Forage quality for growing beef cattle on restored mountain pastures

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Introduction

As a result of the increasing importance of low-input grassland systems, winter grazing is becoming more popular with the emphasis on peripheral sites in Central Europe (OPITZ VON BOBERFELD 1997). CAUWER (2006) found that the quality of the harvested produce is too low to be used as regular forage for highly productive livestock. Nevertheless, herbage or hay from field margins might be used as a source of crude fibre in feeding rations for non-lactating cows or heifers. The quality of forage from semi-natural grassland is lower when compared with intensive grassland. This is mainly due to its lower crude protein content, digestibility and a higher crude fibre content. The aim of this study was to determine the best management to produce quality feed for growing Charolais beef cattle on restored mountain pasture.

Materials and methods

The experimental area used had not been grazed 50th years, and had experienced a period of nationalization with encroachment of trees and shrubs forming area of woodland. The experiments were established on a restored mountain pasture in 2005. The cattle are retained on the experimental area all year round, with no period housing, and with supplementation feed provided during the winter. The stocking rate was 0.30 – 0.60 LU.ha^{-1} per annum. The experiment was situated on a site at Diel in the district of Poltár (48° 25` N, 19°34` E) at an altitude of 920 m a.s.l. in Slovakia. The site was typical of continental climatic conditions. Average yearly temperature was 5.1 °C and during the growth period averaged 10.51 °C. Average precipitation was 926.72 mm and the average for the growth period was 629.81 mm. Soil profile was clay-sandy throughout the whole of the soil depth. Chemical properties are available to the author. The experimental variants (Tab. 1) were organized into randomized incomplete blocks with three repetitions after the experimental area was cleared of encroaching woodland. Above ground phytomass was taken twice a year (Jun, September) and chemical analysis was carried out

Table 1 Experimental variants

Variants	Characteristics of variants
BG	burned places (autumn 2005) and grazing plot
UM	un-management plot
G	only grazing plot
CG	cutting in Jun and after grazing plot
RG	reseeded (5th May 2006) and grazing plot

on these samples – N, ash, fat. Nutrition values as CP, NEF, PDI were calculated and compared with nutrition values required for beef cattle by SOMMER et al. (1994). According to the author, for growing beef cattle with a live weight in the range of 300 to 650 kg and a daily liveweight gain of 0.8 kg will require a subsequent nutritional content:of CP 113.43 – 116.98 $g.kg^{-1}$, NEF 4.71 – 5.52 $MJ.kg^{-1}$, PDI 72.63 – 77.78 $g.kg^{-1}$. For abbreviations of feed quality see legend in tab. 2. On a base of botanical composition (D %) and feed value of species (FV) was calculated on an evaluation of the grassland by the formula $E_{GQ} = \frac{\sum(D.FV)}{8}$ (NOVÁK 2004), to allow comparisons with the chemical analysis. This evaluation of the pasture together with the chemical analysis undertaken allows a whole image regarding the above ground phytomass quality of pasture to be built up. Results were determined by statistical analysis using ANOVA by software Statistica (CZ).

Results and Discussion

According to POZDÍŠEK et al. (2003), feed nutritive value is determined strictly speaking by its energy value and crude protein content. The highest concentration of CP content (Tab. 2) was found in the variant BG and RG in both experimental years (Tab. 2). These concentrations were higher in the second year in comparison with the first year. In the variants BG and RG significant changes (***) were found compared with variant UM. CP concentrations exceeded the upper boundary of growing beef cattle requirements in all the variants in the second year. The variant UM resulted in a CP deficit as required for growing beef cattle over the two years of the experiment (Tab. 2). Control variant P was not significant when compared with the other variants. MOORE & KUNKLE (1995) suggested that the relative response to protein supplementation is highest when the forage consumed has a CP content of less than 70 $g.kg^{-1}$. In the experiment under discussion, we did not observe the decline of CP content in variants G, CG, RG and BG in the second herbage cut. However, LEEWELLYN et al. (2005) found that feed quality (CP) of pasture vegetations decreased by late autumn, in addition VOZÁR (2003) corroborates a decrease in CP content in a third herbage cut in the autumn in spite of addition NPK-nutrients being applied. It was assumed that higher CP concentration observed on the BG and RG variants was due to the high proportion of legumes in those particular swards. These trends were also recorded by GAISLER & PAVLŮ (2005) CP content was increased with increase proportion of legumes. NEF concentration exceeded the limits for the requirements of growing beef cattle in both experimental years. The highest NEF concentration were found in the vari-

