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Výskumný ústav trávnych porastov a horského poľnohospodárstva
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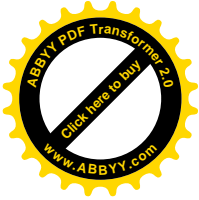
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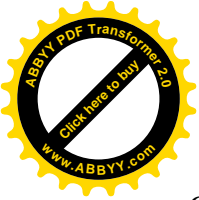
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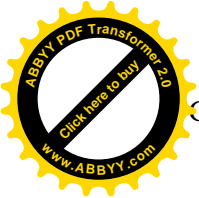




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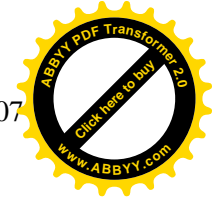
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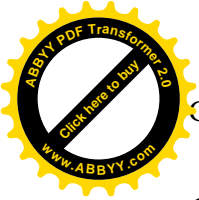
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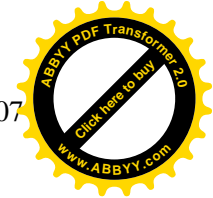
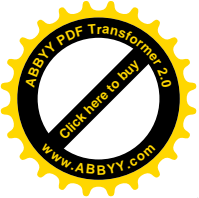
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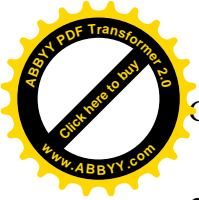
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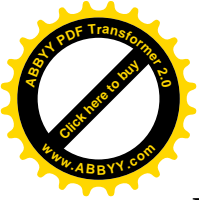
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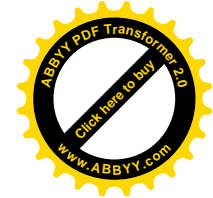
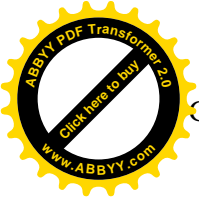
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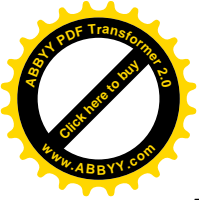
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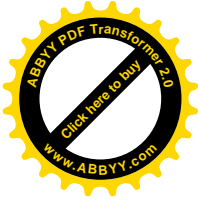
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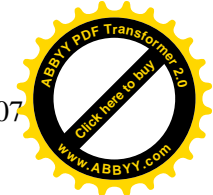
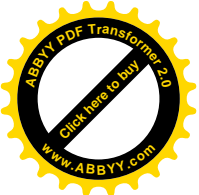


Tematický blok 1

Vlastnosti a funkcie trávnych ekosystémov a ich význam v otvorenej podhorskej a horskej krajine

Thematic Session 1

Properties and functions of grassland ecosystems and their importance in an open sub-montane and montane landscape



Prednášky / Oral Presentations

1.1 Fungování travinných ekosystémů je klíčem k porozumění jejich funkce v krajině

Functioning of grassland ecosystems is a key to understand their function in the landscape

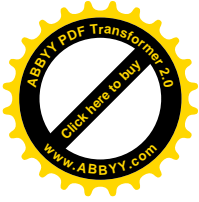
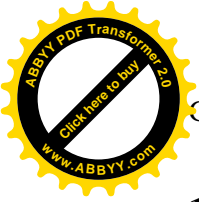
M. Rychnovská

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Abstract

Grassland ecology faces to a new task today: a new paradigm of biodiversity has replaced the previous one – that of productivity. Huge areas of arable land should be cut down and the landscape should restore its multifunctional design primarily based on grasslands. The way of reclamation of (semi)natural grasslands depends on local abiotic conditions, thus different ecosystem functioning should be installed. From xerophilous grassland to wetland meadows. Reclamation of semi-natural landscape depends thus on proper functioning of relevant newly introduced ecosystems. The understanding of ecosystem functioning lies in the knowledge of biotic elements, their relations and processes, leading to soil recovery, mineral cycling and energy flow. Examples of neglected knowledge concerning root systems, water turnover and life-history of meadow species are recalled. They are essential for the desired landscape functions: for soil reclamation, for climatic temperation and for ecological stability of those landscape elements.

Keywords: landscape restoration, biodiversity reclamation, ecosystem elements, landscape function versus ecosystem functioning



1.2 Štruktúra, vlastnosti a funkcie trávnej mačiny v horských poloprirodných a prírodných ekosystémoch I.

Structure, properties and functions of grassland sod in mountain seminatural and natural ecosystems I.

V. Krajčovič, Ľ. Ondrášek

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Abstract

Previous conferences Grassland Ecology I – VI. did not specifically deal with the problems of grassland sod. Therefore, data on the definition, composition and functioning of grassland sod within the ecosystems and the landscape have been collected.

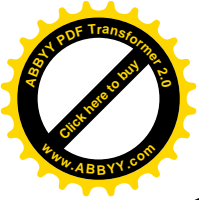
Drawing on long-term experiments focusing on ecosystems, grassland sod (GS) can be regarded as a crucial sward component that forms physical, morphologic, physiological and metabolic interface between above- and below-ground parts of biocenosis exhibiting significant functions.

Grassland sod was compared at three different sites, two or three levels of nutrition and two use systems. Results obtained from other sites are also used.

Basic structure: total sod biomass (TSB), divided into above-ground biomass (AB), tillering zone (TZ) to be specified, and root biomass (RB). Standing dead (SD) and litter (L) will be quantified as well. Structural components are then analysed according to their properties that determine the functions next analysed.

Finally, conditions for maintaining and preserving all the grassland sod properties and functions within the entire ecosystem are defined. The second, separate part of this paper presentation will provide analysis of soil-microbiological processes within grassland ecosystem.

Keywords: grassland sod, total sod biomass, abiotic and biotic properties, sod functions, tillering zone and root biomass



1.3 Štruktúra, vlastnosti a funkcie trávnej mačiny v horských poloprirodných a prírodných ekosystémoch II.

Structure, properties and functions of grassland sod in mountain seminatural and natural ecosystems II.

L. Ondrášek, V. Krajčovič

SCPV - Výskumný ústav trávnych porastov a horského poľnohospodárstva (SARC - GMARI Grassland and Mountain Agriculture Research Institute), Mládežnícka 36, 974 21 Banská Bystrica, Slovakia

Abstract

In connection to the first part of this paper presentation dealing with problems of grassland sod, the second part addresses soil processes within a carbon and nitrogen complex, involving soil and microbiological analyses of two or three fertilisation treatments and two management regimes.

Basic parameters are C_{ox} , N_t and the ratio of C/N. Long-term averages of their content, as well as variability and dynamics of changes during growing seasons are monitored.

Experiments at 48 sites in 10 regions, at three levels of altitude on southern and northern expositions enable evaluating relations of C_{ox} content with orographic factors. In the C-complex, an easily decomposable share, marked $C_{MH_2SO_4}$ was determined, and the impact of various management regimes considering the quality of organic matter was assessed.

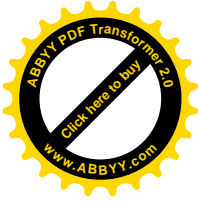
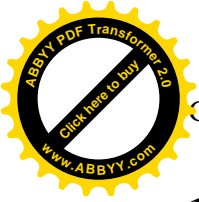
An important problem to consider is soil respiration and CO_2 output into the atmosphere, as well as its uptake in the process of photosynthesis, which is higher compared to output in a 1.4 : 1.0 ratio. Soil CO_2 respiration has been monitored over the entire growing season for 26 years under various conditions.

The research is also focused on the carbon microbial biomass (MB-C), as indicator of biological activity and as a marker for comparison of three grassland management technologies.

In addition to monitoring N_t , also fluctuant components NH_4-N and NO_3 are monitored during growing seasons. Though NO_3-N is given more attention, the ability of sod to translocate increased content from soil to the sward and vice versa decreases excessively emphasised risk of underground water contamination.

As indicators for biological processes and stability of organic matter, respirometric tests have been used. Their system was utilised to analyse permanent grasslands at 61 sites in the Podpol'anie region.

Keywords: microbiological processes, C_{ox} -pool, sod carbon forms, sod N-complex, sod organic matter testing



1.4 Vliv ekologických faktorů na podzemní rostlinnou biomasu travinných ekosystémů

Effect of ecological factors on belowground plant biomass of grassland ecosystems

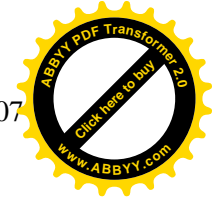
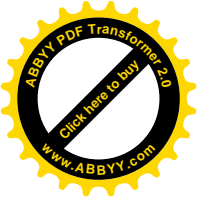
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Abstract

Total belowground plant biomass (TBB, comprising both living and dead plant parts), percentage proportion (PLBB) and amount of living biomass (LBB), as well as, yearly net belowground biomass production (BNBP) and root turnover (TO) were assessed and compared in various stands of grasslands studied in the Czech Republic, northeaster part of USA and in Cuban savannas. TBB assessed in 45 different grassland stands varied in a broad range of values. There was mostly only 1000 to 1500 g DM m⁻² in fresh moist meadows and dry grasslands but 2500 to 3500 g DM m⁻² in old wet and moist meadows. Higher values (up to 3000 g DM m⁻²) were also found in mountain grasslands of clear cut areas. PLBB in TBB and LBB were also considerably variable (mostly ranged from 10 to 80% of living parts and from 260 to 2300 g DM m⁻²). Values of PLBB and LBB gradually increase and TBB decrease from wet meadows through moist and fresh moist meadows to clear cut grasslands. The highest values of LBB were also recorded in the center of soil moisture gradient of a natural meadow hydrosere (1500 to 1700 g DM m⁻²). The lowest values of BNBP were recorded in unmowed *Polygalo-Nardetum* stands (750-950 g DM m⁻² yr⁻¹) and the highest ones in unmowed *Polygono-Cirsietum palustris* (1300 g DM m⁻² yr⁻¹). 500 g DM m⁻² yr⁻¹ was estimated in a savanna community. Obtained results suggest that TO period of total belowground plant mass is mostly about two to three years in mesophytic meadows and probably longer in stands growing in either dry or wet habitats. Meadow stands rich in plant species and with greater amount of LBB were more resistant to mowing, i.e., the decrease in both TBB and LBB was slower.

Keywords: net production, fertilization, living biomass, mowing, turnover rate



1.5 Význam a hodnotenie pôd trávnych ekosystémov Slovenska Position and evaluation of soils under grass ecosystems in Slovakia

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Abstract

The main obtained results concerning soils under grassland ecosystems on the basis of soil monitoring system in Slovakia are presented in this contribution. There are evaluated some important soil properties relating to main threats to soil (acidification, alkalinisation and sodification, pollution, decline in soil organic matter and available nutrients, soil compaction and erosion) in correlation with EC proposal. Soils without significant change occur mostly under extensive grassland ecosystems. In case these soils to be polluted, the accumulation of pollutants in topsoil is predominant opposite arable soils. Grassland soils have an important position in greenhouse effect, too. It was determined that about 10-500 thous.t of C-CO₂ emissions are produced from soils under grass within growing season opposite arable soils (700-3500 thous.t). Finally, in EU countries decrease of arable land area opposite grassland and forest land is a characteristic feature of land use especially during last period.

Keywords: soil monitoring, grassland ecosystems, threats to soil, soil properties

1.6 Charakteristika eutrofizovaných pôd v národných parkoch Slovenska

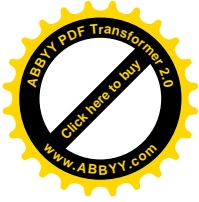
Characteristic of eutrophic soils in Slovak National Parks

J. Novák, K. Stankovičová, J. Chlpík, R. Labuda, S. Javoreková

Slovenská poľnohospodárska univerzita v Nitre, Tr. A. Hlinku 2, 949 76 Nitra

Abstract

This study was carried out on three locations characterized by eutrophic soils within the national parks of Slovakia to refine on their geologic-pedological and some selected biological characteristics. The sandy - loam and clay - loam cambisols in the locations of concern were characteristic by different soil properties, i.e. in exchanging soil reaction (pH 4.65 – 5.69), humus content (1.43-12.19 %, declining with the depth), and skeletal content (from 0 to 20 %). Total microbial accounts as well as amounts of organic compounds showed tendency to decline with the depth from 834 to 116 x 10⁵ CFU.g⁻¹. Of the



microorganisms presented, only composition of mycocenose was thoroughly identified. Of the total 46 fungal species recovered, the highest diversity was found out on a location Pod Ploskou (25 spp.). The most dominant fungi were found to be species within the genus *Penicillium* (13 spp.). The following four fungal species, *Hormographiella verticillata* (Pod Ploskou), *Malbranchea arcuata* (Strungový príslop), *Trichoderma longipilis* (Pod Ploskou, Pod Kečkou) and *Mammaria ehinobotryoides* identified during this study represent newly recognized fungi for Slovakia.

Keywords: cambisol, eutrophic soil, humus, diversity, culticvation, fungi, bacteria

1.7 Počítačový expertný systém na identifikáciu travinnobylinnej vegetácie Slovenska

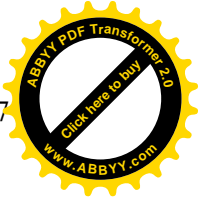
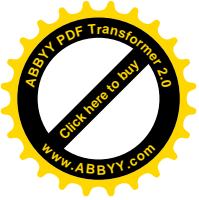
Electronic expert system for identification of Slovak grassland vegetation

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Abstract

We focused on the analysis of phytosociological relevés from semi-natural grassland communities belonging to phytosociological classes *Molinio-Arrhenatheretea*, *Festuco-Brometea* and *Nardetea strictae* stored in the Central Phytosociological Database located in the Institute of Botany, Slovak Academy of Sciences, Bratislava. The main aim was to create an electronic expert system to identify grassland vegetation types unambiguously and to be easily applied also in landscape planning and nature conservation. All accessible published relevés were compiled and, simultaneously, an extensive field survey was carried out with the aim to record the actual stage of semi-natural grasslands in Slovakia after the period of profound land-use changes. The analyzed database of grassland vegetation contained 11 121 relevés, collected by 143 authors between 1924 and 2006. We worked at three basic syntaxonomical hierarchical levels: classes, alliances and associations and we recognized variants as a classification unit at the hierarchical level below the association. We performed the supervised classification method Cocktail which imitates the traditional phytosociological classification approach using the sociological groups of species. The formal definitions are then formulated by means of presence/absence of sociological species groups combined with the dominance criteria of selected individual species. The validity of traditionally accepted syntaxa was checked and the scope of individual associations was revised. The developed expert system was applied on the testing data set from the Starohorské vrchy Mts. and the effectivity of grassland identification was evaluated for this region. The practical



application of the proposed expert system will be demonstrated during the lecture.

Keywords: Central Phytosociological Database, electronic expert system, formal definitions, grassland communities, sociological species groups

1.8 Impact of site conditions on the natural values of selected meadow communities occurring on the lowland and the mountains

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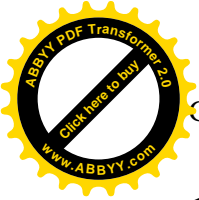
Abstract

Site conditions, including moisture and trophic conditions as well as the level above the sea, influence the development of meadow communities and their floristic composition and diversity and, consequently, their use value.

The study presents the analysis of about 500 phytosociological surveys of selected communities of the *Molinio-Arrhenatheretea* class occurring in the mountains in the neighbourhood of Karpacz (about 100 surveys) as well as on the lowland in the region of Wielkopolska (about 400 surveys) with the aim to determine their natural value on the basis of: floristic composition, the number of species in a phytosociological survey, floristic diversity assessed on the basis of the Shannon-Wiener index and the method of plant community valorisation according to Oświt. The site conditions (moisture content – F, soil reaction – R, soil nitrogen content – N, lighting conditions - L) of the examined meadow communities were evaluated using the Ellenberg's phyto-indication method (Ellenberg) and determining P, K and Mg employing conventional laboratory methods. In addition, the performed site investigations included the determination of soil temperature and light intensity in the sward.

