

Models of cattle breeding in Šumava National Park

Modelové chovy skotu v Národním parku Šumava

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Abstract

The 60 ha grazing land (altitude 1025 m) on the border of Šumava National Park served as a model testing the development of perennial grassland and prosperity of calves (cross-breds with the Galloway race) born in the open air and raised under extensive grazing. – After the elimination of fertilization, the cover of the eutrophic grass species (e.g. *Dactylis glomerata*) decreased by up to three quarters within a 3-year-period. In accordance with the resources of nutrients and the water supply of the stand, propagation of mainly *Agrostis tenuis* and *Trifolium repens* ssp. *silvestre* was observed, and the overall diversity of species and dietetic value of the fodder improved. The non-selective grazing of the studied herd resulted in a limited ruderalization (especially *Rumex obtusifolius*). The predicted development towards the grassland types (*Agrostidetum*, *Deschampsietum* and *Nardetum*) reflects the introduction of races with the ability to process higher fibre contents. The nutritive content in pastures guaranteed a sufficient milk production, so that daily gains in calves 680 g in winter and 1000 g during the grazing season could be achieved. The calves showed a well-developed thermoregulation directly after birth and a minimum morbidity throughout the rearing period. The state of blood parameters reflected a good hematopoiesis, proteosynthesis and early fodder intake. The saturation with Ca, Mg, Na, J solely from grassland was not sufficient. Economic and ecologic aspects suggest that special attention should be paid at calving in January and March, and at sales of calves in the autumn.

Key words: pasture, grassland, beef calves, Galloway, blood

Introduction

In the Šumava Mountains, extensive farming methods resulted in a completely changed forested landscape. Scattered fields were mainly used as pastures or mountain meadows. The naturally occurring gene pool of plants and animals was enriched by species accompanying colonization. Protection of the diversity of anthropogenic grasslands depends on natural farming forms which respect the current trends in modern technologies in breeding and crop production.

The thin population of the mountainous Šumava regions, high costs related to agricultural production, and the rigid regime of nature and landscape protection represent a precondition for extensive cattle or sheep breeding in a net of naturally limited enclaves of non-forested land offered to appropriate farming. Within the Šumava National Park (NP) and its protected zone, the area of these enclaves (agrieological districts) exceeds 50 ha, e.g., 7 enclaves within the total area of the former military zone cover from 77 to 321 ha grassland.

The priority objective focused on farming perennial grassland consists in the stabilization or recreation of the diversity of the original species of the both cultivated grasses and wild plant and animal species. The farmed and stabilized grassland will be able to fulfil a wider



Fig. 1. – Cows of Bohemian Spotted cattle with their calves (cross-breds with race Galloway) on the grazing land in Šumava mountains

Obr. 1. – Krávy plemene České strakaté s telaty (kříženci s plemenem Galloway) na pastvině na Šumavě

range of functions in the protection of water quality in headwater regions and wetlands, in the natural regulation of scattered vegetation and maintenance of light and temperature regime for species on stone walls. The historical extensive farming methods, applied for Šumava grassland, consisting in grazing of several heads of livestock and harvesting fodder from small areas surrounding the farm, cannot be restored by the current farmers depending on incomes derived from agricultural activities.

Similarly, extensive farming cannot be merely reduced to the total of livestock units (1 animal with 500 kg weight) per 1 hectare. It is also necessary to determine the maximum sizes of herds in accordance with the age categories and local conditions of pastures. Taking the expected fodder yields from land without improvement by mineral fertilizers, and the status of moisture and slope inclination into consideration, the limit of 0,3–0,6 livestock units per 1 ha can be established. In accordance with the local conditions and the developmental stage of grassland, this limit should be subjected to appropriate alterations. Extension of the grazing period, cow breeding without commercial milk production, and calving directly in the open grazing land should belong among the most significant rationalization and extensification measures (Fig. 1). Resistent meat breeds (Galloway, Highland, Aberdeen Angus, Saller Cattle, Hereford) which are able to graze even grasslands of lower nutrient levels, can successfully be introduced (SEIDENGLANZ 1992, KRÁL & MILISDÖRFER, 1993).

