Continuous grazing in comparison to cutting management on an organic meadow in the eastern Alps

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Abstract

Continuous grazing is an appropriate pasture system for dairy cows in low input milk production systems like organic farming. Grazing increases for economic reasons and is also caused by regulations in organic farming. If a dairy farm converts a pasture-based system, cows will start grazing on a cutting-managed meadow. Due to the utilisation changing from cutting to grazing, a conversion of the botanical composition and the quantity and quality yield is expected. To document and assess such conversions, a three-year field trial was carried out on the organic grassland and dairy farm of the AREC Raumberg-Gumpenstein between 2007 and 2009. In this study, changes in the botanical composition were found. In contrast to botanical composition, no significant differences between below-ground biomass and quality yield (CP and NEL) could be detected, although the harvest sward yields of the grazing sward were significantly less than in the cutting variant in the trial years 2007 and 2008.

Keywords: plant species composition, below-ground, above-ground, biomass, organic farming

Introduction

Continuous grazing is important for pasture-based systems and is of considerable interest for organic dairy farms with pasture in Austria. Practical knowledge of continuous grazing is low in the eastern part of the Alps. Some farmers have suggested that there is a lower yield under continuous grazing than in mown meadows. Investigations in Switzerland recorded pasture yields from 6276 kg (Schori, 2009) to 13470 kg (Thomet *et al.*, 2004) per year and ha, which is a comparable range to cutting yields under Austrian Alpine conditions. However, the harvested biomass yield is not the only important factor of a continuous grazing system. Change in plant species composition when converting a cutting meadow to continuous grazing, as well as below-ground biomass, are also important. The hypotheses of this study were that biomass yield will not differ between the two management systems and a change in species composition will take place.

Materials and methods

In a three-year field trial, influences of grazing by dairy cows were measured regarding differences in plant composition, biomass production, and quality yield. The field trial was carried out on an organically managed continuous grazing area (680 m altitude, 7 °C average temperature, 1000 mm precipitation per year) as a block design with three replications. Before 2005 the area was used as a meadow and in 2005 the cutting plot was fenced to compare possible changes between the use as cutting meadow and pasture with continuous grazing. Changes in plant composition were measured in 2009, using area percent rating. To identify below-ground biomass, five soil cylinders (each measuring 0-10 cm in height and 6.2 cm in diameter) per variant and replication were sampled three times. Below-ground biomass was

separated from the soil by a root washer (water and pressure air mixes the samples, which are filtered by a riddle with a mesh width of 1000 µm). After washing, dry matter (DM) of the below-ground biomass was evaluated by drying in an oven at 105 °C for 48 hours. The DM of the harvested green biomass was assessed with the same method. Above-ground biomass was harvested with a motor mower at a cutting height of 7 cm from the cutting meadow as well as from the continuous grazing variant. This variant was harvested seven times per year at an average sward height of 15 cm. The sample cutting area on the continuous grazing variant was changed between two harvest times. One part of the continuous grazing variant was grazed 50% of the time by dairy cows and the other part was fenced in for harvesting the sward and to evaluate the DM production. Therefore, the effect of grazing was at least 50% on each continuous grazing variant area. The cutting meadow was harvested four times at the conventional cutting times with the motor mower. Crude protein (CP) contents were analysed with the Weender Analysis in the laboratory of AREC Raumberg-Gumpenstein. Regarding the MJ net energy (NEL), the calculation was based on a regression equation considering crude nutrients (GfE, 1998).

Table 1. Listing of important parts and species of plant composition using area percent rating.

Variant	Grass	Legumes	Herbs	*Lolium perenne*	*Poa trivialis*	*Trisetum flavescens*	*Dactylis glomerata*	*Poa pratensis*	*Trifolium repens*
	in %	in %	in %	in %	in %	in %	in %	in %	in %
Grazing	68[a]	18[a]	13[a]	20[a]	5[b]	2[b]	3[b]	21[a]	17[a]
Cutting	78[a]	8[b]	12[a]	11[b]	18[a]	12[a]	11[a]	7[b]	7[b]