Meadow plant communities occurring in the mountains are characterised by higher natural values, smaller changes in their floristic composition in comparison with typical forms, higher floristic wealth and diversity than those occurring on the lowland. The differences are particularly apparent in the case of communities of the *Molinetalia* order which, in mountain conditions, are characterised by only slightly changed phytosociological structure as evidenced by the occurrence of a significant proportion of species typical for this order. In addition, favourable site conditions, especially higher total precipitation during the vegetative season as well as limited anthropo-pressure, enhance the natural value of these communities.

Keywords: site conditions, meadow communities, floristic diversity, phyto-indication method



1.9 Hodnotenie biodiverzity Ivančinských lúk v Ramsarskej lokalite Mokrade Turca

Evaluation of Biodiversity of Ivančinské lúky in the Ramsar locality of Turiec wetlands

J. Tomaškin¹, Z. Brusilová¹, J. Čunderlík²

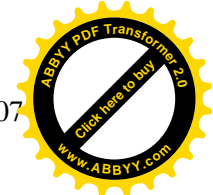
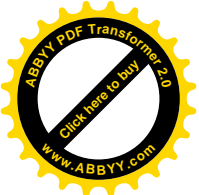
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² Slovak Agricultural Research Centre - Grassland and Mountain Agriculture Research Institute, Mládežnícka 36, 974 21 Banská Bystrica, Slovakia, E-mail: cunderlik@vutphp.sk

Abstract

This paper presents the results of grassland biodiversity evaluation of Ivančinské lúky - Meadows which belongs to the Ramsar locality Turiec Wetlands. During growing periods in 2005 and 2006 a botanical analyses of meadow was performed at 19 representative sites. Altogether 107 vascular plant species were identified at the analysed meadows though individual sites have lower number of species (7 - 16). Shanon's index of meadows diversity and index of evenness ranged from 1.08 to 2.58 and from 0.56 to 0.95 respectively. The lowest number of species was observed in meadows of the western part (7 - 11 species) and the highest in the meadows of eastern part of the municipality (14 - 16 species)., Diversification of plant communities along gradients of numerous environmental factors (light intensity, sunlight regime of plants, requirements for soil nitrogen, soil moisture and pH, altitude, inclination, soil depth) was analysed by methods of direct gradient analysis (CCA) The diversity of meadows was significantly influenced by soil nitrogen and soil moisture. The paper suggests appropriate systems of meadow management focused on conservation and protection of biodiversity.

Keywords: wet meadows, sward biodiversity, gradient analysis, ecological factors, Turiec wetlands



1.10 Vegetation forming biological construction at the bed of Skawica river

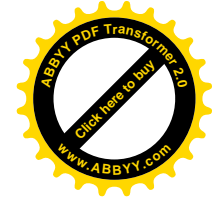
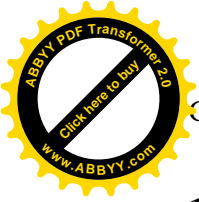
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Abstract

Skawica river is left bank inflow of Skawa river in the Skawce locality. It is typical mountain river, which flows through next localities and namely Zawoja and Skawce. About the mountain character this river testify first of all big inclination the bed river more than 30 ‰ and also high elevation above the valley which are: mountain ranges of Babia Góra and Polica from the side of SE and also mountain range of Jałowiec from the side of NW. Similarly how on the other carpathian rivers also at Skawica river there is biological construction, which protects the banks of this rivers against devastation the great flows inundations. For the sake of big speed devastates the banks of river and especially in places, where biological construction is absent or very scanty. In presented paper the authors describe the state of biological construction which there is on the banks of Skawica river. They inform in which conditions there are particular plant species and what is their effectiveness in banks protection, against big flows of inundations.

The authors were found, that the most frequent components of the biological construction mentioned river are: alders (*Alnus sp.*), willows (*Salix sp.*), ashes (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*), *Petasites officinalis*, *Agrostis stolonifera* and many others. In the reach yearly big flows the vegetation of biological construction creates the belt of bed river vegetation which is very frequent flooded by the bigger flows after intensive rain falls. The belt of the at banks vegetation occupies higher terraces flooded only during catastrophic flows, which take place from time to time. Everywhere there, where biological construction is suitable even the biggest flows do not devastate the river banks. Therefore knowledge about biological construction the rivers and streams is very necessary and useful.



1.11 Kvalita podhorských trávnych porastov a ich bioindikácia pomocou rovnokrídlovcov (*Orthoptera*)

Submontane grasslands quality and its bioindication by grasshoppers and crickets (*Orthoptera*)

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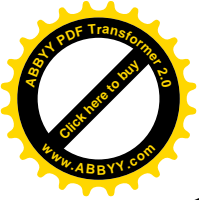
²State Nature Conservancy of Slovak republic, Administration of Protected Landscape Area - Biosphere reserve Poľana, Hurbanova 20, 960 01 Zvolen, Slovakia, e-mail: hruz@sopsr.sk

³Institute of Forest Ecology of the Slovak Academy of Sciences in Zvolen, štúrova 2, 960 01 Zvolen, E-mail: kristin@sav.savzv.sk

Abstract

Grasslands are changing more quickly than forest ecosystems thank to different structure and type of management. These changes can be studied and reflexed by different methods. One of the important methods is to study succession processes and structure of selected model plant and animal groups in grasslands, where is known management history. Biosphere Reserve Poľana area is located in Central Europe along a big span of altitudinal gradient (464–1458 m n.m.) and belong so to suitable model types of Central European sub-montaneous and montaneous grasslands. On other hand, the grasshoppers and crickets (*Orthoptera*) belong top such insect groups, which can clear reflex quality and management of grasslands also on small scale (several m²). In Slovakia were found altogether 121 orthopteran species, of them only in study area of Poľana Mts. 46% species (56) and so belongs this area to exceptional valuable grassland areas of Europe. In the last years we are continuing in previous studies, and working on five experimental plots (with different management system – pasture, moving, abandoned grasslands, etc.) and five control plots. Material of insects is collected using usual entomological methods (sweeping, pitfalls and individual collection). Main goals of this study were: i/ to compare different types of grasslands considering presence and abundance of grasshoppers; ii/ to analyse the structure and diversity of orthopteran species; iii/ to found characteristic and important species for particular types of grasslands and their different management; and iv/ to increase research activity of ecology in selected endangered and rare species of *Orthoptera*.

Keywords: grasshoppers, grasslands, management



1.12 Reakce dvou expansivních trav *Calamagrostis epigejos* a *Arrhenatherum elatius* na zvýšenou dostupnost dusíku

Response of two expansive grasses *Calamagrostis epigejos* and *Arrhenatherum elatius* to enhanced nitrogen availability

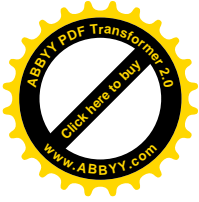
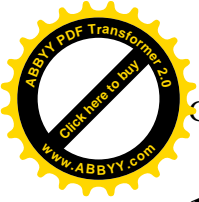
P. Holub

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Abstract

A large increase in density and cover of the tall grasses *Calamagrostis epigejos* and *Arrhenatherum elatius* has been observed in short dry acidophilous grasslands in the Podyjí National Park in the last decades. Effect of extra N input on biomass production and the concentration of N and P in plant matter were studied during 2002 and 2003 growing seasons in order to assess and compare whether and how higher N availability can support expansion of these tall grasses. In both studied years, *Calamagrostis* total biomass reached higher values (1529 and 1184 g m⁻²) than in *Arrhenatherum* (1227 and 990 g m⁻²), but significant only in 2002. Consequently, significantly higher values of fresh above-ground litter were observed in *Calamagrostis* (699 in 2002 and 533 g m⁻² in 2003) in comparison with *Arrhenatherum* (434 and 284 g m⁻², respectively) at the end of the growing seasons. Contrariwise, both concentrations of N and P were significantly higher in *Arrhenatherum* peak above-ground biomass (11.6-14.3 mg N g⁻¹ and 2.3 mg P g⁻¹) than in *Calamagrostis* (8.4-10.3 mg N g⁻¹ and (1.6-1.7 mg P g⁻¹). Substantial differences were found between species in resorption of nutrients, mainly P, at the end of the growing seasons. P concentrations in *Arrhenatherum* fresh litter were twice and three times higher than in *Calamagrostis*, while N concentrations in *Arrhenatherum* were higher only by 51-111% than in *Calamagrostis*. Thus, at the end of the growing season, *Calamagrostis* probably more effectively retranslocated nutrients (N and mainly P) from above-ground biomass in comparison with *Arrhenatherum*. Recorded differences between both grasses were similar after N application.

Keywords: competition, dry mass, fertilization, N:P ratio, tissue nutrient concentration.



1.13 The importance of ecological grasslands in the natural environment

R. Kostuch

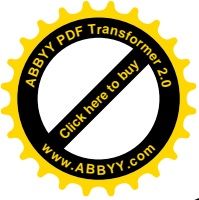
Agricultural University of Krakow, Department of Ecological Bases of Environmental Engineering, al. Mickiewicza 24/28, 30-059 Kraków, Poland, Tel: 048 012 662 4013, Email: rmmiszta@cyf-kr.edu.pl

Abstract

Considering their area, ecological grasslands constitute definitely the largest portion of ecological lands in Poland. They cover a wide variety of biotopes from wetlands through moderately moist to very dry habitats. They are characterized by a great floristic diversity comprising primarily plant species under legal protection, rare and endangered species, but also beautiful plants and those with therapeutic properties. Generally, the floristically richest grassland ecosystems which deserve to be counted among ecological ecosystems, usually occur on strongly moistened habitats or overdried ones because this type of biotopes, not very much utilized by humans are the least anthropogenized by them. Their environmental importance involves among others soil protection against corrosion, improvement of soil structure, increasing water capacity and water retention, soil enrichment in organic matter and fertilization but also increasing the numbers and activity of soil microorganisms. Ecological lands have also considerable impact on the atmosphere increasing humidity of its lower layers whereas by emitted essential oils improve its bacteriological state. Landscape amenities are an important feature of ecological grasslands. These are due to the occurrence of beautiful flowering plants, which are not perceivable on farmed grasslands because the sward use does not allow their full flowering. Particular landscape aspects are apparent during the flowering period in xerothermic plant habitats, most frequently occurring on the Lubelska Upland and Malopolska Upland. Ecological grasslands are also a peculiar bank of therapeutic plants, which are important for curing various health problems in humans and animals.

However, the sward of ecological grasslands should be utilized to some limited extent (by means of cutting or grazing) to prevent their afforestation which would make their existence impossible. Moreover, they favour maintenance of rich species composition of the sward because almost all its components reach full cycle of development producing seeds, which germinate after spilling and develop into new specimens.

Keywords: ecological lands, biodiversity, xerothermic vegetation, landscape amenities



1.14 Diverzita travných porostů v ekologickém zemědělství ve vztahu k dotační politice

Grassland diversity in relation to subsidies

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Abstract

The nonproductive effects of grassland will be increasing in the future, mainly in organic farming and in the ecological landscape infrastructure developing process. The presented article evaluates the quality of grassland in the micro region of Jeseníky in 2001-2007, where it, from the viewpoint of biodiversity, does not differ from conventional agricultural methods. The article also analyzes current subsidies in 2001-2007 and introduces a new suggestion to condition a part of payment with increased stand species diversity, and evaluated based on some number of designating plant species. In preference, this suggestion refers to organic farming, but is also found in conventional farming.

Keywords: organic farming, grassland, biodiversity, subsidies

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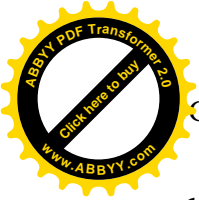
1.15 Effect of using mountain grassland ecosystems on infiltration and evapotranspiration

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Abstract

In case of grassland plants the fundamental difference in the amounts of water draining away occur between meadow and pasture way of sward use. The main reason for diverse quantity of water draining away from a meadow or pasture is the frequency of cutting. It causes that different amounts of water are used for the evapotranspiration process by a meadow – about 480 mm and pasture – about 413 mm. Pasture crop yield, about 20 percent smaller than meadow yield, causing about 15 percent decrease in water consumption for evapotranspiration, caused over 50 percent increase in the quantity of water draining away from the pasture during vegetation period in comparison with a meadow. Mean values of water effluents for the multi-annual period of research measured during the vegetation season from the soil covered by sward with constant height of



between 8 and 15 cm were 233.7 and 247.1mm, depending on the occurrence or lack of ground waters, whereas the simultaneous mean water effluents from similarly nitrogen fertilized meadow were respectively 148.8 and 216.3mm. Effluents from a pasture assume intermediate values. For instance at mean precipitation during the vegetation season reaching 560.4mm effluents from sodded soil used as a pasture were about 180 mm (32.1% of precipitation). At the same time amounts of water draining away from a meadow were definitely smaller and did not exceed 120 mm (21.3% of precipitation).

Effluents from the sodded soil profile assume different values in the subsequent months of the vegetation period. Decade values of meadow effluents without the ground water range between 0.8 and 28.6 mm. Effluents from a pasture in all decades were greater and ranged between 1.7 and 34.8mm. In the period beyond the vegetation season a weakened diversification of the effluent values is observed.

The obtained research results demonstrated that through diversified management system of grass communities and cultivation measures, diversifying the conditions of precipitation transformation into water effluent from grassland rhizosphere, it is possible to shape its amount. In the situation when anthropogenic activities comprise larger areas, they may significantly affect water cycling in agricultural catchments.

Keywords: mountain grassland ecosystems, meadow, pasture, infiltration, evapotranspiration

1.16 Hodnocení infiltrace vody na travních porostech

Evaluation of water infiltration on grassland

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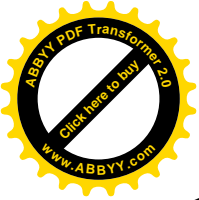
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²Oseva PRO, Research station for grass Zubří, Hamerská 698, 756 54 Zubří, Czech Republic

Abstract

In the Czech Republic increases share of permanent grassland particularly in marginal areas. With regard to protection against impact of rainstorm the hydrological properties of these areas are investigated as well as effect of grassland varieties. So far the mixed grassland effect is very favourable. Monocultures grown on natality areas have not so favourable infiltration abilities.

Keywords: grassland, infiltration, soil erosion



1.17 Dopad deficitu zrážok na produkčnú schopnosť trávnych ekosystémov

Impact of rainfall deficiency on the grassland ecosystems productivity

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Abstract

In this paper results on the impact of reduced amount of rainfall on the seminatural and temporary grassland in Slovakia are reviewed. Reduced amount of rainfall over growing period resulted to decrease of leaf area index (LAI) and net assimilation rate (NAR) of the monoculture sward of cv. Perun. Studied grass assortment (timothy, meadow fescue, perennial ryegrass) differed in their response to rainfall deficiency. Timothy was the least and ryegrass the most sensitive grass species to rainfall shortage. The great differences were confirmed among cultivators of individual species. Over the period 1991 to 2000, as many as four years exhibited a considerable decrease in rainfall amount during a growing period. Consequently, the decrease of rainfall amount resulted in the reduced productivity of permanent and temporary grassland, respectively. However, the negative impact of rainfall deficiency was reduced by the application of mineral fertilisers.

