Productivity and floristic diversity of a continuous grazing system on short swards in mountainous regions of Austria

Poetsch E.M., Resch R., Haeusler J. and Steinwidder A.
Agricultural Research and Education Centre (AREC) Raumberg-Gumpenstein, A-8952 Irdning, Austria
Corresponding author: erich.poetsch@raumberg-gumpenstein.at

Abstract

Austrian farmers cast major doubts on a successful implementation of a continuous grazing system on short swards due to the assumption it may cause high ecological and mechanical stress on grassland. Productivity, forage quality and botanical composition of a continuous grazing system have therefore been investigated for a period of six years on a mountainous site in Central Austria. Growth rate, digestibility of organic matter, energy concentration and content of crude nutrients were analysed, as well as the botanical development of the swards. Even under unfavourable climatic conditions, in mountainous areas continuous grazing on short swards resulted in high yields and excellent forage quality without any negative botanical impact on the grassland ecosystem during the observation period. The results suggest that this grazing system can be recommended for practice in Austria.

Keywords: Pasture, dairy cows, simulated grazing, forage quality, crude protein

Introduction

Grassland and dairy farming in mountainous regions have to meet serious challenges due to natural disadvantages in climate and site conditions. Low productivity, high costs of forage conservation for a long winter feeding period and expensive special mechanisation are the main drivers of new and cost-effective farming strategies. Grazing has long been a traditional part of grassland management and dairy farming in mountainous regions. After a longer period of increasing indoor feeding, nowadays there is recurrence of grazing stimulated by both cost pressure and rising demands for animal welfare (Steinwidder *et al.*, 2008). Continuous grazing on short swards is seen as an intensive system that imposes mechanical and ecological stresses on grassland. Austrian farmers cast major doubts on a successful implementation of this grazing system, which is already well established in New Zealand and is nowadays being introduced in some European countries.

Materials and methods

From 2004 to 2009, experiments with continuous grazing on short swards were conducted at the Agricultural Research and Education Centre Raumberg-Gumpenstein, which is located in the production area 'Hochalpen'. This mountainous site is characterized by a low annual temperature of 6.8 °C, an annual precipitation of 1030 mm and an average yearly period of permanent snow cover of nearly 100 days. The field experiment was carried out on two pastures with a herd of dairy cows. The size of the grazing area was adjusted depending on the actual yield growth rate, aiming at a high proportion of grazed forage in the total feed ration. Yields were estimated using (i) a plate pasture meter, (ii) a yard stick and (iii) simulated grazing plots which were yearly relocated and cut at a growing height of approximately 10 to 12 cm. Forage was analysed for DOM, energy concentration and crude nutrients, and the botanical composition of the pasture was observed periodically by plant surveys.

Results and discussion

The yield growth curves for six vegetation periods presented in Figure 1 originate from the simulated grazing plots of the experiment which were cut 7 to 9 times per year. The shape indicates significant differences in both the curve progression and in the daily growth rate, for which the maximum was achieved in 2007 with 76 kg ha^{-1} day^{-1} DM. Depending on the yield, stocking rate on pasture had to be adjusted several times during the vegetation period. In all years, a clear yield decrease occurred within the vegetation period which was mainly caused by high temperatures and low precipitation. Such situations require a flexible grazing management to provide the animals with a sufficient amount of forage by enlarging the pasture area. The total DM yield varied between 6.95 and 9.3 t ha^{-1} y^{-1}, which can be regarded as sufficient and within a normal oscillation of grassland productivity in mountainous regions of Austria. In addition to exact yield measurements, the growth height - as an important indicator of pasture productivity in practice - was recorded by the plate pasture meter and by a yard stick. There was a significant relationship between the measured DM yield and the results of the plate pasture meter at the 99% confidence level (left part of Fig.2). The correlation coefficient equals 0.73, indicating a moderately strong relationship between the variables. The same significant relationship but with a lower R^2 of 0.49 occurred between the measured DM yield and the results of the yard stick measurement (right part of Fig. 2).

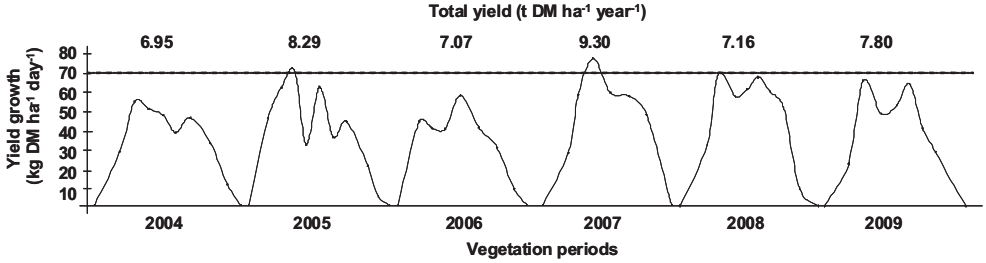

Figure 1. Dry matter yield curves and total yield amount in the short sward grazing experiment at AREC Raumberg-Gumpenstein during six vegetation periods (2004-2009)

