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Phytocenological relationships in extensive pastures

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Abstract

Phytocenological relationships in pasture stands, belonging to the *Cynosurion* (*cristati*) Tx. 1947 alliance were cultivated and utilised under different environmental conditions between 1993 and 2000. The competitive pressure of tiller-forming grasses on legumes is 1.6 times as intense in these communities as is the pressure of tussock-forming grasses. Optimum representation of legumes (20–25%D) in extensive and continuously grazed pastures can be achieved if these communities comprise 46–64% of tussock-forming grasses and 6–14% of tiller-forming grasses. The best conditions for the formation of species-rich grassland communities develop in pastures occurring in transport zones, i.e., in the middle zones of mountain slopes. The application of a suitable pasture technology, namely of continuous grazing by low-impact beef breeds (e.g., Galloway breed) leads to the best results. This grazing technology has a beneficial biological ameliorative effect in ruderalised pastures after their manuring has ceased. This is indicated, e.g., by a retreat of *Rumex obtusifolius*, accompanied by the development of a harmonious plant species composition and by an increase in biodiversity in grassland stands.

Key words: pastures, phytocenology, regulation of legumes proportion, species richness, Bohemian Forest

Introduction

One of the most important non-production functions of grassland is its protective function with respect to both plant and animal gene pools (Rychnovská & al. 1985). This significant non-production function can be developed only by efficient management and use of grassland vegetation (Opitz von Boberfeld 1994). Pasture management results in different phytocenological relationships in a grassland plant community than does its management as a hay meadow. Apart from the set of habitat conditions, it is the intensity of management and use that significantly affects the formation of a grassland community (Klapp 1965).

Material and Methods

During the period of 1993 to 2000, the phytocenological relationships were studied within various pasture communities at eight sites, most of them in southern Bohemia, differing in environmental conditions. The result presented in this paper focus on cultivated pastures of the *Cynosurion* (*cristati*) Tx.1947 alliance. The characteristics of the localities studied are given in Table 1.

Table 1. – The sites and plant communities studied, and their environmental *characteristics*.

	Site	Region	Altitude (m a.s.l.)	Annual mean temperature (°C)	Total annual precipitation (mm)	Stand type (subtype)
I	Slabce	District of Rakovník (Central Bohemia)	408	7.8	486	*Dc (Dc-Fa)* *Dc-Pp* *Lo (Lo-Dc)*
II	Dolní Stropnice	České Budějovice Basin	470	7.1	660	*Lo (Lo-Fp)*
III	Těšínov	Třeboň Basin	560	7.1	610	*Lo (Lo-Fr)*
IV	Pístina	Třeboň Basin	650	7.2	630	*Lo (Lo-Fp)*
V	Mýtinky	Bohemian-Moravian Highlands (southern part)	670	6.1	700	*Dc-Fp*
VI	Kuklov	Blanský Forest Mts.	710	7.0	700	*Tr (Tr-Fp)*
VII	Hněvanov	Bohemian Forest foothills (southern part)	740	5.6	675	*Lo*
VIII	Nové Hutě	Bohemian Forest Plains	1020	4.2	1088	*Dc (Dc-Fp)*

Explanations: *Dc: Dactylidetum; Lo-Dc: Lolieto-Dactylidetum; Dc-Fp: Dactylideto-Festucetum pratense; Lo-Fp: Lolieto-Festucetum pratense; Dc-Fa: Dactylideto-Festucetum arundinaceae; Lo-Fr: Lolieto-Festucetum rubrae; Dc-Pp: Dactylideto-Poetum pratense; Lo: Lolietum; Fp: Festucetum pratense; Tr: Trisetetum; Tr-Fp: Triseteto-Festucetum pratense.*

All of the above stands observed were not fertilised and were grazed at a low intensity by beef cattle breeds. Klimeš (1997, 1999) gives detailed analyses of the studied communities and of the methods used for evaluating both the experimental data and the results of field observations. This paper focuses on a synthetic treatment of some earlier results published by Klimeš (1997,1999), Klimeš & Voženílková (2001, in press).

Results and Discussion

In the pasture stands studied, optimum representation of individual agrobotanical plant groups (grasses: 60–70%, legumes: 20–25%, other herbaceuos plants: 10–15%, Mrkvička 2001), was encountered in the *Trisetetum* grassland type. But even in this type, excessive spreading of *Taraxacum officinale* (up to 14% coverage) is a serious problem. From the viewpoint of species variety and diversity, the *Lolietum* grassland type showed the highest values within the whole set of pasture communities studied. Continuous grazing and absence of manuring of this type of vegetation leads, however, to excessive spreading of *Trifolium repens* (>40% coverage). The *Festucetum pratense* grassland type exhibits an even stronger tendency towards excessive spreading of legumes (even over 60% coverage). On the other hand, the *Dactylidetum* grassland type shows a tendency towards a reduction (mostly up to 15%) of the cover of legumes if manuring and fertiliser application are stopped.

Apart from the effect of the dominant species, it was the ratio between the coverage of tussock-forming and tiller-forming grasses that had a pronounced effect on the relative proportion of legumes in grassland stands. The following conclusions and practical recommendations can be drawn from a theoretical reconstruction of empirical data made by means of: (a) a multiple regression model, and (b) the definition of limits set by the required structure of pasture communities. A system of disparities was employed for this purpose (Klimeš 1999).

1. The competitive pressure of tiller-forming grasses *versus* legumes is 1.6 times stronger than that of tussock-forming grasses.

2. Legumes will maintain their optimum proportion (20–25% coverage) in low-intensity pastures if the cover degrees of tussock-forming and tiller-forming grasses vary between 46 and 64%, and 6 and 14%, respectively. At a higher coverage by tiller-forming grasses, legumes, among them especially *Trifolium repens*, are excessively suppressed. The stronger competitive pressure of tiller-forming grasses is evidently due to the similarity in the mode of vegetative spreading between these grasses and legumes. On the contrary, legumes will spread excessively if the tiller-forming grasses are under-represented (<6% coverage) in grassland stands. This may lead, especially on hot days, to dietetic problems (intestinal gas formation) in cattle grazing upon this vegetation. The proportions between individual plant species, or species groups, in freshly sown pasture stands usually differ form the final proportions between the species when the same pasture stands are established. At the time of sowing, the optimum proportion of tiller-forming grasses is 7 to 16.5% and that of legumes is 22 to 29.5%. The study of phytocenological relationships in low-intensity pastures has also proved that the best conditions for achieving a great species variety and high species diversity of their vegetation occur in pasture stands occupying the transport zone, which is found in the middle parts of mountain slopes and hillsides. By contrast, a smaller increase in species variety and diversity occurs after the transition to a low-impact management and use in pasture stands occupying the accumulation and infiltration zones on hillsides. The assumption has thus been confirmed that low-intensity forms of grassland management and use enhance its biodiversity (RYCHNOVSKÁ & al. 1985, OPITZ VON BOBERFELD 1994). Also, ruderalised pastures can be ameliorated by continuous grazing of low-intensity beef cattle breeds characterised by a small grazing selectivity (e.g., Galloway breed), in combination with no manuring or fertilizing. This type of grassland management suppresses ruderal plant species (e.g., *Rumex obtusifolius*), harmonise the stand structure and enhance the species variety in pasture stands.

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