Keywords: rainfall, reduction, LAI, NAR, grasses, species, cultivars, grassland, production

1.18 Produkce biomasy, aktivita půdních mikroorganismů a mineralizace půdního dusíku různých lučních ekosystémů při různém množství srážek

Plant biomass production, soil microbial activity and N mineralization in various grasslands affected by different amounts of precipitation

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Abstract

Field experiment was established to quantify the effects of different amounts of rainfall on plant growth and soil N mineralization in three types of grassland ecosystems occurring in lowland region (short dry grassland), in highland (wet



Cirsium grassland) and in mountain (*Nardus* grassland). Roofs constructed above the canopy of grass stands and gravity irrigation simulate three climate scenarios: (1) rainfall reduced by 50 % (dry), (2) rainfall enhanced by 50 % (wet) and (3) the full natural rainfall of the current growing season (ambient treatment). Reduced rainfall decreased above-ground plant biomass of dry grassland by 29% and by 16% in mountain site than found in wet treatments. The highest production of aboveground biomass was found in wet *Cirsium* meadow ranging from 492 (ambient) to 695 g m⁻² (dry). Enhanced rainfall resulted in a significantly greater biomass of forbs in lowland site and in a higher biomass of mosses in all studied grasslands. Significantly more below-ground dry mass was accumulated in mountain and highland grasslands (2018 and 2074 g m⁻², ambient treatment) than that in dry grassland (951 g m⁻²). A decrease in yearly root increments recorded at reduced precipitation coincided with lower values of total below-ground dry mass assessed in the same treatments in highland (by 21%) and mountain grasslands (by 14%) in comparison with enhanced precipitation treatments. Effect of both reduced and enhanced amount of precipitation on activity of cellulolytic microorganisms was most pronounced in dry grassland where the fastest cellulose decomposition of all studied grasslands was recorded. Ammonium N has a dominant role in all grasslands. The lower actual amount of ammonia-N was recorded in dry grassland with a low biomass production. The greatest actual amount of nitrate-N was assessed in wet *Cirsium* meadow, characterized by higher above-ground biomass production. The average net ammonification showed on very low values ranging from 0.3 (wet *Cirsium* meadow) to 2.8 mg NH₄⁺-N.kg⁻¹.month⁻¹ (mountain site, ambient treatment) probably due to the concurrent effect of microbial immobilisation. The average net nitrification appeared to be negligible.

Keywords: biomass production, decomposition, drought, root increments, soil N mineralization

1.19 Vliv hnojení na množství kořenové fytomasy a výnosy lučního porostu

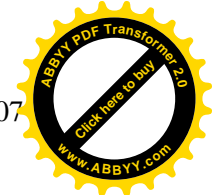
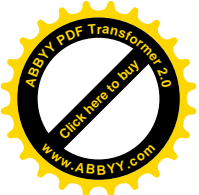
Effect of fertilization on quantity of root phytomass and the yield of meadow stand

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Abstract

In 1998 - 2000 the effect of fertilization on the quantity, stratification of root biomass and yields of dry mass on mesophyte meadow stands was studied. The root dry matter in the soil depth of 0.0 - 0.25 m was oscillating and the extreme values in individual samplings were found in 1998 (402 - 702 g/m²). In 1999



and 2000 the oscillating minimum and maximum values of dry underground mass in all variants were 418 - 622 g/m², 423 - 678 g/m² respectively. The mean values of dry root mass in unfertilised variants ranged from 484 to 540 g/m². PK increased the values insubstantially (507 - 565 g/m²). The higher nitrogen dose (200 kg/ha) decreased predominantly the total quantity of dry underground biomass by 36-102% was found in the check variant, compared in the yield of dry harvestable above-ground mass. In the systematic P₄₀K₁₀₀ fertilization the root weight in slightly moisten years (1998 and 2000) was by 18 - 70 % higher in comparison with the dry year 1999 when the root mass was 24 % less. In the fertilization 200 kg/ha N (+ PK) in the first two ears of studies the root mass was less by 12 % and 38 % compared with the yield of the dry meadow fodder. The results were processed by means of Statgraphic programme.

Keywords: permanent meadow stands, fertilization, root phytomass, vertical distribution

1.20 Vliv ročníku a obhospodařování na aktivitu půdních mikroorganismů lučního porostu

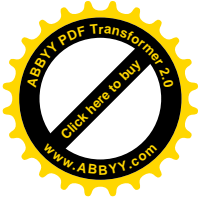
Influence of year and maintenance on soil microflora activity of floodplain meadow

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Abstract

The effect of soil temperature, air temperature and maintenance (mowing, mulching) on soil microflora activity of floodplain meadow was studied during years 2004 to 2006. The experiment was carried out on a permanent meadow of *Alopecuretum* community type near the village of Černíkovice (near Benešov, 363 m a.s.l.). Following treatments were evaluated: mowing once and twice a year, mowing twice a year +NPK, mulching once and twice a year and non-harvested. Cellulose decomposition during a growing season and all year was evaluated. Data were tested using ANOVA model and Tukey HSD multiple comparison procedure. Results show that an average cellulose decomposition rate ranged from 48 % at the non-harvested plots to 64 % at twice a year mowed + NPK plots. The decomposition of cellulose was also significantly dependent on the year (p=0.0). The highest microbiological intensity and decomposition



was observed in relatively warm year 2006. The relatively high decomposition rates took place even in the winter period probably due to soil washing by precipitation and melting water, not only due to micro flora activity.

Keywords: microbial activity, meadow, cutting, mulching, soil temperature

1.21 Diverzita zväzu *Polygono-Trisetion* a jeho rozšírenie v rámci Slovenska

Diversity of the alliance *Polygono-Trisetion* and his distribution in the Slovak Republic

K. Hegedüšová¹, H. Ružičková²

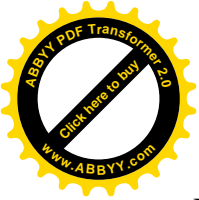
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Abstract

The alpine meadows of the alliance *Polygono-Trisetion* in the Slovak part of the Western Carpathians are distributing at altitudes 700 – 1500 m a.s.l. Meadows with characteristic species of these alliance (*Crepis mollis*, *Geranium sylvaticum*, *Senecio subalpinus*, *Phyteuma spicatum*, *Silene dioica*, *Crocus discolor*) occur mainly as small islands over calcareous bedrocks (Starohorské vrchy Mts, Veľká Fatra Mts, Belianske Tatry Mts, Nízke Tatry Mts, Slovenský raj Mts, Muránska planina Mts, Spišská Magura Mts, Levočské vrchy Mts, Poľana, Bukovské vrchy) at wetter and colder sites of saddles and slopes with mainly northern aspect, rarely on the non-carbonate substratum. Associations of these alliance have tight relationships to the alliances *Arrhenatherion*, *Mesobromion* and *Nardo-Agrostion*.

Phytocoenological material (324 relevés) was analyzed by cluster analysis processed by the program PC-ORD 4 where Ward's linkage method and the relative Euclidean distance as a resemblance measure were applied. Optimal number of clusters was determined by Crispness method. Diagnostic taxa for the individual clusters were determined by calculating the constancy and fidelity measure of each species to each cluster, using the *phi* coefficient of association in the program Juice. The CANOCO 4.5 package was used for running indirect gradient analyses. Detrended correspondent analysis (DCA) defined major gradients in the spatial arrangement of species of the analysed data set. Average Ellenberg indication values for relevés were plotted onto a DCA ordination diagram as supplementary environmental data. Based on the analysis five associations can be recognized within the alliance of *Polygono-Trisetion*: *Alchemilletum pastoralis* Szafer et al. 1927, *Geranio phaei-Alchemilletum crinitae* Hadač et al. 1969, *Geranio sylvatici-Trisetetum* Kapp ex Oberd. 1957,



Rhinantho pulchri-Alchemilletum monticolae Hadač et al. 1969, *Campanulo glomeratae-Geranium sylvatici* Ružičková 2002, *Crepido mollis-Agrostietum capillaris* Ružičková 2004.

This research was supported by grants APVT-51-015804 and VEGA 2/5084/25.

Keywords: *Polygono-Trisetion*, diversity, distribution

1.22 Grasslands in Strandza mountain

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Abstract

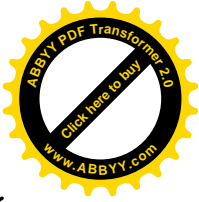
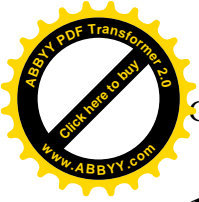
The main objective of the study was to analyze the main pasture type in the region of Strandza mountain in Bulgaria. – their status, botanical composition and use.

Most of the meadows and pastures in Strandja are xerothermal - belonging mainly to the *Chrysopogon gryllus* and *Andropogon ischemum* type. The meadows along the river valleys are mesothermal (*Poa silvicola*) and the more moist ones on the slopes belong to the *Agrostis vulgaris* and *Cynodon dactylon* - *L. perenne* type.

The Mediterranean influence on the phytocenological peculiarities of the natural grass stand in the area is expressed in the constant, abundant participation of the annual clover - *Tr. subterraneum*, *Tr. setiferum* and some typical representatives of the grasses - *Hordeum bulbosum*, *Phleum graecum*, *Hordeum crinitum*.

The process of ruderalisation in Strandja area is a rather advanced one and the wide distribution of the species *Eringium campestre*, *Echium italicum* and *Tragopogon mayus* proves it.

Keywords: grassland, pasture types, botanical composition



1.23 Záchyt dusíkatých vstupů vegetací vřesovišť v Národním parku Podyjí

Captured nitrogen inputs through the interception from dewfall into heathlands in National Park Podyjí

P. Křiváková, I. Novosádová, J. Záhora, Z. Gazdík

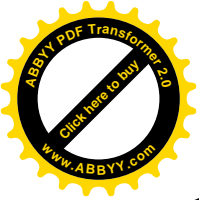
Agriculture Faculty, Mendel University of Agriculture and Forestry, Zemědělská 1, 613 00 Brno, Czech Republic, e-mail: zahora@mendelu.cz

Abstract

Massive damage of heathlands and their conversion to grasslands connected with species diversity loss occurrences in North West Europe during last decades. The same problem has occurred in National Park Podyjí. Heathlands started to be overload by competitive strong grasses *Calamagrostis epigeios* and *Arhenatherum elatius*. Expansive propagation of *Arhenatherum elatius* started in 1995 and acquired massive measurement in 1996 and 1997. One of the key reasons could be the increasing content of mineral N due to high amounts of nitrogen in atmospheric deposition.

The main aim of this work is to describe the amount of nitrogen input via vertical and horizontal precipitations. Measuring compares results from two different localities. Evidence was found of high N inputs through interception from dewfall. Our results support hypothesis that the propagation of grasses *Calamagrostis epigeios* and *Arhenatherum elatius* could be caused by increased inputs of nitrogen into vegetation. These inputs were adsorbed to vegetation as a horizontal precipitations and fogs. Inputs of these forms are very considerable in NP Podyjí and scale up amount of ammonium-N by tenfold and amount of oxidize N-forms by six fold. As a consequence of the high atmospheric nitrogen deposition we can observe limited heath's competing possibilities as well as the limited competing possibilities of other valuable plant species.

Keywords: nitrogen inputs, atmospheric deposition, heathland



1.24 Occurrence and hazard to dwarf cherry (*Cerasus fruticosa*) at Jaksice on the Miechów Upland

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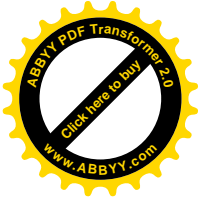
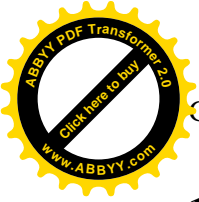
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Abstract

Despite the fact the Miechów Upland is the area where xerothermic vegetation habitats with typical steppe flora are quite numerous, dwarf cherry grows here sparingly. Its best preserved stands, numbering at least several dozen specimens usually forming scrubby thickets, are found at Jaksice village situated on the south-western end of the Miechów Upland on a southern slope situated about 40 m of relative altitude above the Szreniawa River valley. It is a limestone elevation with a between 45 and over 50 degrees angle, on its eastern side traversed with deep erosion dells. The crest of the elevation is covered by loess layer deep enough to enable cultivation of field crops, which however was abandoned over the recent years. Fallowed arable lands became overgrown by grasses and herb plants due to self-sodding process and slowly they started to self-afforestate. On the steep slopes the loess cover has been almost completely washed off so that rock mantle reaches the surface. Under such habitat conditions, on the edges of the above mentioned erosion indentations into the limestone bedrock, dwarf cherry stands occur.

It was found that despite no hazards posed for the environment by anthropogenic activity, existence of dwarf cherry under these conditions is not fully safe. The plants is endangered by extinction for genetic reasons. It is pollinated by pollen of other species from *Cerasus* genus and in result hybrids are formed, which are not similar to dwarf cherry. Preservation of dwarf cherry will require so called active protection involving removal of hybrids from the stands of this precious species.

Keywords: ecological lands, biodiversity, xerothermic vegetation, landscape amenities



1.25 Physical soil characteristics under grassland by organic manure application

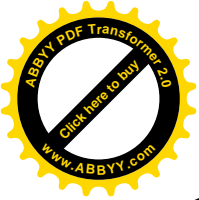
J. Ržonca, M. Svozilová, J. Pozdíšek, P. Vařeková

Výzkumný ústav pro chov skotu, s.r.o. Rapotín, Výzkumníků 267, 78813 Vikýřovice, Česká republika, e-mail: jozef.rzonca@vuchs.cz

Abstract

The paper deals with ascertain of basic physical soil parameters into an experimental area of Research Institute for Cattle Breeding in Rapotín. Soil samples from topsoil and subsoil were collected and following soil parameters analyzed, in spring of the years 2005 - 2007: the content of exchangeable bases – S, cation exchange capacity – T, total acidity – Hc, extent of soil sorption saturation – V (%), soil reaction. The undisturbed soil samples were taken by Kopecky cylinders in depth 0.01 – 0.3 m for the purpose of some physical parameters determination and following parameters analyzed: bulk density (ρ_d , kg.m^{-3}), total porosity (P, %), capillary porosity (Pk, %) and non - capillary porosity (Pn, %), maximal capillary water capacity (Θ_{KMK} , %), retention water capacity (Θ_{RVK} , %) and capillary absorbability (Θ_{KN} , %). Values of bulk density moved from 1332 to 1531 kg.m^{-3} , total porosity values were in interval 40.3 - 49.9%, maximal capillary water capacity was in interval 31.22 - 39.91% and retention water capacity from 24.81 to 33.80% in dependence on layers in year 2005. Organic manure application caused increased of cation exchange capacity. Values of maximal capillary water and retention water capacity increased, as well. Increase of maximal water capacity was higher by application of slurry in comparison with farmyard manure application. In reverse retention water capacity increase was higher by treatments of farmyard manure application. After 3 years exploitation of grassland were values of bulk density from 1319 to 1558 kg.m^{-3} and values of total porosity moved from 40.7 to 50.8%.

Keywords: cambisol, stocking rate, bulk density, hydro physical characteristic



1.26 Vyplavování minerálního dusíku do podzemních vod z půdního prostředí různých ekosystémů

The leaching of mineral nitrogen into underground water from soil environment of different ecosystems

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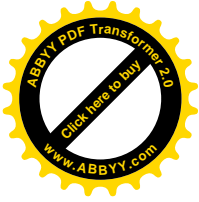
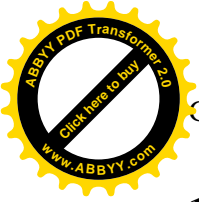
Abstract

The aim of the presented study was to compare the caught mineral nitrogen in both forms, ammonia-N and nitrate-N as well, into the ion exchange resin (IER) exposed to percolating soil solution in the different soil depths (20 and 50 cm). IER were installed in pastures affected by different grazing intensities, in semi-natural grasslands and in arable land. The method, using IER technique, represents minimal damage of soil environment and was applied during growing season 2005, as well as during winter dormancy period 2005/2006 in the selected area located near the town of Březová nad Svitavou. The reason of the interest in this locality, which is the most important source of the drinking water for Brno agglomeration, is the fact that the content of the nitrates started to exceed the limit value for drinking water in some water wells.

Considerable differences were found between the arable land, intensive pasture and semi-natural grassland. The values of mineral nitrogen captured in IER in soils of arable land were manifold higher than that in semi-natural grassland ecosystems. These differences were found particularly in the course of the growing season. It was proved, that agricultural production affects fluency of nitrogen cycle, especially. It is evident, that arable soil represents permanent risk for underground water quality. If we take account of the total area of arable land in studied region (more than 70 %), we can hypothesize, that the nitrogen inputs from nitrogen fertilizers and from atmospheric deposition could explain the overloading of accumulative capacities in soil for nitrogen with the well known and described consequences.

