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The forage quality of meadows under different management practices in the Italian Alps

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Abstract

In many alpine valleys in northern Italy there is evidence of an ongoing intensification of farming systems in favourable locations. In contrast, marginal grasslands on mountain slopes tend to be abandoned. Extensive management is necessary to preserve the cultural landscape here. The present study was carried out to investigate the forage quality of meadows in Valle d'Aosta (NW Italian Alps), Trentino and South Tyrol (NE Italian Alps), under different management intensities, in order to find suitable usage of the forage harvested. Two cutting frequencies and two NPK fertilization levels were applied to semi-natural meadows over a period of four years. The yield and all quality parameters were affected by cutting frequency, whereas only yield and crude fibre responded to fertilization. The yield from meadows cut once a year can be increased by fertilization, but their forage quality is not suitable for dairy cows. Fertilization is considered reasonable in three-cut meadows to ensure adequate yield, taking nutrient balance into account.

Keywords: forage quality, mountain meadows, management techniques

Introduction

Meadows ensure the production of forage which is essential for satisfying the nutritional needs of the different ruminant species present on the farms in mountain areas. Over the last decades political and economic strategies have encouraged these farms to become markedly specialized in the production of dairy milk. On the one hand, since more productive dairy cows are being bred, it is necessary to optimise meadow management practices in order to meet their increasing needs for high-quality forages. On the other hand, there is an ongoing abandonment of marginal areas, leading to shrub encroachment, fires and an increase of forested areas. Under such conditions, extensive management of meadows, with minimal intervention, is required to ensure the preservation of their functionality, biodiversity and landscape appeal, particularly in tourist areas. As the forage quality determines its possible use for animal nutrition (i.e. for cows or only for heifers), a study was carried out to investigate the effect of cutting frequency and fertilization on the forage quality of permanent meadows in the Italian Alps.

Materials and methods

From 1997 to 2000, four treatments were compared on semi-natural meadows in Ville sur Nus (Aosta, NW Alps, 1120 m a.s.l.), Aldino (Bolzano, NE Alps, 1250 m a.s.l.) and Borgo Valsugana (Trento, NE Alps, 520 m a.s.l.), combining two NPK fertilization levels (F0 = 0 NPK, vs. F1 = 40-11-42 kg ha⁻¹ cut⁻¹ for N, P and K respectively) and two cutting frequencies (C1 vs. C3: 1 vs. 3 cuts yr⁻¹ respectively). In the C1-treatment, plots were harvested around mid July; in the C3-treatment, cuts were performed before mid June and then every 6 to 8 weeks. On each site, treatments were applied to plots measuring 7×2 m, arranged as a rando-

mized complete block design with four replicates. The vegetation was surveyed according to Daget and Poissonet (1969) with 33 sampling points per plot. DM yield was obtained after weighing the fresh biomass in the field and determining its dry matter content on a 500 g subsample dried at 60°C. Ash (CA), crude protein (CP) and crude fibre (CF) were determined on these subsamples (Naumann *et al.*, 1997). Absorbable protein (AP) content and net energy for lactation (NEL) were estimated by regression equations (RAP, 1999) taking the CA, CF, CP contents and the botanical composition of the plots in terms of functional groups into account. For statistical analysis, summary values of the quality parameters were examined by a mixed model. Cumulated yearly yields were computed for each plot and averaged across the investigation period, while quality parameters were obtained within each year as weighted means with respect to the yield and then averaged across the investigation period. The cutting frequency, the fertilization level, their interaction and the block were considered to be fixed, while the site and its interactions with the other factors were considered to be random. A *P*-value < 0.05 was regarded as significant.

Results and discussion

According to their floristic composition, the three grasslands were fairly representative of the main associations of mountain meadows i.e. *Arrhenatheretum* and *Trisetetum* (Table 1).

Table 1. Mean Specific Contribution (S.C.) according to Daget and Poissonet (1969) of main species at each site (%).

Aosta		Bolzano		Trento	
Functional groups/Species	S.C.	Functional groups/Species	S.C.	Functional groups/Species	S.C.
Grasses	49.2	Grasses	67.1	Grasses	67.8
Legumes	14.5	Legumes	23.4	Legumes	9.5
Herbs	36.3	Herbs	9.5	Herbs	22.7
<i>Dactylis glomerata</i>	21.8	<i>Festuca pratensis</i>	14.8	<i>Dactylis glomerata</i>	25.7
<i>Poa pratensis</i>	11.1	<i>Trifolium repens</i>	13.1	<i>Festuca pratensis</i>	19.4
<i>Taraxacum officinale</i>	7.3	<i>Poa pratensis</i>	10.3	<i>Poa trivialis</i>	11.3
<i>Trisetum flavescens</i>	7.1	<i>Trifolium pratense</i>	9.0	<i>Ranunculus acris</i>	9.5
<i>Anthriscus sylvestris</i>	5.8	<i>Lolium perenne</i>	7.3	<i>Taraxacum officinale</i>	6.0

In Trento and Bolzano, grasses prevailed with a fair contribution of legumes in the latter. In Aosta, herbs represented more than a third of the total grassland cover with a high proportion of *Apiaceae* such as *Anthriscus sylvestris* and *Heracleum sphondylium*.

