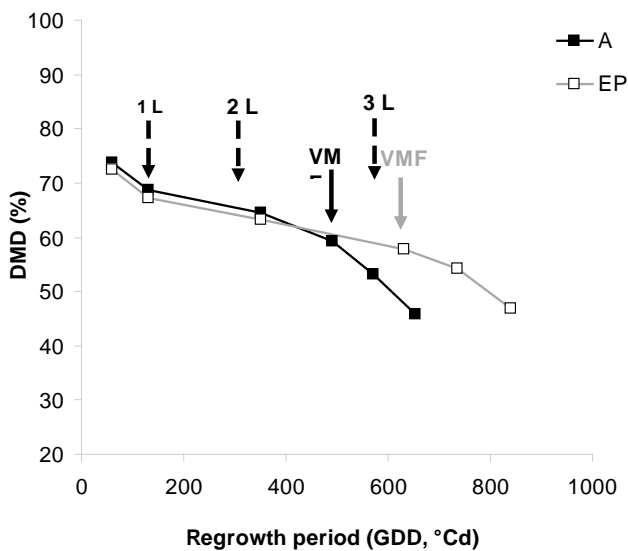


Figure 2. DMD content along a regrowth of tall fescue cv. Grasslands Advance (A) and “EL Palenque Plus” (EP). Full arrows indicate LLS and senescence onset. Dashed arrows indicate leaf stage.

avoid sharp declines in leaf quality due to senescence. The differences in NLL observed between cultivars indicate that the proper window of defoliation would be narrower A than in EP (from 2 to 2.5 and 2 to 3.3 leaf stage, respectively).

Conclusions

Soft and rough-leaved cultivars did not differ in leaf quality

if defoliated at a similar defoliation interval relative to their specific LLS (or in terms of leaf stage). However, the softer-leaved cultivar, due to its shorter LLS, requires more frequent defoliations (in terms of calendar or thermal time) so as to achieve similar leaf quality than the rough one.

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