

Effect of different management systems on quality parameters of forage from mountainous grassland

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Abstract

Data from comprehensive field studies in eight different Austrian grassland regions and data from exact field trials were analysed concerning aspects of floristic diversity and forage quality. Special attention was paid on the impact of different management measures, which are offered within the Austrian agri-environmental program. The mentioned measures, mainly focusing on the reduction of farm external resources, only showed a marginal influence on forage quality. This clearly indicates that farmers efficiently use their natural nutrient resources, which are an essential part of a low input strategy. Nutrient balances on a farm gate scale show in general a well balanced result and confirm a sustainable, environmentally friendly management. But on some farms a N-surplus is existing and has to be considered critically.

Keywords: forage quality, nitrogen balance, floristic diversity, agri-environmental programs.

Introduction

In contradiction to some intensive European grassland regions, homegrown forage from pastures and meadows is the main feed basis for grassland and dairy farms in Austria.

This paper is dealing with the effects of different management systems on parameters of yield, quality and botanical composition of forage from mountainous grassland. Measures like organic farming, reduction and renunciation of yield increasing substances are censoriously considered and discussed, regarding the above mentioned parameters.

Materials and methods

The presented results originate from comprehensive field studies, carried out in eight representative grassland regions of Austria in the period from 1997 to 2002. At all, more than 2200 forage samples were taken and analysed for their content of crude nutrients, minerals, trace elements, heavy metals, digestibility of organic matter and energy content (Poetsch and Resch, 2005). Beside detailed recordings of farm structure data and aspects of management, investigations on soil properties, floristic diversity, forage quality and feed intake have been carried out. Nutrient balances have been calculated both on a farm gate and on a field scale, mainly focusing on nitrogen.

Results and discussion

Forage from pastures and meadows amount up to 95 % of the feed ration for dairy cows and therefore its quality is of great importance (Gruber and Poetsch, 2005). About half of the total permanent grassland is used in a very extensive way with low stocking rates and is cut or grazed once or twice a year. Permanent grassland in more favourable regions of the Austrian mountains can be at least used three times per year (silage cut, hay cut, second cut hay or alternatively grazing in the autumn). Only in some small, very productive lowland areas even up to five cuts per year can be harvested.

It is well known, that beside other aspects forage quality strongly depends on the composition of plant communities and on the stage of vegetation. Concerning the most relevant grassland types for production there is a negative correlation between the floristic diversity and the energy concentration of forage. Forage from species rich grassland types is therefore of lower quality than that from grassland with a smaller number of plant species (Table 1). Up to a medium production level of about 5,000 to

6,000 kg milk per cow and year (the official average Austrian milk production level is at 5,432 kg) forage from species rich grassland can be used in a very efficient way. But with an increasing production level, the requirements for the quality of the feed ration significantly rise up and displace forage from more extensive grassland types.

Table 1. Relationship between floristic diversity (species number) and energy value of forage from selected grassland types (Poetsch and Blaschka, 2003).

Grassland type	n	Ø	min.	max.	Ø MJ NEL (kg DM ⁻¹)
Extensive pastures	120	54	6	115	5,13
Cultural pastures	73	46	24	86	5,50
Mowing pastures	105	38	18	64	5,64
One cut meadows	235	46	8	91	4,55
Two cut meadows	693	38	14	88	5,39
Three cut meadows	328	32	13	58	5,69
Four cut meadows	28	29	7	52	5,60
Ley farming areas	15	32	23	48	5,89

For Austria and some other countries with mountainous production conditions, special programs and support are necessary to balance the natural disadvantages. Low input strategies are efficiently supported by the Austrian environmental program for agriculture “OEPUL”, which covers the whole country and is with 82% well accepted by the farmers. Some special measures with different premiums are offered within this program, mainly focusing on the reduction of yield increasing substances like mineral nitrogen or pesticides both on grassland and arable land.

Table 2. Forage quality parameters of selected grassland types with different management measures (Poetsch and Resch, 2005).