Considering all sites, the DM yield increased significantly by about 40% both in C3 and in F1 treatments (Table 2) and the interaction between these two factors was also almost significant (*P*-value = 0.051), with a stronger effect of fertilization at the higher cutting frequency. Increasing the cutting frequency from 1 to 3 cuts resulted in lower CF content (from 335 to 270 g kg⁻¹ DM respectively), while the fertilization increased it from 295 to 310 g kg⁻¹ DM. Fertilization, promoting a more intense growth and modifying the stem/leaves ratio, resulted in a richer production of structural carbohydrates. At the same time, legumes presence were reduced in favour of grasses, in Bolzano and Trento, and also that of herbs (especially *Apiaceae* and *Asteraceae*) in Aosta, where their S.C. represented more than 50% of the vegetation in fertilized plots. In these semi-natural grasslands, it is important to control the balance between inputs and outputs carefully, in order to prevent undesirable changes in floristic composition and ensure its long term stability.

Crude protein was greatly affected by cutting frequency. It was quite low in the C1 plots, with only 91 g kg⁻¹ DM, with an average increase of more than 40% in the C3 plots, from 91 to 129 g kg⁻¹ DM. Fertilization did not affect this quality parameter. This result might be related to differences in the floristic composition between sites and during the investigation period.

Table 2. Mean annual dry matter yield (DMY), crude fibre (CF), crude protein (CP), absorbable protein (AP) and net energy for lactation (NEL).

Treatment	DMY (Mg ha ⁻¹)	CF (g kg ⁻¹ DM)	CP (g kg ⁻¹ DM)	AP (g kg ⁻¹ DM)	NEL (MJ kg ⁻¹ DM)
C1F0	5.28	331.5	89.9	75.8	4.87
C1F1	6.52	338.7	91.4	75.3	4.78
C3F0	6.68	258.6	132.1	90.2	5.48
C3F1	9.85	280.9	124.9	86.3	5.21
<i>P</i> -values of effects					
C (Cut)	0.007	<0.001	<0.001	0.001	<0.001
F (Fertilization)	0.011	0.032	0.486	0.179	0.217
C×F	0.051	0.071	0.098	0.286	0.123

However, total CP yield was affected positively by fertilization in Bolzano and Trento, as a result of the DMY increase, but not in Aosta because of the little effect fertilization had on DMY (Bassignana *et al.*, 2003). As for CP, C1 plots showed a low AP content, while the C3 plots reached acceptable levels. Daccord (1990) showed a particularly slow ruminal degradability of proteins of grass mown in species-rich meadows, if the cut is late. He suggested a minimum NEL of 4.5 MJ kg⁻¹ DM in dairy cows rations, to avoid nutritional imbalances. The grass from C1 plots had slightly higher energy levels, but in the practice they would probably fall below the recommended threshold because of the losses due to haymaking operations. In contrast, in C3 plots the forage had a higher margin of safety, exceeding 5.3 MJ kg⁻¹ DM.

Conclusions

Our study on permanent grasslands, both in the western and in the eastern sector of the Italian Alps, showed that these meadows can be cut once a year, for landscape preservation, and can also be fertilized, to increase DMY, but their hay has to be reserved for less demanding animals, such as heifers or dry cows. For dairy cows, it is necessary to produce hay from more intensive meadows, with three cuts and an adequate fertilization, to assure larger yields and forage with a high nutritional value.

References

- Bassignana M., Bozzo F., Clementel F., Della Marianna G., Gusmeroli F., Kasal A., Lamesso M., Ligabue M., Orlandi D., Paoletti R., Parente G. and Venerus S. (2003) Effetti produttivi, ambientali e paesaggistici dell'estensificazione colturale in prati di montagna. Azienda Regionale Veneto Agricoltura, Legnaro, I, 64 pp.
- Daccord R. (1990) Nährwert von Heu aus artenreichen Wiesen. Landwirtschaft Schweiz 3, 620-624.
- Daget P. and Poissonet J. (1969) Analyse phytologique des prairies: applications agronomiques. *Document* 48, CNRS-CEPE, Montpellier, F, 67 pp.
- Kessler J. and Jolidon V. (1998) N-Düngung und Mineralstoffgehalt von Wiesenfutter. *Agrarforschung* 5, 117-120.
- Naumann N., Bassler R., Seibold R. and Barth C. (1997) Methodenbuch Band III, Chemische Untersuchung von Futtermitteln, VDLUFA-Verlag, Darmstadt, D.
- RAP (1999) Fütterungsempfehlungen und Nährwerttabellen für Wiederkäuer. Landwirtschaftliche Lehrmittelzentrale, Zollikofen, CH, 327 pp.