Forage quality of cultivated and natural species in semi-natural grasslands

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Abstract

To conserve or improve floristically diverse grassland areas, there is a need for some agricultural management to avoid scrub vegetation. Description of the forage quality of the most common species in these swards will make it easier to make appropriate use of the forage produced. The objective was to determine forage quality by analysing for *in vitro* organic matter digestibility (IVOMD) and neutral detergent fibres (NDF) of individual species commonly occurring in low lying semi-natural grasslands in Denmark. Eight species of grasses, eight herb species and one species of rush were collected in June and July under grazing and cutting. The IVOMD was relatively low and NDF relatively high compared to more intensive grasslands. However, a large variation between species was found. The IVOMD varied from 416 to 780 g kg^{-1} organic matter (OM) and NDF from 287 to 714 g kg^{-1} dry matter (DM). The herbs maintained a relatively high IVOMD in mid-summer cuts, contrary to the grasses, where a later cut resulted in a lower IVOMD. Two species often occurring in substantial amounts in such swards, *Deschampsia caespitosa* and *Juncus effusus*, had low IVOMD and high NDF, and it was concluded that management strategies that reduce the occurrence of these species will increase the forage quality.

Keywords: semi-natural grassland, grasses, herbs, digestibility, neutral detergent fibres, cutting, grazing

Introduction

In the past 50 to 60 years many floristically diverse grassland areas have disappeared from Danish agricultural land, but because of concerns for the nature value of these areas, there are attempts to reverse this trend. While conserving or improving the nature value of semi-natural grassland areas it is important to gather basic information about the swards to facilitate the needed agricultural management of these areas. The objective was to determine forage quality by IVOMD and NDF analyses of individual species commonly occurring in long term swards in Denmark.

Material and methods

The grassland, where the species were collected, was situated on wet organic soil. The fields had not been fertilised since 1989 and was alternately cut or grazed. The species were collected in two replications two times during the growing season (when possible), around 10 June and 15 July in 1997 and 1998, in cut areas and paddocks grazed by steers (Tables 1 and 2). In the cut area the species were collected at 7 cm stubble and the herbage mass was on average 1 t DM ha^{-1} in June and 3 t DM ha^{-1} in July. The species collected under cutting were from the same growth period and the plants were more developed and older in July compared to June. In the continuously grazed paddock, species were collected at 2 cm stubble and the herbage mass was approximately 1 t DM ha^{-1}. Each of the species were analysed for IVOMD (Tilley and Terry) and NDF (van Soest). The IVOMD was determined by using rumen fluid from fistulated cows kept indoors and fed with 1/3 concentrate and 2/3 hay. In 1999 a comparison was carried out between rumen fluid from indoor cows, and rumen liquid from fistulated steers grazing at the sampling site.

Results and discussion

The cultivated grasses on the investigated grasslands had a relatively low IVOMD (Table 1) compared to results from more intensively grassland areas (Nørgaard Pedersen *et al.*, 1971). In the analyses rumen liquid from indoor cows was used, but a comparison of IVOMD by using liquid from indoor cows or grazing steers did not provide a full explanation for the low digestibility of cultivated grasses in semi-natural grassland. The IVOMD only increased from 615 to 628 g kg^{-1} OM when using rumen liquid from grazing steers on 16 species with two replications analysed in June and July. Another reason for the low IVOMD could be that there was a low production rate, resulting in a high proportion of old leaves in the sward.

Table 1. The IVOMD of species collected at semi-natural grasslands.

Groups and species	Cutting		Grazing		Management*time intertact. (p-value)
	June	July	June	July	
Cultivated grasses	g kg^{-1} OM				
Phleum pratense (L.)	697^{a}	535^{ab}	731^{a}	708^{a}	***
Festuca rubra (L.)	552^{c}	488^{b}	570^{c}	614^{b}	-
Poa pratensis (L.)	598^{b}	591^{a}	653^{b}	679^{ab}	-
Natural grasses					
Glyceria fluitans (L.)R.Br.	656^{b}	541^{ab}	637^{b}	696^{a}	**
Phalaris arundinacea (L.)	716^{a}	563^{ab}	714^{a}	649^{a}	*
Alopecurus geniculatus (L.)	630^{b}	588^{a}	681^{ab}	706^{a}	*
Holcus lanatus (L.)	630^{b}	531^{b}	674^{ab}	664^{a}	*
Deschampsia caespitosa (L.)Be.	567^{c}	421^{c}	577^{c}	543^{b}	-
Herbs					
Cerastium vulgare (L.)	706^{cd}	523^{b}	685^{c}	613^{c}	***
Trifolium pratense (L.)	673^{d}	570^{b}	659^{c}	645^{bc}	**
Trifolium repens (L.)	776^{ab}	680^{a}	751^{b}	710^{b}	-
Cirsium palustre (L.) Scop.	621^{e}	581^{b}	668^{c}	569^{c}	-
Ranunculus repens (L.)	785^{a}	742^{a}	804^{a}	787^{a}	-
Taraxacum sp.(L.) (leaves)	749^{ab}	736^{a}	760^{b}	711^{b}	-
Urtica dioica (L.)	748^{bc}	674^{a}	743^{b}	705^{b}	-
Rumex acetosa (L.)	530^{f}	326^{c}	-	-	-
Rush					
Juncus effusus (L.)	489	323	466	384	*