Due to the local specifics of the living conditions in particular non-forested enclaves of the Šumava, it is necessary to examine both the all-round prosperity of the cross-breds or pedigree animals, and their grazing options within the ecologically favourable development of grassland.

Material and methods

The studies of the prosperity of cross-breds F_1 of Bohemian Spotted Cattle x Galloways (CxG) and the development of multifunctional functions of grassland were carried out in the period 1993–1995 on the farm Nové Hutě, at the altitude of 1025 m, with the total acreage reaching to 472 ha. Pregnant cows of the C-race and cows with calves (CxG) stayed on the pastures (60 ha) throughout the year. During the winter period, they had free access to a shelter with deep bedding. During frosty periods and days with snow cover, the shelter provided also drinking water and hay silage.

The following criteria determining production and health conditions of the studied animals are essential: weight gain in calves and young livestock, clinical morbidity symptoms in calves and cows, blood parameters in calves determined in the course of the spring and autumn weighing, surface temperature in calves after birth.

The grazing land was, until 1993 periodically restored and fertilized. The last fertilization was carried out in spring 1993, the dosis amounting to 85 N ha⁻¹ in the form of ammonium nitrate. The mean content of minerals in fodder (hay, silage, pasture) was: Ca 1.9, P 1.2, Mg 0.5, Na 0.5, and K 0.4 g.kg⁻¹ dry matter.

Results and discussion

Development of a multifunctional character of the grassland

Elimination of fertilization measures, in accordance with the protection regime, within controlled stands A, B, C (Table 1) had a significant impact resulting in the disappearance of the higher trophical level (meso-eutrophical to eutrophical levels) and a gradual transition to a lower – and ecologically more favourable – trophical level. Thus, the biodiversity and, in several cases, the development of *Trifolium repens* could be enhanced. The most significant bioindicator of the decrease of the trophical level is the gradual drop of the dominance of demanding species with ruderal strategy, especially of *Rumex obtusifolius*.

In the course of the three-year study, the coverage of *Dactylis glomerata* within the studied grassland decreased by a third to three-quarters. Besides the propagation of *Agrostis tenuis* which was particularly strong in the upper slope sections (especially in stand C), where its coverage in the course of the three years grew from values under 1 % D (+) up to 33 % D, a positive trend towards *Trifolium repens* could be observed in the third year of investigation (1995) (in stand B from 11 % D to 23 % D in 1994 and in 1995 in stand C from 8 % in 1994 to 33 % in 1995).

Table 1. – Changes of the stand type in a controlled grazing enclosure Nové Hutě
Tabulka 1. – Změny typu porostu na kontrolní ploše v pastevním areálu Nové Hutě

Stand	Year	Pasture growth
A	1993	Dactylideto–Festucetum pratense
A	1994	Dactylideto–Festucetum pratense
A	1995	Agropyretum
B	1993	Dactylideto–Festucetum pratense
B	1994	Dactylideto–Agrostidetum
B	1995	Dactylideto–Festucetum pratense
C	1993	Festucdeto (prat.) – Dactylidetum
C	1994	Agrostideto–Festucetum pratense
C	1995	Agrostidetum

The study shows that within the investigated pastures the substitution of eutrophic species by less demanding species had a positive compensating effect on the development of quality-forming species, such as *Trifolium repens*, but also on other plants with a high dietetic value (*Alchemilla vulg.*, *Carum carvi* etc.). The qualitative improvement of the grassland composition shows again better levels in the upper slope sections, while in lower situated stands the impact of the former intensive nutrition and related grassland ruderalization is of more permanent character (stand A).

