Xerothermic grassland as a source of forage for small ruminants

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Abstract

High nature value (HNV) areas may be a potential source of forage for livestock. Xerothermic grassland (thermophilic communities of marginal land on calcareous soils) in Polish conditions is an example of a possible compromise between livestock farming and active nature conservation because using them as a forage source supports their effective protection against degradation. Among HNV areas, Natura 2000 sites are a significant part of permanent grassland representing a variety of habitats and communities. This study was aimed at determining the fodder potential of grassland communities of the type of xerothermic grasslands on which various forms of protection were implemented. Field and laboratory research was carried out in the years 2016 - 2017. Representative points were determined on the paddocks from which samples were taken for testing in three replications. The productivity and rate of use of sward by animals were studied. The basic feed quality parameters were determined, i.e. energy, fibre, protein and sugar contents, as well as digestibility of dry matter (DM). The fodder quality of xerothermic sward in areas where active protection is kept is sufficient for extensive grazing of sheep and goats. The variable fibre content of plants may be a limiting factor in the use of forage by animals. A high diversity of botanical composition and DM yield requires further research to precisely determine their utility value.

Keywords: xerothermic grassland, rendzina soil, yield, fodder quality

Introduction

High Nature Value (HNV) habitats are threatened throughout Europe. The greatest threat to permanent grasslands is the cessation of use and alteration of water and trophic relationships in habitats (Sienkiewicz-Paderewska and Stypiński, 2009). They decline due to the abandonment of extensive farming, traditional farming methods and the intensification of agriculture (Zarzycki and Szewczyk, 2013). Xerothermic grass communities, the occurrence of which is determined by specific conditions (calcareous soils, strong sunlight, high temperature of air and soil) require effective and sustainable protection, not only by cutting down trees and bushes that shade the lower parts of the sward, which limits the growth and development of plants, but also by exposing the surface to well-timed and extensive animal grazing (Michalik and Zarzycki, 1995, Dzwonko and Loster, 1998). There are currently 159 Natura 2000 sites in Poland where xerothermic turf is protected. In Małopolskie Voivodeship, there are 30 such areas, of which 18 are located in the Miechów district. The aim of the study was to evaluate the usefulness of xerothermic grasslands as a source of feed for small ruminants.

Materials and methods

The study covered six areas included in the Natura 2000 network. In the past, they were used as pastures but following abandonment in the 1990's they were systematically degraded. The six areas were: PLH120063 Chodów-Falniów (1) - 4.04 ha, PLH120054 Kalina Mała (2) – 1.60 ha, PLH120062 Kaczmarowe Doły (3) – 2.85 ha, PLH120074 Sławice Duchowne (4) – 1.03 ha, PLH120075 Uniejów Parcele (5) – 0.60 ha, PLH120076 Widnica (6) – 1.05 ha.

These areas are located on shallow rendzina, calcareous type of soils. Prior to the start of the research, they required partial restoration so active protection was carried out at the beginning of 2015 and consisted of clearing of trees and bushes and mowing of the surface. Grazing by sheep (indigenous local breed

Olkuska) has been conducted since May 2015 in three rotations per year. For each area, the stocking density and the number of grazing days were calculated so that the average stocking rate was 0.5 livestock unit (LU) ha^{-1} $year^{-1}$. No fertiliser was applied to avoid the risk of excessive eutrophication of habitats.

The studies and evaluations were conducted in 2016 - 2017. In subsequent rotations, the DM yield before and after grazing were measured (0.5 m^{-2} cut at a height of 3 cm). Before grazing, the proportions of grasses, legumes and other plants in the yield were evaluated. Samples were taken from the designated points representative for the area (transect method, three replicates from each sampling point) and analysed for dry matter (DM) content, crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) content. The DM content was determined after drying at 105 °C, and the Kjeldahl method was used to determine nitrogen (N) (AOAC, 1990). Crude protein content was calculated as N × 6.25. Neutral detergent fibre, ADF and ADL contents were determined according to the methods of Van Soest *et al.* (1991) using the Foss Tecator Fibertec System M6. Data were statistically analysed for significance by ANOVA and Tukey's test.

Results and discussion

The study areas differed significantly in terms of species composition. A reference to the results can be found in other works of the authors (Musiał *et al.*, 2017). The dominant plant fraction reaching 86% of DM yield was grass (Table 1).

The only exception was PLH 120074, dominated by herbs and weeds (81%). Share of legumes ranged from 4 to 16% of DM yield. The potential DM yield of the examined paddocks was similar considering that the rate of sward use varied. The lowest grazeable DM yield of forage (0.92 t ha^{-1}) was found on paddocks with the highest proportions of herbs and weeds in the sward. Differences in DM yield between rotations and years were also observed. With high variability of species composition, heterogeneous evaluation of the fibre fraction was expected (Van Soest *et al.*, 1991). Analyses showed similar ADL content and significant differences in NDF and ADF fibre content. The study confirms findings from other sources (Jančík *et al.*, 2008; Goliński *et al.*, 2017) who found that, as well as the positive effect on grassland biodiversity, agricultural utilisation may also be an economically justified method of maintenance for protected areas.

Table 1. Characteristic of the pasture sward and forage harvested from six study areas. Data are derived from three rotations (spring, early and late summer) in two grazing years (2016 - 2017).[1]

	Chodów-Falniów	Kalina Mała	Kaczmarowe Doły	Sławice Duchowne	Uniejów Parcele	Widnica
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of grasses (%)	71	64	79	14	86	85
Proportion of legumes (%)	5	14	16	5	4	7
Proportion of others (%)	24	22	5	81	10	8
Potential yield (t DM ha^{-1})	7.7ns*	7.6ns	9.6ns	5.4ns	5.6ns	8.8ns
Grazeable yield (t DM ha^{-1})	4.24^{b}	4.79^{b}	4.03^{b}	0.92^{a}	1.40^{a}	4.05^{b}
CP content (%)	6.9^{a}**	9.0^{b}	6.8^{a}	8.4^{b}	10.0^{c}	6.2^{a}
CP yield (kg ha^{-1})	292^{c}	431^{d}	274^{c}	77^{a}	140^{b}	251^{c}
NDF content (%)	49.8^{b}	50.2^{b}	46.9^{a}	54.2^{c}	52.7^{c}	49.6^{b}
ADF content (%)	29.5^{ab}	26.9^{a}	28.2^{a}	32.4^{b}	31.3^{b}	28.5^{a}
ADL content (%)	3.11ns	3.05ns	3.66ns	3.35ns	3.25ns	3.73ns

[1] *: no significant difference; **: the same letters denote homogeneous groups.

Conclusion

The requirement to protect valuable natural habitats remains a potential source of forage for animal husbandry. Sheep grazing, particularly native breeds, is a good option to manage such grasslands despite the heterogeneity of forage quality. Variability of forage resources during the grazing season requires monitoring of forage supply and a precise determination of the stocking density.

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