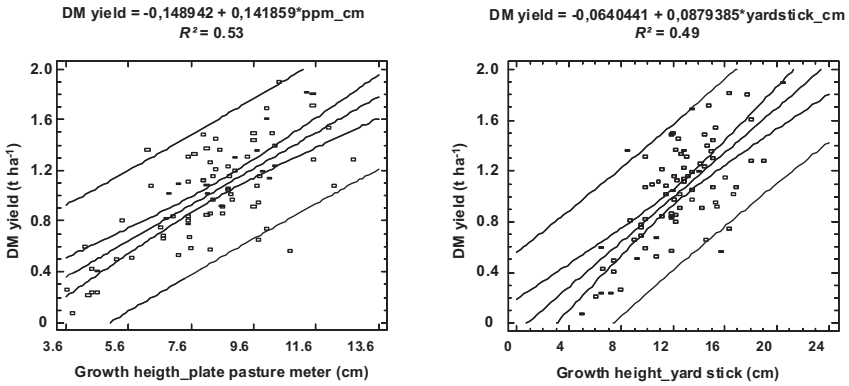

Figure 2. Relationship between yield productivity measured in simulated grazing plots and different measurements of growth height in the short sward grazing experiment at AREC Raumberg-Gumpenstein (2004-2009)

Table 1. Forage quality of short sward pastures and of simulated grazing areas (average data of 2004-2009)

	DM	Crude protein	Crude fibre	Crude ash	DOM	NEL in DM
	% in FM		% in DM		%	MJ kg^{-1}
Short sward grazing (n = 80)	15.6[a]	20.8[a]	20.4[a]	10.5[a]	74.7[a]	6.25[a]
Simulated grazing (n = 82)	14.5[b]	22.0[b]	19.3[b]	11.0[a]	75.3[a]	6.30[a]

The relationship between the growth height measurement with the plate pasture meter and the yard stick was strong (R^2=0.83) with a correlation coefficient of 0.91. Both methods can therefore be used in practice to estimate the yield without any complex analysis to adjust the size of the pasture area to the actual growth rate. The forage quality of both systems tested in the project was high with a low content of crude fibre indicating an early date of utilisation (Table 1). This corresponds with a high average concentration of protein, which in practice has to be seriously considered in terms of milk urea content. The digestibility of organic matter reached more than 74%, resulting in an NEL concentration in the DM of about 6.3 MJ kg^{-1}, and this is an excellent basis for high milk performance (Poetsch *et al.,* 2006). High forage quality from pastures helps to reduce the amount of concentrates in the feed ration and is therefore an essential part of a low-input farming strategy.

On all tested plots the projective coverage of the vegetation reached the maximum of 100% at the end of the observation period. The number of different species ranged between 21 and 26, indicating a significant lower floristic diversity compared with extensively used grassland types in Austria (Bohner *et al.*, 2002). The proportion of grasses has increased up to 60%, of which *Lolium perenne* and *Poa pratensis* were the dominating species but also *Festuca pratensis* and *Dactylis glomerata* contributed to the vegetation. *Poa trivialis*, which is an undesirable and widespread grass species, only occurred on some plots and at negligible proportions. Other weeds also played only a subsidiary role.

Conclusion

The findings of the presented experiment indicate that even under unfavourable climatic conditions in mountainous areas continuous grazing on short swards can result in high yields and excellent forage quality without any negative botanical impact on the grassland ecosystem. The data and findings obtained from the simulated grazing system were quite consistent with those of the real grazed areas.

References

Bohner A., Sobotik M. and Poetsch E.M. (2002) The species richness of the Austrian grassland and the importance of grassland management for biodiversity. EGF-Meeting 2002, La Rochelle (France), *Grassland Science in Europe* 7, 766-767.

Poetsch E.M., Resch R., Schaumberger A. and Buchgraber K. (2006) Effect of different management systems on quality parameters of forage from mountainous grassland. EGF Meeting 2006, Badajoz (Spain), *Grassland Science in Europe* 11, 484-486.

Steinwidder A., Starz W., Podstatzky L., Kirner L., Poetsch E.M., Pfister R. and Gallnboeck M. (2009) Ergebnisse zur saisonalen Low-Input Vollweidehaltung von Milchkühen im österreichischen Berggebiet. *Beiträge zur 10. Wissenschaftstagung Ökologischer Landbau,* Zürich, 11-13 February 2009, Tagungsband 2, 62-65.