Besides the mentioned trends which are characterized by some species significant from bioindication viewpoint, similar trends in the total typological dynamics can be observed. In the stand A a transition from eutrophic to meso-eutrophic type is obvious – due to the propagation of *Trifolium repens*. Stand B showed a stabilization of the community at the mesotrophic level, whereas stand C underwent a gradual decrease from the mesotrophic to meso-oligotrophical level.

The observed trends can, from the point of view of landscape ecology and biodiversity protection, be evaluated as a positive development. The slight decrease in production is in accordance with the total lower consumption of the produced biomass, and moreover, it is also compensated by a qualitative improvement which can be partly ascribed to the grazing of the tested herd of meat cattle.

The non-selective grazing which had positive effects especially on the decreased coverage of *Rumex obtusifolius* and further ruderal species, has to get a positive mark.

When studying in the Nové Hutě area the fibre content of the grass biomass as a significant qualitative parameter, it was found that, with the exception of grasslands with dominant *Nardus stricta* and *Festuca angustifolia*, where high fibre levels were determined already in young pasture fodder (29,4 to 37,5 % in dry matter) before the beginning of the grazing period (27 April 1995), most of the high fibre values were due to the delayed use of grassland. The delayed use does not only mean a worsened fodder quality, but also deteriorated conditions for a successful development of less minute plant species and as a result of this, worsened conditions for the development of biodiversity. This fact is of major significance, especially at the present time, when traces of the previous high trophical level are still present and more robust and highly competitive plant species are still predominating in the grassland community (e.g., *Dactylis glomerata*) which also tends to increased fibre levels and lignification. Some trends towards the development of grasslands with dominant *Nardus stricta* and *Festuca angustifolia*, and some more robust species, indicate that higher fibre levels could become a serious problem in future, even on condition that undelayed use of grassland could be guaranteed.

This focus on extensive meat races in the Šumava is fully substantiated, and it can be expected that an appropriate management of grassland communities in Šumava NP cannot do without extensive cattle and sheep breeds.

This approach shows that an appropriate plant gene pool management must be coordinated, with a certain margin, with an adequate gene pool of farm animals, in this case particularly with their original breeds. Higher bulkage levels in fodder are not appropriate for new more efficient breeds, and the compensation of the bulkage content by grain fodders means a further nutrient import into Šumava NP. Although the present bulkage levels can, to a certain extent, be attributed to delayed use, in future higher bulkage values can be anticipated even in younger fodder; as today, the future typological composition of grassland can be anticipated (*Agrostideta*, *Nardeta*, *Deschampsietta* etc.). The present surplus of grass biomass should be solved by hay sales to inland farms with intensive production of grain and lack of grasslands. This would also enhance the balance between the fodder biomass production and its undelayed use. Destruction of the grass biomass by mulching seems, from this point of view, less appropriate and can be applied only at a temporary and limited scale.

Table 2. – Blood parameters in calves F1 (CxG) 4 months old
Tabulka 2. – Krevní parametry u telat F1 (CxG) 4 měsíce starých

		x	S _x
Packed cell volume	l.l ⁻¹	0,44	0,04
Hemoglobin	g.l ⁻¹	126,2	12,8
Leukozytes	G.l ⁻¹	9,7	1,8
Glukose	mmol.l ⁻¹	3,5	1,4
Urea	mmol.l ⁻¹	5,3	1,4
Carotens	ug.dl ⁻¹	681,0	164,0
Total protein	g.l ⁻¹	60,9	3,8
Cholesterol	mmol.l ⁻¹	4,0	0,4
Total lipids	g.l ⁻¹	4,7	0,6
Alcaline phospatases	ukat.l ⁻¹	3,2	0,8
Calcium	mmol.l ⁻¹	1,9	0,2
Magnesium	mmol.l ⁻¹	0,76	0,06
Inorg. Phosphorus	mmol.l ⁻¹	2,6	0,17

Table 3. – Surface temperature in calves F1 (CxG) – 24 hours after birth
Tabulka 3. – Teplota povrchu těla telat F1 (CxG) – 24hodin po narození

Date	Outside temperature (°C)	Air humidity (%)	Surface temperature (°C) x
10.1.–12.1.94	+3	91	32,4
13.1.–17.1.94	+5	95	32,6
18.1.–21.1.94	-2	55	31,5
22.1.–26.1.94	+3	97	31,9

Production and health of grazing cattle

The most significant precondition of an economically and ecologically effective management of permanent grassland consists in providing the required number of adapted livestock as early as before the start of the grazing period. In the cow breeding without commercial milk production, this means successful calving of cows and heifers in the course of January and February.