Means with same letter are not significant different; T-test $P > 0.05$

Results and discussion

On examination of the botanical composition, a difference between grazing and cutting management of important species in Alpine permanent grassland could be measured (Table 1). Due to grazing, a significant lower coverage of bunch-type growth grasses like *Dactylis glomerata* and *Trisetum flavescens* on the grazing variant was found. Therefore, typical pasture plants like *Lolium perenne*, *Poa pratensis* and *Trifolium pratense* covered a significantly greater area on the grazed variant than on the cutting variant. This grazing effect on the botanical composition could also be detected in a trial in Switzerland (Thomet *et al.*, 2000). The below-ground biomass shows no significant difference between grazing and cutting at the three samplings. This result is interesting, considering the differences in the plant composition. At the first sampling in spring, the below-ground DM biomass ranged between 4792 kg ha^{-1} in the cutting variant and 4289 kg ha^{-1} in the grazing variant (Fig. 1). However, in a Swiss trial (Thomet *et al.*, 2000) 5525 kg ha^{-1} (0-7.5 cm soil sampling depth) below-ground DM biomass at continuous grazing areas was found. One possible reason for the higher below-ground biomass in the Swiss trial could be the better climate condition in the Swiss midland (Schori, 2009) than in the eastern Alpine area. The harvested above-ground biomass showed a significantly lower yield in the grazing variant, but only in the trial years 2007 and 2008 (Fig. 2). In these yields, no technical harvesting losses (in practice, grassland management) were included. This is interesting in terms of the CP and NEL yields: both of these quality parameters showed no significant differences between grazing und cutting management. Similar yields on a pasture were measured in an organic trial in Switzerland (Schori, 2009). In the Swiss trial the highest DM yield from a pasture was measured in 2004, with 8439 kg DM ha^{-1}, and the highest yield from the respective grazing variant of this trial reached 9381 kg DM ha^{-1} (in 2007).

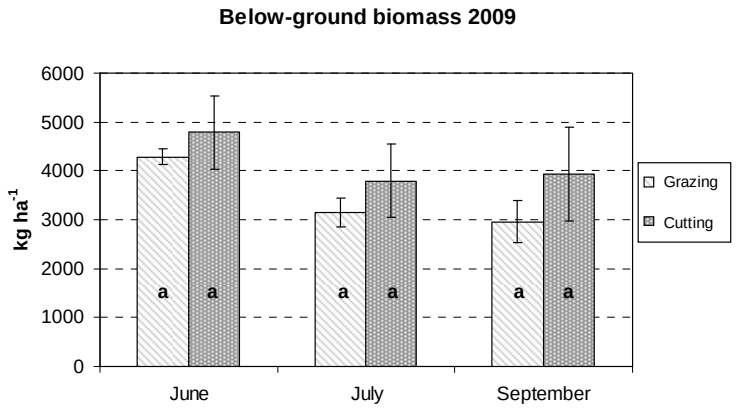

Figure 1. Illustration of below-ground biomass in vegetation year 2009. Means with same letter are not significant different; T-test $P > 0.05$

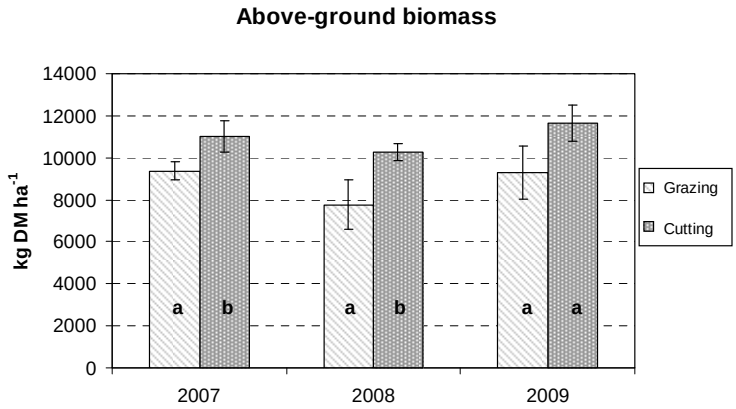

Figure 2. Dry matter yields of above-ground biomass in the three trial years. Means with same letter are not significant different; T-test $P > 0.05$

Conclusion

This field trial, carried out to evaluate the impact of continuous grazing in the eastern Alpine region, clearly showed changes in the botanical composition as a result of conversion from a cutting meadow to continuous grazing. However, the suggestions of farmers that there is a lower yield under continuous grazing could be disproved by the results of this trial. Continuous grazing can be a suitable pasture system for organic farms in eastern Alpine areas that have more favourable climate conditions.

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