

Fibre quality in timothy, *Festulolium* and tall fescue around first cut

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Introduction

Fibre quality and available energy expressed as iNDF (indigestible neutral detergent fibre) decrease with maturity stage in timothy (Nordheim-Viken and Volden 2009). It is widely accepted that fibre quality also decreases with plant age in other forage grasses. However, climate factors such as temperature and water availability can interact with maturity stage in determining iNDF (Nordheim-Viken and Volden 2009). In the Norfor system, iNDF is an important measure of available energy in forage evaluation for ruminants (Åkerlind *et al.* 2011). This study examined how fibre quality in different forage grasses was affected by maturity stage and climate.

Materials and Methods

Variety trials with timothy (*Phleum pratense* L.), *Festulolium* (*Lolium multiflorum* Lam. x *Festuca arundinacea* Schreb. hybrid) and tall fescue (*Festuca arundinacea* Schreb.) from the Swedish Value of Cultivation and Use (VCU) testing programme were conducted at the Swedish site Rådde (57°36'N, 13°16'E) during 2009–2011. The six trials included were established in spring, undersown in a cover crop. A single-factor, randomised block design with three replicates was used, and plots were harvested three times. Plots were fertilised with 100, 80 and 60 kg N/ha before cuts 1, 2 and 3, respectively, and P and K were applied according to plant-available levels in the soil. The average plot size was 12 m² and all plots were harvested using a Haldrup plot harvester with 1.5 m working width. Data for three cultivars *Festulolium* cv. Hykor, tall fescue cv. Swaj and timothy cv. Switch are presented here. Sampling of timothy started on 2 June in 2009 and 2010 and 1 June in 2011. Sampling of *Festulolium* and tall fescue started on 27 May in 2010 and 25 May in 2009 and 2011.

The first cut was taken when the timothy control cv. Switch and *Festulolium* cv. Hykor were in heading stage, *i.e.* when half the panicle was visible on 50% of shoots.

The tall fescue cv. Switch was four days later than *Festulolium* cv. Hykor. Around this cut, samples were taken in each plot 7 days before heading, at heading and 7 days after heading (samplings 1–3), and always in the first ley year after establishment. Each sample consisted of 12 randomly spread sub-samples per plot, cut with scissors from 12 sub-cut areas of 1 dm². These samples were dried at 60°C for 30 h, weighed, milled and analysed according to Table 1. The corresponding reference method for iNDF is rumen *in situ* incubation in dairy cows using small pore (12 µm) nylon bags (Åkerlind *et al.* 2011).

The data were statistically analysed using calendar year, sampling time (maturity stage) and variety as fixed factors, and block within year and trial as random factor. Least squares means were calculated and used in the analyses, which were performed using the Mixed model procedure in SAS Version 9.3 (SAS Institute Inc. 2010). The three sampling times were included in a repeated measures analysis.

Discussion

The statistical analysis revealed a strong interaction ($P < 0.01$) between year, maturity stage and variety for all dietary fibre parameters. This shows the strong influence of climate conditions in different years. In terms of varieties, timothy cv. Switch had higher levels of NDF and iNDF_{DM} and lower levels of pdNDF in all three years and at all three sampling times compared with *Festulolium* cv. Hykor and tall fescue cv. Swaj. Thus the available energy (high iNDF_{DM}) and fibre quality (low pdNDF) were always lower for timothy than for the other grass species (Table 2). Low levels of iNDF in tall fescue have been reported previously (Jancik *et al.* 2011). The differences between timothy cv. Switch and the other grasses as regards iNDF_{DM} were rather consistent through the maturity stages, indicating that this is an effect of genotype rather than maturity stage or climate. There were very few significant differences in NDF, iNDF_{DM} and pdNDF between *Festulolium* cv. Hykor and tall fescue cv. Swaj, indicating that they are very

Table 1. Analyses and calculations performed on nutritional parameters.

Analysis and calculations
NDF fibre, g kg/DM – Method/reference Mertens ISO/CD 16472
iNDF (indigestible neutral detergent fibre), g/kg NDF - determined by NIRS* based on NorFor (Åkerlind <i>et al.</i> 2011)
iNDF _{DM} , g/kg DM = iNDF*NDF/1000
pdNDF (potentially digestible NDF), g/kg NDF = 1000-iNDF
NIRS* = near infrared reflectance spectroscopy

Table 2. Fibre content (NDF, iNDF_{DM} and pNDF) in cv. Hykor (*Festulolium* hybrid), cv. Swaj (tall fescue) and cv. Switch (timothy) around first harvest, 2009-2011.

Year and sampling time*	NDF, g/kg DM			iNDF _{DM} , g/kg DM			pdNDF, g/kg NDF		
	Hykor	Swaj	Switch	Hykor	Swaj	Switch	Hykor	Swaj	Switch
2009									
1	498	518	608	21	21	98	957	960	839
2	540	548	613	57	46	122	894	916	799
3	558	547	622	70	62	114	874	888	817
2010									
1	487	450	564	12	11	69	976	976	877
2	506	506	637	16	22	104	969	956	837
3	561	557	609	17	51	127	970	909	790
2011									
1	522	509	614	44	35	123	916	931	799
2	557	561	669	68	63	137	877	887	795
3	599	599	649	88	84	143	853	860	780

LSD ($P < 0.05$) for all comparisons was 32 for NDF and 26 for iNDF_{DM} and pdNDF

*1=7 days before heading, 2=at heading and 3=7 days after heading

similar in fibre quality. Since the genes in cv. Hykor are dominated by tall fescue through backcrossing, the similarities in fibre quality between cvs Hykor and Swaj can be expected. With increasing maturity stage, the fibre content expressed as NDF and iNDF_{DM} generally increased in all three varieties (Table 2) and the opposite occurred for pdNDF as expected. In 2009 and 2011, the greatest change in all parameters was between the first and second sampling, but in 2010 it was between the second and third sampling. However, the level of the parameters varied between years, showing the impact of weather conditions in different years. The level of iNDF_{DM} was lowest in 2010 and highest in 2011. In 2010, *Festulolium* cv Hykor showed no significant change in iNDF_{DM} with increasing maturity stage. iNDF was expressed on DM basis to make comparisons easier with NDF.

Conclusion

Timothy cv Switch had lower fibre quality than *Festulolium* cv Hykor and tall fescue cv Swaj around first cut. Fibre quality decreased with increasing maturity stage in all varieties, but there were large variations in levels between years.

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