Concentration of the births into a short period of time can be implemented by synchronized rutting and insemination. On the Nové Hutě farm, concentrated calving within the pasture complex with a shelter was tested in 36 cows. In accordance with the present knowledge, most births were of spontaneous character. Nevertheless, especially in the case of simultaneous births in heifers and simultaneous calvings of more individuals, qualified supervision and assistance must not be underestimated in approximately 18 % of mothers. Within the studied group of cows, calves deaths were related to difficult births. The vitality of cross-breds C x G born in the open grazing land with a directly formed bond to mothers was on a high level, it can be documented both by a well developed thermoregulation (Table 3) and by the low morbidity level. Light diarrhoea and bronchitis were registered in 20 % of individuals of only up to three months age. In mothers, health disorders were also related to the after-birth period (retentio secundinum, paresis) in 15 % of cows. Other diseases including

milk gland inflammation were not observed. During the first months of lactation the studied mothers showed a considerably worsened condition, which improved rapidly after grazing started. The deteriorated condition can be attributed to the lack of energy in the winter ration consisting predominantly of hay silage. Although clinical morbidity symptoms did not develop in cows, a rapid and high loss of weight represents a considerable metabolic risk. In Bohemian Spotted Cattle mothers with the inherited higher production after birth higher than in meat breeds, this fact should be taken into consideration, especially when feeding hay silage made of young growths, and should be compensated at least by minimum supplements of grain even in extensively managed herds.

The state of blood parameters in the four-month calves (Table 2) reflected, in comparison with values found in calves of traditional herds (SLANINA & al.,1995), a full saturation of the tested animals with digestible nitrogen substances and energy coming not only from milk, but also from fodder. The nutrition, exercise and early adaptation to the natural conditions were most significantly reflected in the formation of blood in hemoglobin and packed cell volumen. On the other hand, the levels of calcium and magnesium in blood proved the necessity to supplement locally differentiated minerals even within extensive management.

The mean daily weight gain in calves born in January and February during the first four months amounted to 680 g. The gains in the course of the following summer period reached up to 1000 g.

The positive experiences both in terms of health condition and perennial grassland management will result in a further development of herds of extensive meat breeds or their cross-breeds in areas of marginal character. The limit of 0,3 livestock unit per 1 ha equals 30–40 pieces of cattle per 100 ha perennial grassland, including 20 cows without the commercial production of the annual average state. The herds are focussed exclusively on the production of calves and young cattle for sale.

Proposed parameters of a herd (race Galloway)

Birth weight of calves	28–30 kg
Weight of adult cows	470–500 kg
Natality (live-born calves)	95 %
Covering of heifers	20–21 months
Discarding (scrapping)	up to 16 %
Weight of young cattle for sale	200 kg
Daily gains in calves	700 to 750 g
Daily gains in young cattle	500 to 600 g

In spite of the good prosperity of herds and low technical equipment requirements for the extensive management of meat breeds, the costs exceed revenues, and financial subsidies up to 3,000 Kč aimed at perennial grassland management on the Šumava NP territory seem to be necessary (a joint project of the Ministry of Agriculture and the Ministry of Environmental Issues of the Czech Republic, 1994). In accordance with the economic analysis of the model with twenty cows without commercial production per 100 ha, the annual costs amounted to 323,000 Kč and the annual revenues to 114,000 Kč. The subsidies mentioned above represent a possibility to manage perennial grassland in grazing without losses, and to acquire environmentally appropriate farm machinery.

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