The obtained results helped us to understand connection between the input of nitrogen, the sustainability of the landscape and the accumulation capacities of particular ecosystems for nitrogen.

Keywords: percolated mineral N, nitrate N, ion exchange resin, drinking water



1.27 Agroenvironmentálny prieskum krajinných segmentov v Nízkyh Tatrách

Agroenvironmental survey of landscape segments in the *Nízke Tatry* mountains

Ľubomír Hanzes, Vladimír Krajčovič, Norbert Britaňák, Iveta Ilavská, Lukáš Lipták

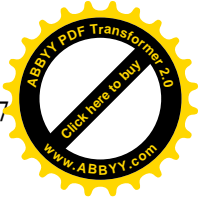
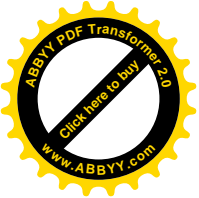
SCPV - Výskumný ústav trávnych porastov a horského poľnohospodárstva, Výskumné pracovisko (Grassland and Mountain Agriculture Research Institute, Research Station), ul. SNP 2, 058 01 Poprad (Slovakia)

Abstract

A field survey of agroenvironmental situation was performed at *Liptovská Teplička*, a village in the eastern part of the *Nízke Tatry* mountain range. Effects of grassland farming on the air and water quality were monitored at 8 research sites. Emissions of CO₂, CH₄, SO₂, NO₂, nitrogen and sources of emissions from animal production were measured. On average, CO₂ and CH₄ production were classified as negligible or inconsiderable. The values of SO₂ and NO₂ ranged between 3.02 and 4.63 µg m⁻³. A negligible to slight risk of air pollution from animal paddocks and passage ways was found at the *Terasy*, *Zadošťianka* and *P. hoľa* sites. The most numerous water sources were found at *Mokrad'* site and there was minimum risk of pollution from the aspect of site management techniques. Small areas of wetlands were found at *Došťianka* site (2 ha) but these were disturbed by grazing animals.

The data and information from the survey might be used in planning the agroenvironmental measures. The assessment could be also useful in the management of agricultural production considering a subsequent positive impact on the non-production and landscape-forming functions as well as on the sustainable agriculture.

Keywords: agroenvironmental measures, water, air

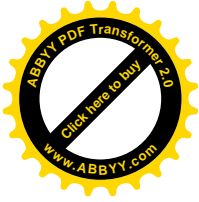


Tematický blok 2

Ekosystémy poloprírodných a dočasných trávnych porastov – komplexné hodnotenie

Thematic Session 2

Ecosystems of seminatural and temporary grasslands – complex assessment



Prednášky / Oral Presentations

2.1 Využitie tráv a d'atelinovín v osevných postupoch horských a podhorských regiónov

Utilisation of grass and clover in cropping patterns for mountain and upland regions

I. Ilavská, N. Britaňák, Ľ. Hanzes, L. Lipták

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Abstract

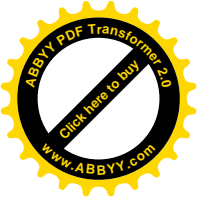
A research was carried out in the Nízke Tatry (Low Tatras) mountain range region investigating cultivars of four intergeneric grass hybrids (IGHs Lofa, Bečva, Hykor and the newly-bred HŽ 13 DK), three tetraploid red clover (*Trifolium pratense*) cultivars (Beskyd, Amos, Dolina) and three simple grass/clover mixtures composed of HŽ 13 DK and the red clover cultivars.

The results recorded in the first harvest year showed that the monocultures of intergeneric grass hybrids were the most advantageous ones when the condition of sward was considered (low weed infestation, very consistent sward). Their ground cover was ca 90 % at the 1st cut and ranged between 94 and 100 % at the 2nd and 3rd cuts and consequently the yield of dry matter (DM) was from 9.392 to 11.292 t ha⁻¹.

The sward condition at red clover and at simple grass/clover mixtures equalled that of IGHs, however, the weed proportion was higher (10 to 20 % of ground cover at the 1st cut). This situation changed in favour of the sown species after the 1st cut as shown by the botanical composition (the proportion of sown species ranged from 87 to 90 %). Such a condition of sward influenced also DM yield which was from 8.197 to 8.481 t ha⁻¹ at the red clover monocultures and from 9.034 to 9.374 t ha⁻¹ at the simple grass/clover mixtures.

Considering the species and varieties used in the research, the significant differences in DM yields were found only between the intergeneric hybrid cv. Hykor (*festucoid* type) and the other IGHs, namely *lolioid* ones. The differences in DM yield between the red clover cultivars were not significant thus indicating their versatile use in upland and mountain regions. Similar conclusions were drawn for the simple grass/clover mixtures because high DM yields were recorded also here. Moreover, the importance of swards with the above-mentioned composition is rising also in relation to the assessments of their dietary and nutritive value.

The following parameters were recorded at IGHs: PDI between 48.1 and 57.3 g kg⁻¹ of dry matter and NEL from 5.37 to 5.94 MJ kg⁻¹. The differences found between the red clover monocultures and the simple grass/clover mixtures were



not notable. The values of PDI ranged between 76.2 and 80.0 g kg⁻¹ DM and NEL was 5.34 - 5.66.

Keywords: intergeneric hybrids, red clover, simple grass/clover mixtures, dry matter

2.2 Opakovaný prísev do trávniho porastu a jeho vliv na produkci a kvalitu píce

The repeated direct seeding into grassland and its effect on forage production and quality

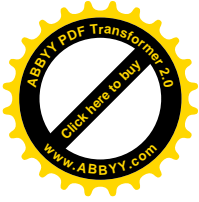
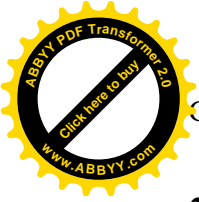
P. Komárek, A. Kohoutek, V. Odstrčilová, P. Nerušil

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Abstract

The trials were established on a fluvisoil at the Jevicko site, the Czech Republic. Directly sown grassland was compared with permanent grassland and temporary grassland. Direct seeding was performed in 1991 (a seeding machine SE-2-024) and repeated in 1996, 2000, 2003 and 2006 (a seeding machine for strip-sowing - a prototype with the grass sward cultivated into 150 mm deep and wide strips with 450 mm between strips and with a sowing mechanism, Øyjord) and the same mixture and seed quantity were used (29 kg ha⁻¹). Temporary grassland was sown only on the one occasion in 1991. The grass-legume seed mixture comprised: Festulolium hybrid (*Lolium multiflorum*. x *Festuca arundinacea*) cv. Felina (12 kg ha⁻¹), Perennial ryegrass (*Lolium perenne*) cv. Sport (8 kg ha⁻¹), Cocksfoot (*Dactylis glomerata*) cv. Niva (4 kg ha⁻¹), Red clover (*Trifolium pratense*) cv. Kvarta (3 kg ha⁻¹), White clover (*Trifolium repens*), cv. Huia (2 kg ha⁻¹). The experiments were monitored at four levels of fertilization (no fertilization, P₃₀K₆₀, N₉₀P₃₀K₆₀, N₁₈₀P₃₀K₆₀) and harvested three times annually. Plot area was 10 m², 4 replicates. This paper reports dry matter (DM) yield in 1991-2006 and forage quality in 1995-2006. DM yield was influenced by the type of grassland. Average DM yields from 1991-2006 were 8.11 t ha⁻¹ (direct sown grassland) and 8.45 t ha⁻¹ (temporary grassland), which in both cases represent significant increases (P<0.01) when compared with permanent grassland (6.93 t ha⁻¹). Direct sowing significantly increased NEL concentration (5.61 MJ kg⁻¹) compared with temporary grassland value 5.53 MJ kg⁻¹ and 5.46 MJ kg⁻¹ under permanent grassland. Repeated direct sowing of legume-grass mixture into the permanent grassland performed every 3-5 years significantly increased forage yield in comparison with permanent and temporary grassland. Increasing rate of nitrogen fertilizer increased forage yield and quality.

Keywords: direct sowing, grassland, fertilization, forage quality



2.3 Specifics in formation of plant communities on arable lands removed from intensive treatment

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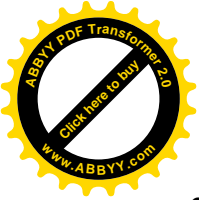
Abstract

It is foreseen to convert 10-12 million hectares of marginal arable lands in Ukraine into meadow lands and, partially, reforestation areas, to optimize the structure of agrolandscapes, to protect soils from erosion, and to provide the cattle with cheap valuable feed. This has aroused a keen interest in the study of plant communities' formation patterns, first of all in poiums, including those formed spontaneously.

In this connection, a research was made into the process of spontaneous revegetation at different overgrowing stages on the light gray forest loam soils in the north part of Ukraine's forest-steppe near Kiev in 2000-2006, and into the impact of start reseeding of permanent grasses, and fertilizer dressing on the acceleration of formation of zonally adapted and economically valuable phytocenosis.

Our researches have shown that on the areas of arable lands that remained untreated, plant communities of 40 to 50 or more wild species of grass spontaneously appeared already in the first year, however, in terms of cropping capacity and feeding value they were for a long time significantly inferior to the artificially seeded grass. Complementary seeding of grass in the first year of overgrowing in the amount of ½ rate of the herbage or legume-grass mixture seed sowing does not increase the number of species in communities, however, brings about a 1.3 to 2.2 increase in the cropping capacity of the meadow lands and their feeding value. This process is enhanced by the application of N₉₀P₅₀K₇₀, while complementary seeding of multi-specious seed mixture of stable natural phytocenosis increases the full ecological and biological value of plant communities, their adaptive capacities, and in 5-7 years accelerates the formation of zonally and ecologically balanced phytocenosis with a high self-renewal ability.

Keywords: ecosystems of grassland, spontaneous reestablishment of plant cover, ecological and cenobiotic structure



2.4 The impact of legumes to above ground biomass in grassland and to subsequent crops

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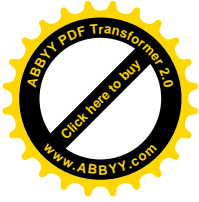
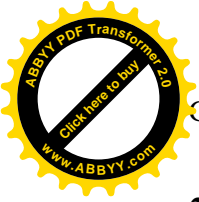
Abstract

The stable balance between legumes and grasses in the swards, sustainable forage production over several years are still relevant objectives in grassland management. A whole range factors and their interactions influence the potential of legumes as nitrogen suppliers. The experiments on a loamy *Endocalcari-Epihypogleyic Cambisol* in Dotnuva (55° 24' N) were aimed to assess the impact of several legumes to above ground biomass in grassland experiment and to subsequent crops in crop rotation experiments.

Different swards consisting of *Trifolium repens* L., *Medicago sativa* L., *Lolium perenne* L., *Poa pratensis* L., *Festulolium* hybrid in were investigated under grazing management. The proportion of legumes in the legume/grass mixtures fluctuated both from year to year and within individual growth periods, and was very strongly influenced by environmental stress. The yield of legumes in the swards consisting lucerne after eight years of grazing accounted for nearly half and even more than half of the total sward yield. The content of white clover decreased more rapidly than content of lucerne. Among three functional groups (legumes, grasses and forbs), the persistence and competition of grasses with increasing sward age decreased. A positive effect of lucerne on stability of grazing swards was obtained over eight years.

The effect of different legume/grass swards on the subsequent winter wheat crop depended on sward composition, and highest grain yield was obtained after ploughed-in lucerne. Spring wheat following lucerne/grass swards produced a higher grain yield than that red clover swards. Pre-crop of white clover and conventional drilling significantly affected winter wheat grain yield and the yield of triticale was higher following wheat after pre-crops that included white clover. The highest winter wheat and following barley grain yield was achieved on the ploughed-in legumes plots using conventional sowing method.

Keywords: lucerne, red clover, white clover, grasses, subsequent crops



2.5 Porovnanie prísevov do TTP v rozdielnych stanovištných podmienkach

Oversowing of seminatural grassland - a comparison between diverse regions in Slovakia

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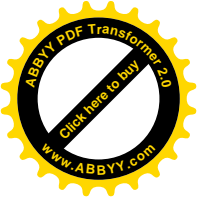
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Abstract

The research was carried out with the aim to investigate oversown grasses, legumes and mixtures at three sites under different climatic conditions. At all the research sites, yield of legume treatments was higher than the control. The production of oversown grass/clover mixture treatments was higher than the control. Mean production of oversown grass treatments was lower than the control at the *Banská Bystrica* and *Lubiša* sites. At *Liptovská Teplička* site, yields of grass/clover mixture treatments were lower than the control but the yield at the oversown grass treatments was higher than the control. The oversowing of seminatural grassland with legumes showed good results, especially when white clover (*Trifolium pratense* L.) was used - the white clover was very flexible. The oversown grasses, legumes and grass/clover mixtures improved yield and enhanced sward canopy.

Keywords: grassland, oversowing, grass/clover mixtures, control treatments, sites



Postery / Posters

2.6 Vplyv využívania krajiny v časovom horizonte 50 rokov na súčasné druhové zloženie lúk horného Liptova (na príklade katastrálneho územia obce Východná)

Species composition of recultivated meadows of upper Liptov region within the 40 years time horizon

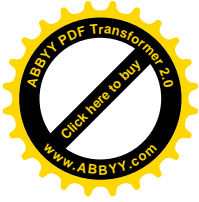
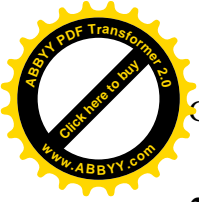
Z. Válkovcová, H. Ružičková

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Abstract

The agriculture of upper Liptov region is oriented mainly towards cattle and sheep breeding. Extensive recultivations of permanent grasslands were in this region performed mainly from 1950s till 1970s. The recultivations especially included drainage, intensive fertilising and resowing of species with high feeding value with the aim to increase the feeding potential and yields. Nowadays, in most cases recultivated meadows are characteristic by high homogeneity, predominance of grasses and low diversity of plant species. The species composition of recultivated meadows is however influenced also by form of agricultural land use in the past. In the paper we concentrate on the species composition of recultivated meadows, and with the use of ArcGIS programme also on their evaluation based on the way of land use during the last 40 years.

Keywords: Intensive meadows, Land use



2.7 Productivity formation of cultural pastures' agrophytocenosis in the Forest-Steppe of Ukraine depending on the techniques of their creation and practices of use

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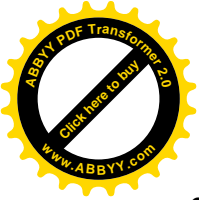
Abstract

The results of long-term researches carried out in the central Forest-Steppe of Ukraine on the theoretical substantiation of agroecological influence of different technological techniques of creation and practices of use of sown perennial phytocenosis on the change of density, floristic diversity of grass cover, fodder productivity and quality of cultural pastures are stated. The use of green manure crops as preceding ones when sowing perennial grasses results in the formation of more dense sod – in average 2228-2485 stems/m², increase of cereal grass content in leguminous-cereal grass stands up to 6-7%, substantial increase of meadow-pasture grasslands' productivity.

The influence of different levels of load and intensification of cultural pasture use on the grass productivity formation under conditions of natural soil moisture supply is established in the trial with milking cows. Pastoral livestock influence is considered to be the most negative one, while the most suitable one is the interchange of cutting and pasture use year by year or a regime of two cuttings for hay per season facilitating the increase of *Lotus corniculatus L.* content in leguminous-cereal grass stands by 13.9-18.1% and *Galega orientalis Lam.* content by 5.8-9.0%. Cereal grass stand provides the highest productivity in constant pasture use under conditions of sufficient nitrogen nutrition; green mass cutting for hay decreases fodder unit output by 23.7-24.5% and crude protein – by 42.9-43.4%.

Among the combined hay-pasture practices of cultural pasture use the most productive one is the start of livestock grazing after the first cutting for hay which provides its productivity both in fodder units and crude protein correspondingly, 5,2-5,5 and 1,0-1,2 t/he; these indices appeared to be the lowest in the variant when the grazing has started after the annual hay-cutting use. Double cutting per season of *Galega orientalis Lam.* in grass mixtures with cereals is a more productive regime than carrying out of 3-4 cycles of grazing which results in the output reduction of fodder units and crude protein per hectare to the level of 3,8-4,4 and 0,6-0,7 t correspondingly.