Different letters indicate significant difference ($P<0.05$) within the species groups in each column.

The IVOMD varied very much between the species (Table 1). On average, *Ranunculus repens* had the highest value of IVOMD, 780 g kg^{-1} OM, and *Juncus effusus* the lowest, 416 g kg^{-1} OM. A high variation among various species grown in a glasshouse experiment was also observed by Wilman and Riley (1983). The NDF was generally high and the variation between species within a species-group reflected the variation of IVOMD. A lower concentration of NDF was found for herbs compared to grasses, which is in agreement with the results of Marten *et al.* (1987). Both analyses showed that *Deschampsia caespitosa*, *Rumex acetosa*, and *Juncus effusus* had low quality. Other parameters than the ones shown here are important in the evaluation of species in semi-natural grassland. Palatability is one of these factors, which might be the reason that some species, like *Urtica dioica,* with a high digestibility and a moderate level in NDF, are rejected in the grazing situation.

Table 2. NDF of species collected at semi-natural grasslands.

Groups and species	Cutting		Grazing		Management*time interact. (p-value)
	June	July	June	July	
Cultivated grasses	------------- g kg^{-1} DM -------------				
Phleum pratense (L.)	544^{b}	625^{a}	528^{b}	524^{a}	**
Festuca rubra (L.)	631^{a}	628^{a}	590^{a}	551^{a}	-
Poa pratensis (L.)	617^{a}	567^{b}	564^{ab}	534^{a}	-
Natural grasses					
Glyceria fluitans (L.)R.Br.	594^{a}	625^{b}	563^{b}	540^{b}	-
Phalaris arundinaceae (L.)	517^{b}	601^{bc}	503^{c}	556^{ab}	-
Alopecurus geniculatus (L.)	507^{b}	516^{d}	493^{c}	465^{c}	-
Holcus lanatus (L.)	563^{a}	591^{c}	518^{c}	521^{b}	-
Deschampsia caespitosa (L.)Be.	611^{a}	668^{a}	621^{a}	601^{a}	-
Herbs					
Cerastium vulgare (L.)	441^{a}	523^{b}	436^{a}	472^{a}	-
Trifolium pratense (L.)	361^{bc}	440^{c}	371^{b}	392^{bc}	**
Trifolium repens (L.)	284^{d}	326^{ef}	262^{d}	304^{d}	-
Cirsium palustre (L.) Scop.	389^{b}	392^{cd}	395^{b}	416^{ab}	-
Ranunculus repens (L.)	284^{d}	294^{f}	269^{d}	302^{d}	-
Taraxacum sp.(L.) (leaves)	303^{d}	292^{f}	301^{c}	335^{cd}	-
Urtica dioica (L.)	318^{cd}	364de	319^{c}	357^{bcd}	-
Rumex acetosa (L.)	473^{a}	668^{a}	-	-	-
Rush					
Juncus effusus (L.)	703	725	709	717	-

Different letters indicate significant difference ($P<0.05$) within the species groups in each column.

In general, and contrary to grasses, the herbs maintained a stable IVOMD during the growing season in cut swards. This is shown by the interaction between management and time (Table 1). The interaction was in most cases significant for the grasses, but was only significant for two of the herbs.

It was concluded, that data on forage quality of individual species grown in intensively managed swards should not be expected to count for these species when grown in extensively managed swards. Also that herbs in swards for cutting maintained a more stable IVOMD during the growing season compared to grasses. A high variation in forage quality among common species in semi-natural grasslands was found, and the results indicated that management strategies that reduce the occurrence of species like *Juncus effusus* and *Deschampsia caespitosa* will increase forage quality.

References

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