Are leaf traits suitable for assessing the feeding value of native grass species?

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Introduction Research on forage feeding value other than *in vivo* assessment can be roughly divided into three kinds of approach. The first aims to predict feeding value using a set of enzymatic or physical methods. A second approach is based on phenological stages of species. These approaches are mainly used for pure stands of improved grasses or legumes. However, for native grassland, a complex type of vegetation, a third approach, based on botanical records, has been proposed to rank grassland communities for their feeding value. The aim of this work concerns the third approach. We tested whether leaf traits (e.g. specific leaf area (SLA), leaf dry matter content (LDMC) and leaf life span (LLS)), assessed under non-limiting plant growth conditions, ranked the species in the same order as did chemical components and digestibility.

Materials and methods Seventeen grasses collected from their native habitats were sown separately according to a randomised block design with three replicates in Auzeville, France. The list of species is: *Agrostis capillaris*, *Anthoxanthum odoratum*, *Arrhenatherum elatius*, *Avenula pubescens*, *Brachypodium pinnatum*, *B. sylvaticum*, *Briza media*, *Cynosurus cristatus*, *Dactylis glomerata*, *Festuca ovina*, *Festuca rubra*, *Festuca arundinacea*, *Phleum pratense*, *Holcus lanatus*, *Lolium perenne, L. perenne* (cv) clerpin, and *Trisetum flavescens*. Plants were grown with non-limiting nutrients and water. Measurements were made during two growth cycles, corresponding to summer 2001 (I) and spring 2002 (II), of LDMC (leaf dry mass to saturated fresh mass ratio in mg/g) and SLA (ratio of surface area / dry weight of the blade in m^2/kg), following the protocol of Garnier *et al*. (2001). Four tillers were sampled per replicate in 2001 and five per replicate in 2002. The LLS (expressed in degree-days; 0°C basis) was determined from the beginning of each growth period. Blades were sampled for chemical composition and OMD. The sampling was done on the youngest fully expanded leaf in summer 2001, and on all the green blades in spring 2002. The 2001 samples of blades were analysed for fibre, cellulose, hemicellulose and lignin, with an enzymatic method used to estimate *in vitro* OMD. In 2002, chemical components of all green leaves and their OMD were estimated by NIRS (NIRS-OMD), calibrated and validated for a wide range of grasses and legumes.

Results Species ranked for LDMC and LLS in the same order ($P \leq 0.05$) as for fibre, hemicellulose and OMD of leaf blades, whereas ranking by SLA agrees with fibre, cellulose, lignin and OMD (Table 1). These correlations were significant, even though the data were obtained in different years, on different organs (youngest adult blades in 2001 and all the green blades in 2002) and by different analytical methods.

Table 1 Spearman's coefficients of correlation between leaf plant traits (average of two measurement periods for SLA, LDMC and LLS) against leaf composition (fibre content and its components) and OMD

	Design-1					Design-2				
	In vitro OMD	Fibre	Cellulose	Hemicellulose	Lignin	NIRS-OMD	Fibre	Cellulose	Hemicellulose	Lignin
SLA	0.46**	-0.32*	-0.64***	-0.13 n.s	-0.50***	0.65***	-0.58***	-0.55***	-0.41**	-0.60***
LDMC	-0.48***	0.62***	0.27 (¤)	0.65***	0.28 (¤)	-0.62***	0.60***	0.13 n.s	0.69***	0.60***
LLS	-0.61***	0.42**	0.28 (¤)	0.35*	0.54***	-0.72***	0.67***	0.40**	0.62***	0.67***

(¤), $P \leq 0.10$; *, $P \leq 0.05$; **, $P \leq 0.01$; ***, $P \leq 0.001$; NS, not significant. Design-1: in summer 2001, chemical and enzymatic methods were conducted on youngest adult blades for determine the fibre content, its components and IVOMD of blades, Design-2: in spring 2002, NIRS method was conducted on all the green blades of tillers

Conclusions We conclude that leaf plant traits are good indicators for ranking the grasses studied according to their feeding value. Furthermore, LDMC seems to be the most suitable trait to assess the specific feeding value because it ranks the species at least as well as other leaf traits and it is the easiest to measure.

Reference

Garnier, E., B. Shipley, C. Roumet & G. Laurent (2001). A standardized protocol for the determination of specific leaf area and leaf dry matter content. *Functional Ecology*, 15, 688-695.