Keywords: cultural pasture, practices of use, diversity, productivity.



2.8 Ukládání půdy do klidu pomocí trav a zaplevelení následné plodiny

Setting arable land aside with grasses and weed infestation of the follow crop

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Abstract

The influence of four grass forecrops (*Bromus marginatus* Nees. ex Steud., *Taraxacum officinale* L./ P.Beauv. ex J.S. et K.B.Presl, *Medicago sativa* L., *Festuca pratensis* Huds. 'Otava', *Dactylis polygama* Horvat. 'Tosca') and the way of their harvest (once or three times per year cut or once or twice per year mulching (1996-2003) on weed infestation of sward of *Lolium multiflorum* cv. Lolita (4n) was evaluated in a field experiment in Prague in 2005-2006. *Lolium multiflorum* was cut three times per year and the mass was removed. The share of weeds in the *Lolium* phytomass was evaluated. The results were evaluated by the analysis of variance (ANOVA LSD – P0.05) in Statgraphics programme, version XV. Significant influence of the vegetation year, cut, grass species and the way of its harvest was proved. Significantly lower average share of weeds was found on the plots where the forecrop was three times per year cut (14,4%), mulched twice per year (11,4%), significantly higher (in average 25-27%) where the forecrop was once per year harvested in the end of the vegetation period.

Keywords: setting arable land aside, cutting, mulching, follow crop, weed infestation

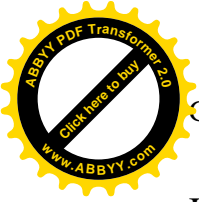
2.9 Agroecological aspects of nitrogen fixation intensification for the productivity increase of meadow grass stands on the arable lands of the Forest-Steppe of Ukraine

V. F. Petrychenko, K. P. Kovtun, Y. A. Veklenko

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Abstract

The ways of intensification of grassland fodder production on the arable lands of Forest-Steppe of Ukraine are substantiated and developed in the article. The model of perennial cereal and leguminous-cereal grass mixtures is offered; technological techniques of their productivity increase are developed.



It is established that the yield of cereal cenosis directly depends on the doses of mineral nitrogen. Increase of the doses of nitrogen fertilizer from 180 to 369 kg/he of nutrients increases dry matter output of early ripening grass mixtures from 1,2 to 3,2 t/he, mid ripening - 2,2-4,7, late ripening - 1,5-7,0 t/he. Differently ripening leguminous-cereal grass stands on the background of $N_{60}P_{90}K_{120}$ have the same productivity as cereals where nitrogen fertilizers were applied annually in the dose of N_{240} .

Regularity of the influence reduction of the vegetation period weather conditions on the cereal agrophytocenosis productivity with the increase of mineral nitrogen fertilizers' rate is determined by means of the regression analysis method.

Agrobiological role of different leguminous grasses for the increase of productivity of leguminous-cereal grass stands, fodder quality and its energy nutrition value is determined.

Technological measures for the use of bacterial preparations and bio-stimulators of plant growth are developed for the intensification of the nitrogen fixation process in the root zone of leguminous and cereal grasses, more intensive plant intake of biological nitrogen, increase of leguminous-cereal grass stands' yield and fodder quality.

Keywords: biological nitrogen, perennial leguminous grasses, productivity, fodder quality.

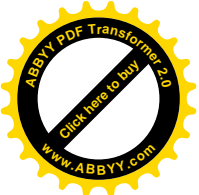
2.10 Effects of certain grassland management procedures on the use value of upland meadow

M. Kasperczyk, W. Szewczyk

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Abstract

The investigation on the mountain meadow (640 m a.s.l.) with prevailing red fescue (*Festuca rubra*) and common bent-grass (*Agrostis capillaris*), and located on brown soil in loamy sand type, was conducted in 1999-2006. An experimental field was limed and divided in two parts. One of them was left as natural grassland, and the other was undersown with red clover (*Trifolium pratense*), which lasted there for as long as 5 years. In the seventh and eighth experimental years, when red clover had disappeared, the undersown plots received nitrogen fertilisation of 100 or 150 kg N·ha⁻¹ plus PK. Experimental evaluation involved the following parameters: botanical composition, yielding and soil pH. Liming alone did not affected dry matter production, however, it positively shaped botanical composition of sward. Fertilisation, especially with



nitrogen at the PK background, proved to be the primary yield-improving factor. Red clover present in the undersown grassland had a beneficial effect on its yielding and botanical composition of sward during a six-year period. Nonetheless, in final experimental seasons the higher level of nitrogen fertilisation resulted in botanical composition similar to the one of natural grassland at the fertilisation level of 100 kg N for 8 years. The positive effect of liming with 2 t CaO·ha⁻¹ on soil pH in mountain grasslands would sustain for as long as 10 years.

Keywords: mountain meadow, undersowing, botanical composition, dry matter yield

2.11 Factors influencing the chemical composition of the meadow sward in the range Radziejowa in the Carpathians

M. Kopeć, J. Zarzycki

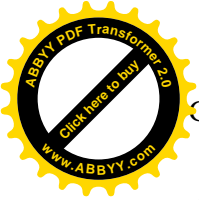
Agriculture University of Kraków, Poland

Abstract

Investigations were conducted in the mountain region- Radziejowa which belongs to the Beskid Sądecki range (Poland). Samples (212) were collected from the grasslands differing in the habitat conditions (height over the sea level, inclination, exposure) and in the way of their management. The maps of land utilization from 80s were used during the investigations. On this base permanent grasslands were outlined as well as grasslands created on the arable land.

It was found that the sward had diversified botanical composition and it was classified into a few phytosociological units.

Mean contents of elements in the meadow sward indicated the shortages of nitrogen, potassium and phosphorus in the plants. In contrast with it the level of calcium was optimal. When it comes to microelements the copper content was lower than fodder requirements are. Sodium, molybdenum, zink and manganese showed the highest sequences and zink and molybdenum showed the highest content variability. On the base of mean contents the weight ratio Ca:P was calculated and it was slightly higher than the optimal value (considering fodder requirements) which resulted from the high content of calcium in the sward (low share of grasses in the sward) and the shortage of phosphorus. The value of ratio K:(Ca+Mg) was very low but similar to the optimal value. Correlation coefficients between the elements determined in the meadow sward indicated a weak connection between the elements. The values of coefficients showing relationship between sward chemical composition and habitat parameters were low therefore attention was paid to their direction. The chemical composition of



the meadow sward collected from the Radziejowa range showed great diversification but it was not influenced by the investigated characteristics (described by the indexes) of the habitat.

Keywords: grass, mountains, chemical composition, environmental indexes

2.12 Impact of environmental factors on fodder value of permanent grassland and grassland situated on former arable land

J. Zarzycki¹, M. Kopec²

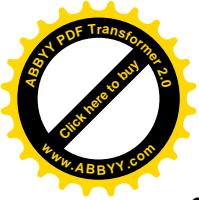
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Abstract

Socio-economical changes of last decades caused huge variation in land use in mountains regions. Severe decline in stock number diminished the need for fodder. A number of meadows and pastures situated in unsuitable conditions was taken out of farming and was afforested or underwent the secondary forest succession. Fodder production is now concentrated on new grasslands created on former arable land. Land use change caused also variation in botanical composition and fodder quality. Based on 312 phytosociological relevé made in grassland communities of *Mollinio-Arrhenatheretea* and *Nardo-Callunetea* class in Radziejowa range (Beskid Sądecki Mtns.), the forage quality was estimated by using forage indicator values. The effect of some environmental factors on the quality was also analysed. The fodder quality was negatively correlated with altitude, soil acidity and slope inclination. However, the main factor influencing the fodder quality was land use in the past. Considerably better was fodder from fields that were arable land in 80. then from permanent grasslands. Unexpectedly no effect of soil soluble P and K contents was found.

Keywords: fodder value, permanent grassland, history of land use



2.13 Zhodnotenie produkčného potenciálu a účinnosti poloprírodných, prisievajúcich a obnovovaných trávnych porastov vo vzťahu k stabilite ekosystému

Evaluation of production potential and efficiency of semi-natural, oversown and restored grasslands in relation to the stability of ecosystems

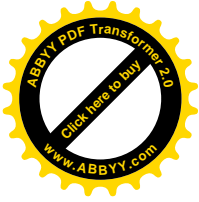
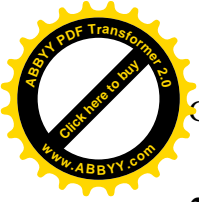
J. Čunderlík, L. Ondrášek

SARC - Grassland and Mountain Agriculture Research Institute, Mládežnícka 36, 974 21 Banská Bystrica, Slovakia, e-mail: cunderlik@vutphp.sk

Abstract

The yield, quality and nutritive value of herbage as well as sward botanical composition in relation to various mineral nutrition were evaluated at the Radvaň site in Banská Bystrica, central Slovakia. Research results showed that the highest herbage yield was achieved with a treatment $N_{120} + PK$. Considering the grassland type, the highest production was observed on temporary grassland (TG). The lowest yield nutrient uptake and statistically significant differences were found with a no-fertiliser control treatment and PK treatment. Mineral fertiliser application had usual impact on the sward botanical composition, i.e. N fertiliser promoted an increase in grass cover but reduced the proportion of legumes. The silage from the 3rd cut was of the highest quality compared to the silage from the 1st cut, being of the worst quality (quality class 2 and 3). Higher PDIN content was found in the 3rd cut and in all cuts with treatments on oversown grassland (OG). The content of total carbon in microbial biomass (MB_C) was affected mainly by the grassland type. In average, permanent grassland (PG) and no-till oversown grassland (OG) had the highest MB_C content. On the contrary, statistically significant decrease in soil MB_C was found on no-till temporary grassland (TG).

Keywords: semi-natural, oversown, temporary grassland, botanical composition, microbial biomass, silage quality



2.14 Zmeny chemického zloženia sušiny dočasných trávnych porastov po prerušení minerálneho hnojenia

Changes in dry matter composition after cessation of fertiliser application to temporary grassland

L. Lipták, Ľ. Hanzes, N. Britaňák, I. Ilavská

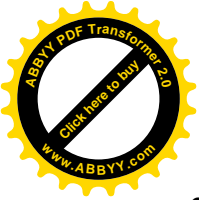
SCPV - Výskumný ústav trávnych porastov a horského poľnohospodárstva, Výskumné pracovisko (Grassland and Mountain Agriculture Research Institute, Research Station), ul. SNP 2, 058 01 Poprad, Slovakia, e-mail: Lliptak@isternet.sk

Abstract

Over 1992 - 2002, a field trial was carried out at *Liptovská Teplička* site (altitude 960 m). The research objective was to study changes in the chemical composition of dry matter (DM) following the cessation of fertiliser application to temporary grassland established in the spring of 1992. The original sward was ploughed up and the site was sown with grass/clover mixture at 29 kg ha⁻¹ seed rate. Every spring, fertiliser was applied at the following rates: N₀ P₃₀ K₆₀; N₉₀ P₃₀ K₆₀ and N₁₈₀ P₃₀ K₆₀, and the application followed after each of the cuts. In the year 2000, the allocated fertiliser treatment was discontinued at one half of each research plot and the cutting frequency was reduced from three cuts to two ones. At the other halves of the research plots, the fertiliser application continued as before.

The cessation of fertiliser application resulted in marked decrease in crude protein (CP) content. The effects of withholding fertiliser were more notable in the second year post cessation. The negative relationship between CP and fibre was only partly confirmed, as the fibre content in the 1st cut was higher at the non-fertilised treatments than at those with fertiliser application, due to the late date of the 1st cut. At both the fertilised and non-fertilised treatments, P content was rising with increasing DM production. At the non-fertilised treatments, K content was decreasing from the 1st to the 3rd cut. Post cessation of fertiliser application, this tendency was true only for the first year. Later, the values were fluctuating. The trend in Na rising with DM production disappeared and there were differences between the treatments and years. The Ca content slightly decreased after the cessation of fertiliser application. The optimum Mg content was found in herbage at the fertiliser treatments, and a small increase was recorded post cessation of fertiliser application.

Keywords: cessation of fertiliser application, nutrient production, temporary grassland



2.15 Rezistencia a resiliencia troch typov trávnych porastov ovplyvnená aplikáciou priemyselných hnojív

Resistance and resilience of three types of grassland influenced by fertiliser application

N. Britaňák, I. Ilavská, Ľ. Hanzes, L. Lipták

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Abstract

A field experiment was conducted at a site in Liptovská Teplička, a mountain village in northern Slovakia. Effects of four fertiliser rates (Treatment 1: $N_0P_0K_0$; Treatment 2: $N_0P_{30}K_{60}$; Treatment 3: $N_{90}P_{30}K_{60}$ and Treatment 4: $N_{180}P_{30}K_{60}$) on three types of grassland ecosystems (semi-natural, from 1992 to 2005; over-sown, from 1993 to 2002 and temporary one, from 1993 to 2002) were investigated. The above-ground dry matter production was affected by anthropogenic interference, such as over-sowing, establishment of temporary sward, nutrient levels and abiotic factors (e.g. total rainfall, mean daily temperature throughout growing season). A reaction of different grassland types to some of the abiotic factors (drought and drought tolerance) is reported. The ability of these grassland ecosystems to recover their equilibrium after a disturbance is presented as the rate of recovery, i. e. resilience.

Keywords: grassland ecosystems, disturbance, resilience, resistance, anthropogenic intervention

2.16 Vliv půdního substrátu na vzcházení *Cirsium canum* L.

Impact of Soil Substrate on Emergence of *Cirsium canum* L.

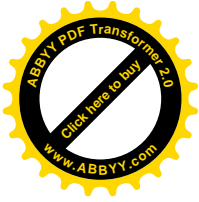
J. Štrobach, J. Mikulka, M. Korčáková

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Abstract

In agricultural production functions, *Cirsium canum* is distributed in green fields and pastures. Its ecological value is increasing as a part of “humid thistle meadows”. With incorrect way of land management (especially permanent grass vegetation management), it spreads mostly in foothills.

The main reason of its distribution is generative propagation by seeds (anemochorous seed transmission). The plumed seeds mostly come from unmanaged areas and they spread around.



During the experiments emergence ability of *C. canum* seeds has been monitored from different depths with use of various substrate types. The emergence has been monitored in several depths: from surface, 0.5, 1, 2, 3, 4 and 5 cm with use of following substrates: brown soil, sand and substrate mixture (1/3 of sand, 1/3 of brown soil and 1/3 of peaty soil).

The top seed emergence (39.2 %) has been reached in brown soil in the depth of 0.5cm. The lowest emergence has been registered in sand where just 21.6 % of the seeds have grown in the depth of 0.5cm.

Keywords: *Cirsium canum*, seed emergence

2.17 The root- creative role of the cultivation of orchard grass and its mixtures with the papilionaceous plants

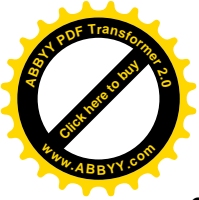
J. Jankowska, G. A. Ciepiela, R. Kolczarek, K. Jankowski

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Abstract

Field experiment was carried out in 2002 – 2004. It was tested the mixture of orchard grass cultivated with red clover or alfalfa. In this experiment the root system was estimated. Significantly largest quantity of the dry root's mass (tab.1) had the mixture of orchard grass with red clover ($5,81\text{t}\cdot\text{ha}^{-1}$), what found confirmation in Benedycki (1991) investigations. This yield was about 17% higher in comparison with the crop of the mixture of orchard grass with alfalfa and about 18% to the root's mass of orchard grass cultivated as monoculture. Significantly higher crop of the dry root' mass produced plants on the objects fertilized with the dose 60 and 90 $\text{kg N}\cdot\text{ha}^{-1}$.

