

Feeding strategies and feed self-sufficiency of dairy farms in the lowland and mountain area of Western Switzerland

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Abstract

The feeding strategy and the feed self-sufficiency of 34 commercial dairy farms in the western part of Switzerland were investigated throughout the year 2010. Feed ration composition of farms from the lowlands with relatively high proportions of maize were compared to farms from the mountain area with relatively high proportions of herbage in the rations. Dairy feeds were categorized into herbage, whole-plant maize and concentrate. The proportions of dry matter (DM), net energy for lactation (NEL) and metabolizable protein (MP) sourced from herbage, maize and concentrates were calculated. Dairy farms located in the mountain area had higher proportions of herbage DM in the ration than farms located in the lowland (70% vs. 51%), as well as herbage-sourced NEL (66% vs. 47%) and herbage-sourced MP (68% vs. 49%). In contrast, lowland farms showed a higher proportion of maize DM in the ration (31% vs. 17%). The degree of self-sufficiency of the total feed ration of mountain farms was shown to be larger for DM, NEL and especially MP. A general negative relationship between the proportion of maize DM in the ration and the dairy herd MP self-sufficiency could be observed.

Keywords: feed self-sufficiency, feeding strategies, roughage, herbage

Introduction

Grassland-based milk production is of major importance in Switzerland. Traditionally, herbage provides the largest proportion of dairy feeds. Due to climatic and topographic restrictions, maize-based dairy systems are usually limited to the lowland area. Inclusion of higher proportions of maize in the rations consequently decreases the proportion of herbage, which in turn requires the purchase of protein rich concentrates. This feeding strategy increases environmental concerns regarding the importation of soy bean meal and the accumulation of excess nitrogen in dairy farms' environment, decreasing the farms' feed self-sufficiency. On the other hand, feeding strategies relying primarily on the utilization of herbage from grassland are considered environmentally sound and sustainably beneficial. However, with increasing specialization and intensification of agricultural production, grassland-based dairy farms tend to decrease in number in Switzerland. A recently established program "Grassland-based milk and meat production" of the Swiss Federal Office for Agriculture (Schweizerischer Bundesrat 2013), aims to promote the utilization of herbage from grassland and to counteract the tendency of a decreasing feed self-sufficiency of dairy farms. This preliminary field study was conducted to obtain a present overview about the differences in the composition of the feed rations and the degree of feed self-sufficiency of dairy farms in the lowland and mountain area of Western Switzerland.

Material and methods

Thirty-four dairy farms were randomly selected within the cantons of Neuchatel and Waadt (lowland: 22; mountain and hills: 12). The feed rations were investigated throughout the year of 2010. The dry matter (DM) consumption of every dairy herd was modelled on a monthly basis according to herd structure and cow characteristics (parity, live weight, lactation stage,

milk yield; Cutullic *et al.*, 2012). The farmer indicated the proportions or fixed amounts of feeds fed to the dairy cows. As land use area, herd structure and milk production were known (extracted from national databases) the consistency between total consumption and available feeds for the herd, and between milk production and nutrients intake, was checked on-farm during the survey. Dairy feeds were categorized as herbage, maize (whole plant) and concentrate. Herbage and maize were additionally categorized as roughage. The relative proportions of DM, net energy for lactation (NEL) and metabolizable protein (MP) sourced from the different feed components were calculated. To estimate the feed self-sufficiency of the farms, feed components were divided into locally grown (origin < 50 km) or foreign (> 50 km) feeds.

Results and discussion

Lowland and mountain farms had similar area, herd size, total and per cow milk production (Table 1) and DMI per cow and day (Table 2).

Table 1. Characteristics of dairy farms in the lowland (L) and mountain (M) area of western Switzerland (mean \pm standard deviation):

	L	M
Farm size (ha)	46 \pm 30	41 \pm 20
Cows per farm	28 \pm 16	22 \pm 11
Milk production (t ECM produced per year)	265 \pm 162	193 \pm 98
Milk production (kg ECM/cow)	25.8 \pm 3.9	23.4 \pm 4.1

Table 2. Composition of feed rations of dairy farms in the lowland (L) and mountain (M) area of western Switzerland: Average proportions of dry matter (DM), net energy for lactation (NEL) and metabolizable protein (MP) from herbage, maize and concentrates. ¹ r.s.e: residual standard error ; Significance² ***, *, +, n.s.: $P < 0.001, 0.05, 0.10, \text{not significant}$

	L	M	r.s.e ¹	Significance ²
DM intake (kg) per cow and day:	19.8	19.1	1.4	n.s.
% DM from				
herbage	51	70	12	***
maize	31	17	10	***
roughage	82	86	7	n.s.
concentrates	14	12	5	n.s.
% NEL from				
herbage	47	66	13	***
maize	31	17	10	***
roughage	79	83	8	n.s.
concentrates	18	16	6	n.s.
% MP from				
herbage	49	68	13	***
maize	22	12	7	***
roughage	71	80	1	*
concentrates	26	20	8	+

The composition of the feed ration, however, followed a clear pattern (Table 3): herbage DM proportion was significantly higher for mountain farms (70%) than for lowland farms (51%), resulting in higher proportions of NEL and MP from herbage. As expected, the proportion of maize DM was significantly higher in rations of lowland farms (31%) than of mountain farms (17%). Some of the mountain farms purchased maize cultivated in the lowland area, which explains the occurrence of maize in the feed ration of mountain farms. Inclusion of a higher proportion of maize DM in the rations of lowland farms significantly increased the contribution of maize NEL in the ration and to a lower extent of maize MP, as maize is a protein-poor forage. This was not compensated by an increased contribution of herbage MP, but by the use of dehydrated lucerne and protein-rich concentrates.

Table 3. Degree of self-sufficiency of dairy farms in the lowland (L) and mountain (M) area of Western Switzerland for dry matter (DM), net energy lactation (NEL) and metabolizable protein (MP). ¹ r.s.e: residual standard error ; Significance² **, *, : $P < 0.01, 0.05$

Degree of self-sufficiency (%)	L	M	r.s.e ¹	Significance ²
DM	90	94	4	*
NEL	88	93	5	*
MP	80	88	8	**

Conclusions

The feeding strategy of mountain farms, which focuses on a maximum utilization of herbage, results in a high feed self-sufficiency. In contrast, the feeding strategy of lowland farms, which include noticeable amounts of maize, results in a reduced feed self-sufficiency. However, in areas with frequent summer droughts, as in the case of the lowland area of western Switzerland, maize cultivation has also been shown to increase the resilience of a feeding system to drought (Mosimann *et al.*, 2013).

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References

- Cutullic E., Chevalley S., Thomet P. and Piccand V. (2012) Etat des lieux sur l'affouragement des vaches laitières. Enquêtes sur les exploitations en lait de centrale de Prolait.
- Mosimann E., Deléglise C., Demenga M., Frund D., Sinaj S. and Charles R. (2013) Disponibilité en eau et production fourragère en zone de grandes cultures. *Recherche Agronomique Suisse* 4 (11–12), pp. 468 – 475.
- Schweizerischer Bundesrat (2013) Verordnung vom 23. Oktober 2013 über die Direktzahlungen an die Landwirtschaft (Direktzahlungsverordnung, DZV), art. 70 – 71.