Grassland type	Parameter	Without OEPUL		Reduction of yield increasing products		Abdication of yield increasing products		Organic farming	
		Ø	s	Ø	s	Ø	s	Ø	s
Two cut meadows n=592	XP g kg DM ⁻¹	147,0 ^a	40,9	150,9 ^a	32,8	145,9 ^a	35,4	143,7 ^a	31,6
	XF g kg DM ⁻¹	252,9 ^a	37,4	244,7 ^a	36,2	250,4 ^a	37,4	248,2 ^a	37,5
	MJ NEL kg DM ⁻¹	5,38 ^{ab}	0,71	5,43 ^{ab}	0,49	5,29 ^a	0,65	5,50 ^b	0,58
Three cut meadows n=322	XP g kg DM ⁻¹	143,7 ^a	27,5	143,5 ^a	22,4	160,5 ^b	34,5	149,4 ^a	30,3
	XF g kg DM ⁻¹	256,2 ^a	30,2	264,9 ^a	32,4	243,8 ^b	31,4	245,5 ^b	34,5
	MJ NEL kg DM ⁻¹	5,73 ^a	0,48	5,53 ^a	0,41	5,69 ^a	0,66	5,74 ^a	0,61
Four cut meadows n=129	XP g kg DM ⁻¹	173,7 ^a	27,0	167,1 ^a	34,5	169,9 ^a	29,4	173,2 ^a	28,5
	XF g kg DM ⁻¹	246,4 ^a	31,7	236,1 ^a	34,9	234,0 ^a	31,6	226,8 ^a	29,7
	MJ NEL kg DM ⁻¹	5,62 ^a	0,52	5,47 ^a	0,43	5,49 ^a	0,57	5,61 ^a	0,53

XP: crude protein; XF: crude fiber.

The results presented in Table 2 deal with the impact of selected OEPUL-measures on aspects of forage quality concerning two, three and four cut meadows, which are the main types for forage production on dairy farms in the mountains (Poetsch, 2000). With the exception of the two cut meadows, which are of great importance for organic grassland farms in mountainous regions, no significant differences in the energy concentration were found concerning the discussed management measures. These results indicate, that farmers efficiently use the natural nutrient resource on farms namely manure and care for sufficient phosphorus supply to improve the growth of legumes.

Table 3. Farm gate balances for nitrogen in different grassland regions of Austria.

Test region	n farms	kg N ha reduced agricultural used area ⁻¹			
		Ø	median	min.	max.
Ennstal	78	+ 7,2	+ 3,8	- 47,6	+ 84,3
Pongau	25	+ 6,9	+ 6,6	- 23,7	+ 43,7
Kitzbüchel	29	+ 6,0	+ 5,4	- 29,1	+ 37,8
Oberkärnten	19	- 7,4	- 6,6	- 51,4	+ 41,7
Hallein	16	+ 9,6	+ 2,4	- 21,0	+ 80,5

Balances for nitrogen were set up on a farm gate scale, including external N-input (concentrates, fertilizer, livestock and fodder purchase, bedding material, N-deposition and biological N-fixation) and N-output (livestock sales, milk, plant products and unavoidable, gaseous N-losses). The calculated N-saldo was then referred to the fertilized grassland area and showed a well equalized result on an average of all farms in the test regions (Table 3). But looking at the range of the results, a strong variation can be noticed between a deficit of 51 kg N ha⁻¹ and a surplus amounting to 84 kg N ha⁻¹.

Conclusions

Forage quality is of great importance for Austrian grassland and dairy farms, which are mainly located in disadvantaged, mountainous regions. In contradiction to intensive grassland regions in Europe a high floristic diversity can be observed on the different grassland types. Species rich, extensive grassland tends to result in lower forage quality, which with an increasing milk production level and rising requirements leads to a displacement of these ecologically valuable areas.

Milk and grassland farming in mountainous regions of Austria strongly meets ecological and environmental demands and fulfils multifunctional tasks for the public. The continuance of the milk quota system is a fundamental assumption for a productive land management system in alpine and mountainous grassland. Alternative forms of grassland utilization like energy production via biogas or heating plants are additional options but will not be able to ensure an area-wide land management.

References

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