Keywords: root system , convertible grasslands, orchard grass, after - harvest residue



2.18 Štúdium agronomických znakov vybraných odrôd a divorastúcich populácií tráv a d'atelinovín

Study of agronomic traits of selected grasses and forage legumes varieties and wild populations

Jana Martincová¹, Jarmila Drobná², Miriam Kizeková¹

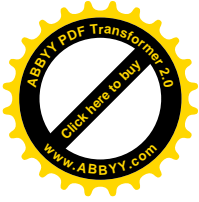
¹SCPV – Výskumný ústav trávnych porastov a horského poľnohospodárstva (SARC – Grassland and Mountain Agriculture Research Institute), Mládežnícka 36, 974 21 Banská Bystrica, Slovenská republika, jmartin@vutphp.sk

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Abstract

In 2005 and 2006 selected varieties and wild ecotypes of grasses and forage legumes were evaluated in the experiment conducted at Grassland and Mountain Agriculture Research Institute in Banská Bystrica. The aim of presented work was to evaluate agronomic traits of selected genotypes, to compare production ability of evaluated varieties and wild populations and to consider variation of yield-related characteristics. Agronomic traits were investigated in the first and second production year (plant height, spring growth intensity, regrowth intensity and dry matter yield (DMY)) on 18 accessions of eight grass species (*Festuca rubra*, *Festuca valesiaca*, *Poa pratensis*, *Trisetum flavescens*, *Phleum pratense*, *Phleum phleoides*, *Bromus erectus*, *Bromus inermis*) and 14 accessions of six forage legumes species (*Anthyllis vulneraria*, *Coronilla varia*, *Onobrychis viciifolia*, *Lotus corniculatus*, *Medicago lupulina*, *Trifolium repens*). Our study showed the significant differences between compared species, populations and varieties of particular grasses and forage legumes. The achieved results have shown that the evaluated varieties were more productive and they were outstanding in all agronomic traits. The most variable trait was dry matter yield. Total DMY ranged between 3.21 and 12.56 t ha⁻¹ at grasses (the highest DMY was recorded at *Bromus inermis* cv. Tabrom) and from 0.59 to 16.83 t ha⁻¹ at forage legumes (the highest DMY was found with *Onobrychis viciifolia* cv. Taja). Among the wild populations the most productive were ecotypes of *Bromus erectus*.

Keywords: grasses, forage legumes, agronomic traits, dry matter yield, variability

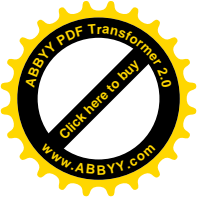


Tematický blok 3

**Vývoj trávnych porastov v dlhodobých experimentoch
– hodnotenie zásadných poznatkov**

Thematic Session 3

**Grassland development in the long-term experiments
– evaluation of essential knowledge**



Prednášky / Oral Presentations

3.1 Vplyv dlhodobého hnojenia a využívania TTP na kvantitatívne a kvalitatívne aspekty produkcie

Impact of long-term fertiliser application and utilisation of permanent grassland on quantitative and qualitative production parameters

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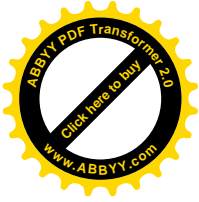
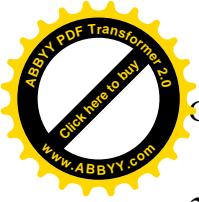
Abstract

Four experiments were established in various regions in Slovakia on semi-natural grassland at altitudes ranging from 130 to 850 m a.s.l. The experimental data include 5, 10, 28 and 46-year research results. Two proportions of NPK fertilisers were monitored (1: 0,3 : 0,8 and 1: 0,15 : 0,4). The results have shown that in average of years, cuts and sites, the increased N rates of 50, 100, 150 and 200 kg.ha⁻¹ at the both nutrient proportions encourage a linear increase in dry matter (DM) production. The first proportion increased the DM production by 3, 4, 5 and 6 t.ha⁻¹ and the second proportion by 2, 3, 4 and 5 t.ha⁻¹ of DM.

From the quality viewpoint, one of the most important findings is that the N rates of 50 and 100 kg.ha⁻¹ at the both nutrient proportions provide feed with lower content of nitrates than the non-fertilised treatments. The content of nitrates at non-fertilised sward is equivalent with swards fertilised with a rate of N 150 kg.ha⁻¹ at the both nutrient proportions.

It was concluded that the regular utilisation of non-fertilised upland meadows over the period of 46 years promotes high production (4,8 t.ha⁻¹ of DM) and high quality opportunities to gain feed, and at the same time it ensures anti-erosion, retention and anti-flood protection of river areas.

Keywords: long-term experiment, semi-natural grassland, mineral nutrition, DM production, soil pH



3.2 Vliv ukončení sečení a hnojení na druhové složení podhorského travního porostu

Effect of cessation of cutting and fertilization on plant species composition of upland grassland

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Abstract

The effect of the management on dynamics of plant species composition was studied in an upland grassland in the Jizerské Mountains. The study was set up on abandoned experiment where all management was finished in 1999. The former experimental management consisted of three (1993-96) or two (1997-99) cuts and four different rate of fertilizers 1) control without fertilizers; 2) 30 kg P + 60 kg K.ha⁻¹.year⁻¹; 3) 90 kg N (1993-96) or 60 kg N (1997-99)+ 30 kg P + 60 kg K.ha⁻¹.year⁻¹; 4) 180 kg N (1993-96) or 120 kg N + 30 kg P + 60 kg K.ha⁻¹.year⁻¹. Seven years of different grassland management by cutting and fertilisation led to diversification of meadow vegetation. The cover of *Alopecurus pratensis* was increased up to 50 % in the most fertilized plots. Consequent abandonment did not resulted in a decrease of plant species richness. However within eight years of abandonment the differences between swards caused by different rate of fertilizers had disappeared and *Festuca rubra* dominated in all swards. Cessation of fertilization and defoliation increased uniformity of grassland communities with previously differing species composition arising from different fertilization.

3.3 An impact of mountain meadow utilisation on the yield and the soil-water environment

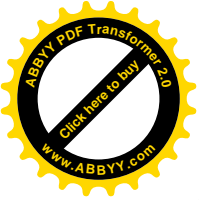
S. Twardy, A. Kuzniar, M. Kopacz

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Abstract

The lizymetric studies on the influence of different utilisation of the mountain meadow on the yield and quality of outflowing waters have been conducted at the Research Station Jaworki –IMUZ, Poland.

The lysimeters (dimensions 1,0x1,0x1,0 m) are filled with a typical brown soil, the natural soil profile was maintained. In 2000, their surfaces were sown using



the grassland and dicotyledonous seed mixtures at known composition. Hence, originated sward from the mixture was identically fertilised, and cared in all lysimeters, the floristic composition of the sward, similar to each other, was obtained.

In the following years different frequencies of mowing were applied from one to four cuts during the growing season, also the treatment with non-cut sward was introduced. In this way the different methods of land utilisation, which occurs in the Carpathians areas were simulated. During the trials, it was registered and analysed:

- plant biomass and its quantitative and qualitative features,
- deep outflow beyond of 1,0 m the soil profile,
- precipitations (amount and distribution during the growing season)
- relations of precipitation – runoff with taking into consideration the chemical composition of the precipitation and outflowing waters, as well as introduced and carried load of chemical substances.

The research showed that the difference in yield from particular sites/treatments were significant, and exceeded 25 per cent of biomass (D.M.). The frequency of sward cutting had influenced on their botanical and chemical composition, as well as the quality of outflowing water beyond the soil profile. The collected results for the period 2000-2006 (and partially in 2007) allow for a better understanding the production and ecological role of grasslands in the mountain areas, particularly in the Western Carpathians.

Keywords: the Carpathians, nature factors, meadows, frequency of mowing

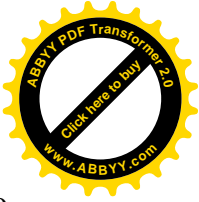
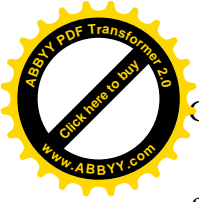
3.4 Vliv intenzity hnojení a frekvence sečení na botanické složení trvalého travního porostu na fluvizemi glejové

Effects of intensity of fertilisation and cutting frequency on botanical composition of permanent grassland on a fluvisoil

V. Odstrčilová, A. Kohoutek, P. Komárek, P. Nerušil

Abstract

At the Jevíčko site in the Czech Republic, the long-term small plot trials with tall oatgrass stand type (*Arrhenatherion*) were established on permanent grasslands in 2003, each consisting of 16 treatments, in 4 replications. The intensity of utilisation: I1=(1st cut until May 15th, 4 cuts per year – cuts at 45-day interval), I2=(1st cut between 16th and 31st May, 3 cuts per year at 60-day interval), I3= (1st cut between 1st and 15th June, 2 cuts per year at 90-day interval) and I4= (1st cut between 16th and 30th June, 1 or 2 cuts per year, second cut after 90 days). Four levels of fertilizer application: F0=no



fertilisation, FPK= P30K60N0; FPKN90=P30K60+N90, FPKN180 =P30K60+N180. This paper is aimed at monitoring of botanical composition which changed under different grassland managements. Species diversity increased territorially, in total 69 plant species were identified. Botanical composition was above all influenced by nitrogen fertilization, which supports grass species and reduces legumes and other forbs. Higher grass proportion was found in two-cut regimes (I3, I4), too. The diversity of plant species and a more balanced proportion of agrobotanical groups (grasses, legumes, forbs) was found especially in grassland without nitrogen fertilization.

Keywords: permanent grassland, cutting frequency, nitrogen fertilization, biodiversity, botanical composition

3.5 Occurrence intensity of *Rumex* sp. and other perennial weeds species in chosen areas on meadows and pastures

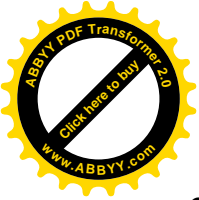
J. Mikulka, M. Korčáková, J. Štrobach

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Abstract

In the chosen areas of the districts Bruntál, Vsetín, Šumperk, Uherské Hradiště, Zlín, Prachatice, Klatovy and Domažlice there was observed occurrence of broad-leaved docks, *Taraxacum officinale*, *Cirsium* sp. and other perennial weeds. In every district there were observed several chosen cadastral areas, where there were carried out 5 assessments on coincidentally chosen localities. The assessment results reveal that in chosen localities there occurred *Rumex* more in Bohemia than in Moravia. The research confirmed high occurrences of *Taraxacum officinale* in the observed stations. On the contrary *Cirsium* sp. occurrence was found scattered and irregular.

Keywords: monitoring, *Rumex* sp., *Cirsium* sp., *Taraxacum officinale*



3.6 Využitie trávnych porastov v suchom poldri Beša

Using of grass stand in dry polder Beša

L. Kováč, R. Mati, D. Kotorová, A. Hnát

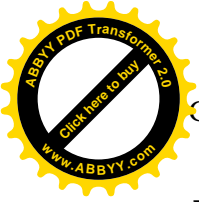
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Abstract

Critical situation on water flows of the East-Slovakian Lowland and followed polder saturation with water in 2006 have effect to research of dry polder Beša. Presens of water on soil surface in polder during whole vegetation season non-enabled consequential ground survey. From monitoring resulted, that perennial grass stands are represented with foxtail stands from association *Alopecoretum pratensis*.

In 2007 ground survey continued. Demonstrations of disposing of sites in south part of polder (acreage 71.9 ha) and in east part of polder (acreage 73.61 ha) were determined. On other areas of perennial grass stands was ascertained its floristic composition. Presens of grass component was favourable in north, south and east part of polder (63.8 – 76.8 %). Leguminosae (*Fabaceae*) had low portion in stands with nearly 100 % presens of bird's tare (*Vicia cracca* L.) on 0.7 – 5.0 % of areas. Herbaceous community had the most expressive representation in central part of polder (38.2 %).

Key words: polder Beša, perennial grass stand, floristic composition, disposing of perennial grass stand



Postery / Posters

3.7 Vliv hnojení a frekvence sečení na příjem minerálních živin trvalým travním porostem na fluvizemi glejové

The influence of fertilization and cutting frequency on mineral nutrients intake of permanent grassland on glei fluvisoil

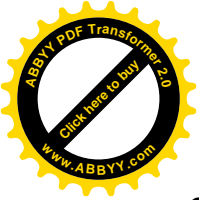
P. Nerušil, A. Kohoutek, P. Komárek, V. Odstrčilová

Crop Research Institute, Prague 6 - Ruzyně, Research Station in Jevíčko, the Czech Republic

Abstract

At the Jevíčko site in the Czech Republic, the long-term small plot trials with tall oatgrass stand type (*Arrhenatherion*) were established on permanent grassland in 2003, each consisting of 16 treatments, in 4 replicates. The intensity of utilisation: I1= (1st cut until May 15th, 4 cuts per year – cuts at 45-day interval), I2= (1st cut between 16th and 31st May, 3 cuts per year at 60-day interval), I3= (1st cut between 1st and 15th June, 2 cuts per year at 90-day interval) and I4= (1st cut between 16th and 30th June, 1 or 2 cuts per year, second cut after 90 days). Four levels of fertilizer application: F0= no fertilisation, FPK= P30K60N0, FPKN90= P30K60+N90, FPKN180= P30K60+N180. This paper evaluates intake balance of mineral nutrients P, K, Ca and Mg in farm yield of DM production in average 2003 – 2006. The nutrients concentration in forage were increased by cutting frequency and decreased by nitrogen fertilization level. With intensity of utilisation decreased the nutrients concentration in forage from I1 to I4: P from 3.2 to 2.4 g.kg⁻¹ DM, K from 19.9 to 15.1 g.kg⁻¹ DM, Ca from 11.2 to 9.8 g.kg⁻¹ DM and Mg from 3.4 to 2.9 g.kg⁻¹ DM. Against the F0 were decreased by graded nitrogen fertilization concentration P 3.0 to 2.4 g.kg⁻¹ DM, K from 17.0 to 16.2 g.kg⁻¹ DM, Ca from 11.7 to 8.9 g.kg⁻¹ DM; concentration Mg were relatively stabled on level of 3.2 g.kg⁻¹ DM. In this paper is also evaluated the mineral nutrients balance in dependence on DM production.

Keywords: permanent grassland; mineral nutrients; mineral balance; cutting frequency; nitrogen fertilization



3.8 Dlhodobý vplyv zrážok na produkciu sušiny lúčnych porastov

Long-term effects of rainfall on dry matter production at permanent grassland

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Abstract

Production of dry matter (DM) in relation to rainfall over the growing season has been investigated in each of 46 research years. The field trial has been established on semi-natural grassland in 1961. The research site divided into plots of 32 m² each (blocks, 4 replicates) is located in central Slovakia (between the Sliač airport and the town of Zvolen, in the river Hron valley); latitude 48° 37'; longitude 19° 10'; altitude 350 m; mean annual temperature 8.2° C (growing season 14.7° C); total annual rainfall 757 mm (growing season 428 mm). The alluvial soil is loamy fluvisol; initial soil pH in KCl = 6.03; available nutrients P = 6.16 mg.kg⁻¹ a K = 96.6 mg.kg⁻¹. The initial sward type was *Festucetum pratense* association with 35 species (*Alopecurus pratensis* dominant) at the trial start. Swards are utilised by 3 cuts. At each cut, botanical composition is determined.

Keywords: cutting, long-term experiment, semi-natural grassland

3.9 Vliv způsobu využívání lučního porostu na množství a kvalitu píce

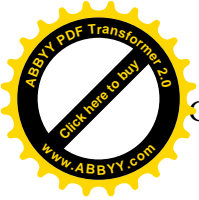
The influence of grassland management over dry matter yields and forage quality

J. Kašparová, P. Šrámek

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Abstract

This work is aimed at assessment of dry matter yields, fodder qualities and monitoring botanical composition which changed under different grassland managements. The trial field of semi-natural grassland was established on the locality Zubří in 2003. The graduated intensity of exploitation (the frequency and timing of cuts) and the different mineral fertilization were chosen as experimental factors. The most significant influence on dry matter yields was



recognized for mineral fertilization, especially nitrogen, which markedly increases production. The intensity of cutting has a significant effect on yields, the higher number of cutting, the lower yields.