Table 2 Forage quality (CP, NEF, PDI) of experimental variants

Sampling	Variants	2006				2007			
		CP ($g.kg^{-1}$)	NEF ($MJ.kg^{-1}$)	PDI ($g.kg^{-1}$)	E_{GQ}	CP ($g.kg^{-1}$)	NEF ($MJ.kg^{-1}$)	PDI ($g.kg^{-1}$)	E_{GQ}
1	BG	128.74	5.95	72.03	11.35	168,40	5.91	75.34	86.14
	UM	97.08	6.06	58.22	38.59	95,84	6.06	57.47	17.95
	G	92.55	5.98	55.50	23.69	153,54	5.96	74.10	38.15
	CG	86.89	6.06	52.11	30.92	121,03	6.00	71.39	44.41
	RG	106.78	5.99	64.03	41.31	121,12	5.99	71.32	58.07
2	BG	122.25	5.87	70.64	66.23	222,61	5.90	80.40	88.92
	UM	73.01	6.07	43.78	33.10	88,01	6.06	52.78	17.23
	G	136.48	5.95	72.34	31.89	138,35	5.96	72.68	39.88
	CG	103.65	5.99	62.16	32.75	170,81	5.99	76.04	37.51
	RG	150.70	5.90	73.21	73.84	191,24	5.98	77.87	62.12
Average	BG	125.50	5.91	71.34	38.79	195,50	5.90	77.87	87.53
	UM	85.04	6.07	51.00	35.85	91,93	6.06	55.12	17.59
	G	114.51	5.97	68.67	27.79	145,95	5.96	73.39	39.02
	CG	95.27	6.02	57.14	31.84	145,92	5.99	73.72	40.96
	RG	128.74	5.95	71.60	57.58	156,18	5.98	74.59	60.10

1, 2 – sampling (Jun, September), variants - for abbreviations of experimental treatment see tab. 2, CP – crude protein, NEF – net energy of fattening, PDI – digestible protein, E_{GQ} – evaluation of grassland quality

ants UM and CG (Tab. 2) and the lowest in the variant BG (Tab. 2) in both the herbage cuts and over both years. However, the differences observed in these values were minimal between experimental variants, but there were significant (***) differences between the variants BG and UM when compared to the other variants. VOROBEĽ (2005) also observed a minimal difference between NEF values on various grassland types. Minimal difference between the NEF values is due to the growth of the plant biomass above ground being a result of changes of nutrients and energy supply between the plant and its growing environment. In the first year (2006) PDI concentration was less than the normal growing beef cattle requirement in all variants except for variant RG where value PDI was at the bottom of the range of normal growing beef cattle requirements PDI 73.21 $g.kg^{-1}$. However, variant RG produced a PDI content exceeding the required growing beef cattle limit l approximately 0.09 $g.kg^{-1}$ in the second cut the same result was observed in variant BG, which achieved the highest PDI concentration of 80.40 $g.kg^{-1}$. The other variants achieved the growing beef cattle requirement PDI concentration in the second cut except variant UM which had a PDI of 52.78 $g.kg^{-1}$. The variant UM had the significantly (***) lowest PDI concentration when compared to all the other land use variants. According to PAVLŮ et al. (2004), dead phytomass proportion increases in unmanaged grassland therefore feed quality rapidly decreases. This conclusion corroborates the result of our experiment. The evaluation by E_{GQ} of the variant BG was found to show a rapid increase of quality from deleterious – worthless (11.35) to less valuable – valuable (66.23) in the first year (2006), and to valuable – highly valuable (87.53) grassland in the second year (2007). In a similar way, the variant RG was improved to less valuable – valuable grassland in both years. *Trifolium repens* participated in the improvement of the pastures in these two variants. Our conclusions in accordance with the suggestions made by NOVÁK & OBTULOVIČ (2004), are that with an increase in legume predominance there is an increase in the value of the E_{GQ} coefficient. Higher proportions of legumes in the pasture upset this ratio bringing about either a protein increase in the available feed with its associated problems or causing excessive flatulence in stock. Therefore, NOVÁK & OBTULOVIČ (2004) recommend an optimum proportion of 25 % of legumes in the available sward. In the variants CG and G there was no recorded important difference in E_{GQ} qualities. These pastures were the least valuable – less valuable in the first year (2006), however in the second year (2006) these variants were classified as valuable grassland due to the management imposed on them in the experiment. In the variant UM the E_{GQ} quality decreased from least valuable – less valuable to worthless – least valuable (17.59). An increase in woodland vegetation types (60.66 %) to the exclusion of blank spaces and other botanical groups was observed on this variant and the proprortion of legumes in the sward was less than 1 %. GAISLER & PAVLŮ (2005) found, that in un-managed plots there were a considerably reduced proportion of legumes. It is the proportion of legumes within the sward that reflected grassland quality.

Conclusions

The manner in which pastures are managed after restoration strongly influences available feed quality. From the results gained from this experiment, looking at the feed quality of pasture at an altitude of 920 m a.s.l. for growing beef cattle; we can make the following observations:

1. Pasture feed quality was improved by reseeding and grazing and by the nutrition supplied to the sward by the burning of tree branches. The quality of these pastures was further improved by the higher proportions of *Trifolium repens.*
2. It is recommended that restored pasture be grazed by cattle only. A combination of cattle grazing with herbage cutting resulted in tree re-encroachment being observed within a short period on restored land.
3. Pasture that is left un-managed after restoration does not provide the quality parameters required for growing beef cattle.

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