Forage quality is positively influenced by the intensity of cutting; with the increasing number of cuttings the content of N substances increases and the content of crude fibres decreases. Significant is also an increase in concentrations of NEL and NEV energies. The increasing level of mineral nutrition of stands significantly increases the content of crude fibres.

Botanical composition of meadow swards was above all influenced by nitrogen fertilization, which supports grass components and reduces legumes; it is obvious especially in two- cuts regimes.

Key words: grasslands, dry matter yields, fodder quality

3.10 Základné agrochemické vlastnosti kambizeme pod trávnyim porastom v dlhodobom pokuse

Basic agrochemical properties of cambisol under grassland in long-term trial

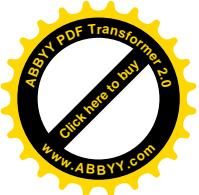
J. Jančovič, Ľ. Vozár, M. Fillo

SPU - Slovenská poľnohospodárska univerzita (Slovak Agricultural University), Tr. A .Hlinku 2, 949 76 Nitra, Slovakia, Jan.Jancovic@uniag.sk

Abstract

On the grassland (association *Lolio-Cynosuretum cristati* R.1937) with brown acidic soil (cambisol) the basic agrochemical properties (pH, C_{ox}, N_t, P, K) was studied during the years 1986 – 2006. Various systems of management (fertilizing + cutting, liming, no management) had different influences to the cambisol qualities, but had not so significant effect. Between the years there was relatively great variability at the available nutrients values (8 – 75%). The available phosphorus had greatest variability (19 – 96%) and also potassium (18 – 82%). Medium till small variability was characteristic for pH (9-14%), C_{ox} (17-19%) a N_t (8-16%). The results are indicating that changes of management systems mean not automatically changes of soil features.

Keywords: cambisol, permanent grassland, systems of utilization



3.11 Produkčný, ekologický a ekonomický potenciál lúk v systéme nízkych vstupov obhospodarovania

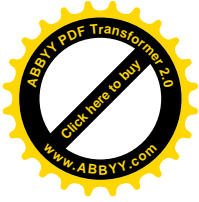
Production Ecological and Economical Potential of Meadows in the Low Input System of Meadow Cultivation

I. Holúbek, R. Holúbek

Abstract

The paper deals with the evaluation of extensification trends in the exploitation of grasslands and it also focuses on the economic, ecological and environmentally useful cultivation and utilization of swards in mountain and disadvantaged areas. The typology and production and ecological classification of perennial grasslands were used for costing of the low input system of grassland cultivation. The calculation formula (Kubánková, 2006) was used for determining the costs used for production of dry matter of fytomass and its quality. The direct costs and total costs for 1 ha and 1 ton of dry matter as well as the total costs for production of proteins and energy nutrients were calculated. The technology of meadow phytocenosis of natural production stages were used for the calculation as well. The obtained results were compared with the results of direct and total costs obtained by the Research Institute of Agricultural and Food Economics in Bratislava in 2004-2006. The average values of the total costs in natural production stages of meadows (L1-L3) reached 207,82 €ha⁻¹ and the values of the total costs obtained by the research Instituted of Agricultural and Food Economics reached 87,94 €ha⁻¹. According to the obtained results, it is possible to conclude that fertilization of grasslands and other technological operation did not reach 50 % of costs for the low input systems. Therefore, it is necessary to deal with the systems of cultivation of meadow phytocenosis in conditions of basic production.

Keywords: meadows - low- inputs -costing management

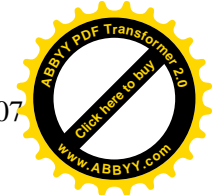
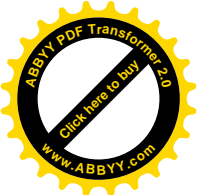


Tematický blok 4

Vzťah trávnych porastov k sekundárnej produkcii v rámci ekologických kolobehov

Thematic Session 4

Interactions between grassland and secondary production within an ecological cycle



Prednášky / Oral Presentations

4.1 Modelová bilance produkce statkových hnojiv při konverzi píce z TTP skotem

Model balance of barnyard manure production by conversion of fodder from permanent grassland by cattle

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²Výzkumný ústav pro chov skotu, spol. s r.o., Rapotín, Česká republika

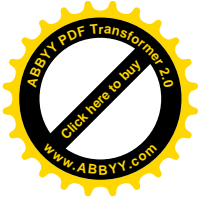
Abstract

Permanent grasslands cover an area of 974 thousand ha in the Czech Republic, i.e. 22.8 % of farmland according the evidence of land registry of the Czech Geodesic and Cadastral Office; 854 thousand ha from that uses pratotechnic (according Czech Statistical Office, 2005).

Cattle numbers in the Czech Republic fell from 1 236 000 head to 568 000 head between 1990 and 2006 (151 thousand head is suckler cows and 427 thousand head is dairy cows). Hence, the conditions of farm utilization and management of permanent grasslands became worse. The forage from c. 300 thousand ha of grassland is converted by suckler cows; c. 0.5 million ha of permanent grassland needs to be converted by a relevant part of herd of dairy cows for agricultural utilization.

On the basis of the results from the long-term pratotechnical trials using various intensity of utilization (two, three and four cuts per year) and fertilization by the stocking rate of 0.1 and 2 LU.ha⁻¹ and optimisation of the feeding ration for particular intensities to the performance 20 kg FCM of milk (medium term mean of CR) we have conducted a model calculation of the herd abundance for the conversion of the forage and for the balance of the barnyard manure production from the model area of 500 thousand ha of permanent grassland. Production of the slurry by unbalanced feeding ration without grain on the model area is about 15.5 million m³ in two cut utilization, about 11 million m³ in three cut utilization, and about 9.9 million m³ in four cut utilization. The slurry production increases with balanced feeding ration containing grain, it is the highest in two cut utilization (20 million m³), it amounts to 14.4 million m³ in three cut utilization, and it the lowest in four cut utilization (12.3 million m³).

Calculated production of the amount of nitrogen in the cattle slurry recounting to one ha is 90.8 – 88.0 – 103.1 kg.ha⁻¹ in variant without grain (two-four cut utilization) or 126.9 – 109.7 – 122.1 kg.ha⁻¹ in variant containing grain. The variant utilises four cuts per year seems to be the most suitable from the ecological point of view. This system reduces import of the grain into the model



area of 500 thousand ha of grassland by 762 thousand t per year; subsequently, the load of the agricultural system with the imported nutrients from the purchased feeds to the farm decreases.

Keywords: grasslands, forage, slurry, cattle

4.2 Vplyv prísevu suchovzdornej d'atelinotrávnej miešanky do pasienka na zmeny v trávnom poraste a úžitkovosť dojníc

Utilisation of swards over-drilled with a drought-tolerant grass/clover mixture by dairy cow grazing

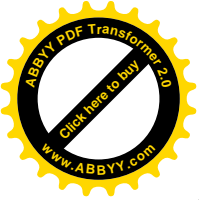
J. Golecký

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Abstract

Farming has been affected by climate changes also in mountain and upland regions of Slovakia. Among the consequences of this phenomenon is that standard grass/legume mixtures fail to provide enough good quality livestock feed. Mainly the dairy cows experience difficulties since they respond to reduced sward volume and quality immediately. In an experiment carried out with dairy cows, a sward over-drilled with grass/clover mixture dominated by *Trifolium repens*, *Lotus corniculatus*, *Festuca rubra* and *Phleum pratense* was analysed. The cultivars with the best drought-tolerant qualities were selected. During the 3-year experiment period, the proportion of over-drilled species increased from 8.3 to 34.0 %, and the yield increased from 5.51 to 7.23 t/ha. This growth was manifested notable on the milk yield that increased by over 3 kg/head/day. All the three experimental years had temperatures over average (0.7 to 8 % over the long-term average). Considering the precipitation, during the first year an increase in the rainfall activity by 20.1 % was recorded, while during the next two years the rainfall activity was down by 14.1 or 14.9 % as compared to the long-term average.

Keywords: sward botanical composition, dairy cows, grassland, direct drilling, milk



4.3 Analýza vybraných metabolických komponentov v krvnom sére oviec v ekosystéme horskej a podhorskej krajiny

Analysis of selected metabolic components in blood serum of sheep in ecosystem of mountain and foothill areas

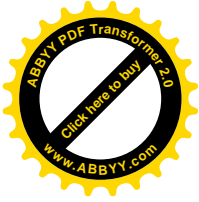
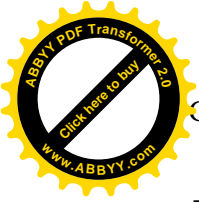
M. Húska, J. Buleca, E. Dudriková, J. Bíreš

Univerzita veterinárneho lekárstva v Košiciach, Komenského 73, 041 81 Košice, SR

Abstract

Our work was focused to the study of selected metabolic components of blood serum of sheep in relationship to environmental load, mainly mineral profile and heavy metals. We have monitored sheep in the industrially developed area where in the eighties increased occurrence of heavy metals in the environment was proved. We selected municipalities in Krompachy environ, where the most important pollution source is Kovohuty Krompachy Co., and municipality Vikartovce localized in Low Tatras mountain area, regarded as one of the lowest polluted municipality considering to the distance from surrounding industrial companies. After analyzing of hematological parameters we noted that values of Ery, Leu, hemoglobine and hematocrit correspond with the scale of reference interval. During evaluation of mineral profile also the values of Ca, Mg and P as well as values of Fe a Cu were found inside of mentioned physiological norms. In heavy metals the highest decrease of Pb values was noticed in Slovinky village comparing to previous period measures, but concurrently also the highest values in control farm in Vikartovce (0,062 mmol/l). All the examined farms showed the lowest occurrence of As (0,098 mmol/l) as well as Cd (0,096 mmol /l) presently.

Key words: sheep, metabolism, heavy metals, ecosystem



Postery / Posters

4.4 Využitie trávnych porastov na produkciu funkčných potravín

Grassland utilisation for production „functional food“

J. Dubravská

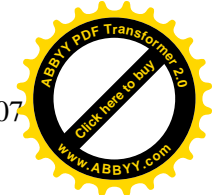
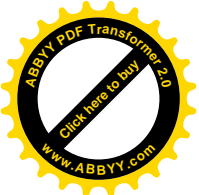
SCPV, Výskumný ústav trávnych porastov a horského poľnohospodárstva, Mládežnícka 36, 974 21 Banská Bystrica, Slovensko, dubravska@vutphp.sk

Abstract

Grasslands play an important role in the landscape formation. Recently, their positive impact on the production of „functional food“ has come into focus also in Slovakia. Changing their life styles, more and more people recognize the necessity to consume high quality and healthy foods capable of favourable influence on the human organism. Though foods from "open farming" systems or from ecological farms are cost demanding, they have a positive impact on human health. Considering the lower availability with less than a 5 % proportion of biofarms in Slovakia, functional food is often substituted with synthetically produced medicines or supplements. Among important compounds, conjugated linoleic acid (CLA) has been a topic of present interest. Not only can the CLA considerably reduce body fat and increase muscle mass but it is also considered an antioxidant and anticarcinogen, while having positive effects on immune function and progression of atherosclerosis. For instance, the CLA has shown benefits in prevention of breast, prostate or lung cancer. This fatty acid is primarily found in milk fat. The high CLA content in sheep milk (the highest from among other types of milk) raises interest of health-aware consumers in milk and dairy products from sheep. It is highlighted that grasslands is a crucial factor influencing the quality of sheep milk dairy products. Preliminary research results obtained during 2007 in Slovakia support the results of researchers from abroad.

The system of animal husbandry influenced both the composition and quality of the produced milk. By grazing natural pasture, animal feed preferences are taken into account. At the same time, getting fresh air enhances the physical condition and health status of animals, consequently reflected in the quality of animal products. Due to the specific environment conditions, Slovakia possesses appropriate grassland areas which can be utilised mainly by sheep farming regarding the accessibility and terrain slope. At present, the total number of sheep is only 326 thousand heads. Grazing sheep are a part of permanent grasslands, and in order to maintain the cultural character of the landscape, their presence on the hilly pastures of Slovakia is inevitable.

Keywords: sheep breeding, environment, grassland, high quality products



4.5 The health response of two dairy breeds to sub-mountain pasture conditions in the southern Bohemia

J. Starý, J. Frelich, M. Šlachta

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Abstract

The dairy husbandry forms an important part of LFA farming in the Czech Republic. The sustainable pasture management requires a productive herd with good health parameters and the choice of convenient breed adapted to local pasture conditions. In the Czech Republic the Czech Pied and Holstein breeds are commonly used for milk production based on seasonal pasturage. In this study we surveyed the pertinence of these breeds to pasture or housing TMR-feeding conditions using the data of frequency and character of the health disruptions from 2005 to 2007 on three sub-mountain farms. The farms were located at an altitude of 575-760 m above sea level and differed by used technology of breeding (TMR, housing vs. seasonal pasturage) and by the amounts of total milk production. The results revealed higher incidence of health disorders on TMR farm than on two farms practised seasonal pasturage.

Keywords: health control, dairy husbandry, pasturage, milk yield, LFA.

4.6 Grassland farming as a way for increasing of milk production

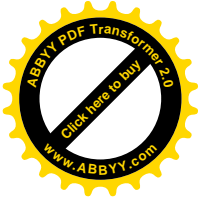
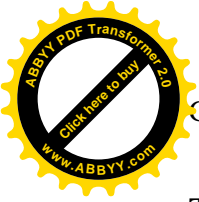
R. Kolczarek, J. Jankowska, G. A. Ciepiela, J. Jodełka

University of Podlasie, Institute of Agronomy, B. Prusa 14, 08 - 110 Siedlce, Poland, laki@ap.siedlce.pl

Abstract

The subject of this investigation was the analyse of the changes in individual farms of the north-east region of Poland in 2002 – 2004. It was used 15 characteristic farms for the region of Siedlce. The grassland in these farms were varied and carried out since 4,67 to 20 ha. It was used own questionnaire during accumulation of the source materials as well as to the statistical materials.

The level of grassland yielding was high and amounted 80-90 % of their potential possibilities. The obtained results of research showed, that the increase of yielding is possible over there on the condition of intensifying of use the pratotechnical measures.



The high level of farming in the grassland in studied farms as well as the big milk production, which is similar to the production obtained in the European Union, showed the big possibilities of development in other farms of this region.

Keywords : grassland farming, the number of protective treatments, level of the nitrogen fertilization, milk production

4.7 The seasonal distribution of coprophagous beetles and their potential for dung decomposition on a sub-mountain dairy cattle pasture

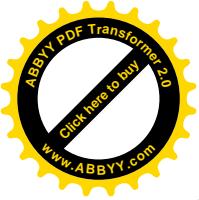
M. Šlachta, J. Frelich

University of South Bohemia in České Budějovice, Faculty of Agriculture, Studentská 13, CZ-37005, České Budějovice, Czech Republic

Abstract

The occurrence of coprophagous beetles (*Scarabaeoidea*, *Hydrophilidae*) participating in early dung decomposition was monitored on a sub-mountain dairy farm in the foothills of Novohradské Hory Mountains in the southern Bohemia (575 m above sea level). The monitoring was conducted using the pitfall traps baited by 1.5 L of fresh cow dung exposed 7 days at a pasture in 5 periods during grazing season from May to October 2006: in spring, in early, advanced and late summer, and in autumn. In total 16 species of *Scarabaeoidea* and not identified number of species of *Hydrophilidae* were found expressing genera and species-specific periods of seasonal occurrence and peaks of flight activity. In all the samples the greatest amount of biomass belonged to the species without burial breeding behaviour, whereas the tunnelling beetles (laying eggs in pieces of dung buried in the soil) formed a minor part of sampled biomass (5 – 20 % of mean DW trap⁻¹). The late summer period was identified as the period of the greatest potential for fresh dung decomposition by beetles owing to the occurrence of the large dung dweller *Aphodius rufipes*. The highest burial activity might be expected in the spring, in advanced summer and in late summer periods.

Keywords: dung decomposition, coprophagous beetles, pasture



4.8 Energetical value of the fodder obtained from the burnt meadow and then renovated by post-mushroom compost

J. Rak, G. Koc, J. Jankowska

Department of Agrometeorology and Land Reclamation, University of Podlasie, ul. Prusa 14, 08-110 Siedlce, Poland, e-mail: melioracja@ap.siedlce.pl

Abstract

The aim of this research was to estimate the potential of post – mushroom compost utilization as organic manure for the recultivation of a burnt meadow. The following combinations were applied: control (without fertilization); mineral fertilization (NPK); mineral fertilization (NPK) + harrowing, mineral fertilization (NPK) + post – mushroom compost. All the combinations were applied on the burnt meadow as well as unburnt one. The obtained fodder had enough high energetical value NEL in compare to her concentrations in the other fodders. The highest energetical value had the fodder from the unburnt meadow, although wasn't any significant differences. The best renovation method, on the burnt meadow, was the fertilization with the NPK together with post – mushroom compost. A possitive influence of the post – mushroom compost on the renovated plots showed the possibilities of utilization of this kind of organic waste for meadow fertilization.

Keywords: energetical value NEL, post-mushroom compost, burnt meadow

4.9 Vplyv rôznej intenzity košarovania na biologické a chemické vlastnosti pôdy vo vzťahu k produkčným a kvalitatívnym ukazovateľom trávneho porastu

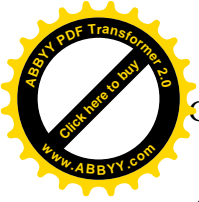
Effects of different folding intensity on biological and chemical properties of soil in relation to grassland production and quality

Ľudovít Ondrášek, Jana Martinová

SCPV- Výskumný ústav trávnych porastov a horského poľnohospodárstva (Grassland and Mountain Agriculture Research Institute), Mládežnícka 36, 974 21 Banská Bystrica, Slovakia, ondrasek@vutphp.sk, jmartin@vutphp.sk

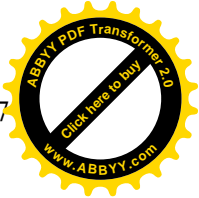
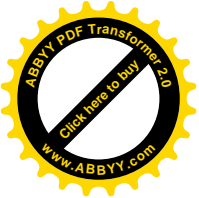
Abstract

Over 2001 - 2005, effects of folding young cattle on production and quality parameters and on some chemical properties of soil were studied at Suchý vrch - Radvaň site (central Slovakia). In the spring and autumn of 2001 and 2004, folding was performed at four stocking rates: Treatment 1: unfolded control; Treatment 2: 15 m² head⁻¹day⁻¹; Treatment 3: 7.5 m² head⁻¹ day⁻¹ and Treatment



4: 7.5 m² head⁻¹ 2 days⁻¹. Effects of folding were found at all the research parameters, the most notable changes were recorded at the areas with the highest stocking rate. In the first year (2001), the influence of spring and autumn folding was very strong, mainly the most intensive autumn folding resulted in a massive disturbance of sward by animals. Consequently, yield was lower than that at the control due to 20 - 30 % of bare ground in the following year. To the contrary, the highest yield (Treatment 4) was found at the area folded in the spring. There were not many changes in botanical composition of sward, only the weed proportion increased at Treatments 3 and 4 in the spring. Different effects of the spring and the autumn folding were found also in soil. While levels of mineral N and nitrates were high in soil 3 weeks after the spring folding (Treatments 3 and 4), the levels were rather low in the year following the autumn folding. Folding stimulated the intensity of total N mineralisation (TMN), the rate of nitrification (NIT) and soil respiration. The content of Mg and K in soil also increased and was reflected in the chemical composition of herbage. The residual impact of folding was indicated by high production until 2003. The next folding in 2004 brought again positive effects on yield and on biological parameters of soil. Because this second period of folding was a simulation and the sward was not damaged by animals, mineral N content in soil was not excessive.

Keywords: grassland, folding, productivity, quality, soil properties

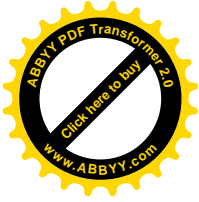


Tematický blok 5

Možnosti a riziká multifunkčného využitia trávných porastov

Thematic Session 5

Opportunities and risks of grassland multifunction utilisation



Prednášky / Oral Presentations

5.1 Mulčování trvalých travních porostů

Mulching of permanent grasslands

J. Fiala

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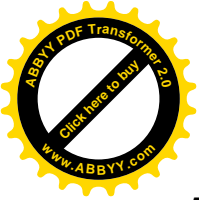
Abstract

In unmanaged forage grasslands large amounts of plant biomass, which is not used, however, on the contrary it makes difficulties, because evidently worsens appearance and function of a forest- agricultural landscape, is spontaneously produced. This area is currently estimated at 250 thousand hectares. It is not profitable to remove such amount of biomass, not used for foraging, and a forced harvest frequently worsens the situation with undesirable removal of this matter in nature. Until the return of cattle to these plots of land, their maintenance necessary for the upkeep of extraproduction functions of grasslands, i.e. the protection of water, soil and conservation of biodiversity, is needed.. Therefore, it is necessary to determine modified pratotechnics which would maintain the ecological stability of the grasslands and the environment.

The publication offers alternative solution of the maintenance of grasslands which are not used for forage otherwise. It justifies the necessity of the maintenance of all grasslands and warns of factors which influence their ecological stability most. The main agroenvironmental criteria for stability disturbance and the technologies of mulched biomass maintenance are determined. The purpose is in the main the discovery of the equilibrium between the accumulation of mulched biomass and their decomposition. It certainly on the assumption, that the mineralization of organic matter even the structure of the final process will not in the long term disrupt the environment. It is also important that water filtered through the landscape – forest-agricultural system, was kept, used and left without contaminants.

This publication is, first of all meant for the agricultural public (as long as mulching will not clash with the grant politics of the state) and the decision-making authorities for the support of ecological and economical manner of the maintenance of grasslands. It has extensive use in all unmanaged grasslands which are not used for forage ,however, from the above-mentioned reasons they have to be maintained of. Furthermore, it is possible to use it at landscape grass-plots, grassy areas of owners of a country cottage and other spontaneously grass-covered areas, students and owners of economically unused plots of land.

Keywords: unmanaged grasslands, lysimetric water, nutrients



5.2 Univerzalita travních porostů a její využití v České republice

Universality of grassland and its utilization in the Czech Republic

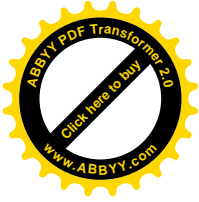
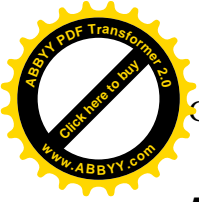
B. Cagaš, J. Frydrych, R. Macháč

*OSEVA PRO s.r.o., Výzkumná stanice travinářská Rožnov-Zubří, Hamerská 698, 756 54
Zubří, Česká republika*

Abstract

The role of grasslands in the Czech Republic has recently changed very dramatically: the area occupied by natural permanent grasslands and forage crop stands on the arable land for production purposes has decreased; on the other hand, the importance of their alternative roles is increasing. Non-traditional ways of their utilizing are bioenergetics, utilization with the aim of soil conservation including landscape restoration and lawn growing. A slightly upward trend is evident in grass seed growing (conventional and organic) as an integral part of grass growing. With a gradual reduction in agricultural production, especially in marginal areas, fallow farmland or some purposefully grown grass species may be a source of material used for alternative heat production (direct combustion, biogas). Of cultivated grass species the most suitable for these purposes seem to be monocultures of some native grass species harvested at the end of the vegetation period. An evaluation of introduced species (*Miscanthus* spp.) is also being carried out. An unsolved question is the utilization of grass from playgrounds and urban green spaces. Grasses are not only a suitable component for conservation of soil which is not temporarily used for growing but also a unique agent for restoration of localities damaged by anthropogenic activities. Whereas in the recent past conventional forage crop mixtures were utilized for these purposes, at present combinations of grasses and herbs (species rich) established and maintained by non-traditional methods (mats, mulching, etc.) are more popular. Lawns in the Czech Republic occupy more than 10 % of the area of arable land. Their large areas, used mostly for sport and relaxation, are established and retained in a special regime. Golf courses whose number is almost 70 are one of the forms of non-traditional and promising utilization of grasslands in this country.

Keywords: grassland, changes, alternative functions



5.3 Údržba trvalých travních porostů jako prvků územního systému ekologické stability krajiny

Maintenance of permanent grassland as elements of territorial system of landscape ecological stability

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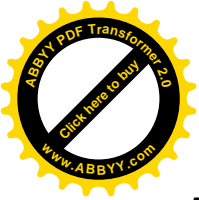
²*Česká zemědělská univerzita v Praze*

Abstract

Agriculture is the most significant form of landscape maintenance with the largest area range. Important parts of ecosystem are the permanent grasslands. The permanent grasslands (PG) provide a lot of non-production functions. It is an important landscape design component and at same time it represents an integral part of the ecological stability skeleton in landscape. Nevertheless the multifunctional PGs can be maintained merely under condition of correct management dealing with processing of redundant grass matter from its maintenance.

This contribution deals with maintenance of permanent grassland and small – scale protected territory creating the part of the ecological stability territorial system in agricultural landscape. Along with the results of measuring of the PG maintenance economical requirements the contribution also comprises description of experiment with aim to verify possibility of the generating residual biomass composting.

Keywords: permanent grasslands, small-scale protected territory, agricultural landscape, territorial system of ecological stability, composting



5.4 The Multifunctional Role of Grassland Commonage in Ireland

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²*Department of Economics, National University of Ireland, Galway*

Abstract

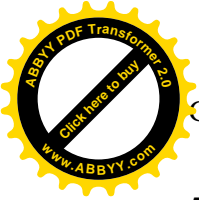
Commonage refers to unenclosed grassland on which two or more farmers have pasture rights held in common (Lyll, 2000)¹. Commonage in Ireland covers 426,124 hectares and involves about 11,837 farmers (Bleasdale and Sheehy-Skeffington, 1995)². This represents 8 per cent of total agricultural area and 8.5 per cent of farmers. In Ireland most commonage is located in remoter coastal and upland mountainous regions and is traditionally allied with extensive rough grazing for livestock. However, commonage is associated with some outstanding natural landscapes and has considerable recreational appeal. This appeal along with increasing personal incomes and enhanced mobility has given rise to increased demands for a wide range of recreation activities on commonage, particularly hill-walking.

This paper uses non-market valuation techniques to investigate economic values associated with improved access to commonage land for recreational walking and contrasts this with returns from traditional agricultural activities. Positive economic returns to agricultural are very much linked to CAP related payments. Without these payments, the financial return to farmers from agricultural activity on marginal quality grassland, such as commonage may be low. A survey of over 200 commonage farmers in the west of Ireland is employed to examine the levels of agricultural activity on commonage and the related financial return from such activity to the farm operator. We then compare these figures to the potential value of this type of grassland as a recreational resource. By asking recreational enthusiasts, that use commonage sites, what they are willing to pay for improved, more formalised access to commonage land for recreational walking we can estimate the non-market value of this marginal grassland as a recreational resource. The analysis indicates that there is significant scope for policy approaches which support the development of non-consumptive recreational land uses and sustainable tourism in marginal grassland areas of Ireland.

Keywords: grassland commonage, willingness to pay, recreational resource, agricultural financial returns

¹ Lyll, A. (2000) *Land Law in Ireland* (2nd Ed.), Oak Tree Press, Dublin.

² Bleasdale, A. and Sheehy-Skeffington, M. (1995) 'The upland vegetation of north-east Connemara in relation to sheep grazing'. In Jefferey, D.W., Jones, M.B. and McAdam, J.H. (eds). *Irish Grasslands, their biology and management*. Royal Irish Academy, Dublin.



5.5 Využití trav pro energetické účely

Grass utilization for energy

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²Oseva PRO, Research station for grass Zubří, Hamerská 698, 756 54 Zubří, Czech Republic

Abstract

With an increasing level and productivity of agricultural production also increases land area not utilized for food production. This area can be used for energy crops growing including the grasses. In the case when the land is introduced in the set-aside condition by grassing or there is not utilized potential of perennial grasses due to reduced cattle herd, there also increases amount of grass which can not be utilized for energy purposes. In the laboratory experiments we deal with slurry, fugat and grass phytomass co-fermentation optimization. The trials were carried-out on principle of one-stage anaerobic digestion within the mezophyle area. During the experiments the biogas cumulative production and its composition were measured. For the treated grass the disintegration was conducted through pressing and cutting. That treatment of material was displayed in biogas increased production by up to 20%. The experimental results have proved suitability of the grass phytomass exploitation as material for biogas production. The combustion tests were carried-out in large boiler of 1,8 MW heat power and in small boiler of 25 kW heat power.

Keywords: grassland, anaerobic digestion, biogas, biogas plants, biomass burning

5.6 Technologie a ekonomika tuhých biopaliv z travních porostů

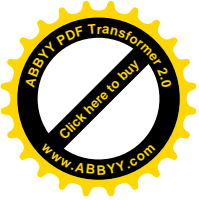
Technology and ECONOMY OF solid biofuel FROM GRASSland biomass

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Abstract

The recent years are characterized by reduction of agricultural land acreage utilized for food production and in contrary the grassland area is being extended. Regarding the considerable cattle herd decreasing and limited possibilities of



grassland production usage for feeding there are verified options and conditions how to use that production for energy purposes. As one of the promising variants considered is the hay utilization as a solid biofuel. This contribution concerns technology and economy of permanent grassland growing and hay utilization for energy purposes. A significant effect on the hay energy utilization economy have the financial support in form of subsidies. The costs per 1 ton of hay without subsidy are over 2000 CZK and its energy utilization is therefore unreal. By using subsidies the final costs per unit of production could be reduced considerably, particularly favourable these costs are in regions with the LFA subsidies.

Key words: grassland, energy hay, technology and economy

5.7 Vliv mulčování travního porostu na hmotnost a strukturu nadzemní fytomasy

The influence of grass mulching on the weight and structure of aerial biomass

F. Hrabě, A. Krausová, L. Rosická

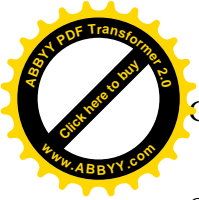
Department of Animal Nutrition and Forage Production, Faculty of Agronomy, Mendel University of Agriculture and Forestry in Brno, Zemědělská 1, 61300 Brno, Czech republic, e-mail: hrabe@mendelu.cz

Abstract

In this contribution there are presented results of 5-year-research, where were studied the influence of grass mulching of newly seeded meadow grass on arable soil and the production and structure characteristics of this meadow grass afterwards. Variations of experiment:

1. without grass mulching (taking over of samples on autumn)
2. grass mulching once a year (during a summer)
3. grass mulching three times a year (spring, summer, autumn)
4. grass cutting three times a year with fodder cutting and hay drying (spring, summer, autumn)

An average productions of dry aerial biomass for years 2002-2006 were in variations order 4,76 t – 3,37 t – 4,48 t – 5,02 t.ha⁻¹. A weight parts of died off biomasses were for single variations 49,1 % - 8,0 % - 18,1 % - 4,0 %; for variations 3 and 4 is this number valid just for first spring cutting. After summer term of grass mulching (once a year) came rather fast mineralizations of mulched fodder. Grass components varied for variations as: 92,8 % - 87,9 % -



83,9 % - 89,3 % and vetch components were 2,3 % - 5,2 % - 7,2 % - 7,5 %, for dicotyledonae species they were 4,9 % - 6,9 % - 8,9 % 3,2 %. In conclusion, uncutted and unmulched grass cover had high volume of died off biomass and therefor higher weight of biomass and lower presence of vetch species. Mulched variations had lower total productions in comparison with variations cutted three times a year to produce a hay (-32,9% 1x mulched and -11,8% 3x mulched grass variation) and higher volume of died off biomass, partly even higher presence of herbs. Absence of grass feeding together with presence of grass mulching did not significantly cause any change in first stage of grass growth (first 6 years) in comparison to cutted grass cover.

Keywords: Grass structure, mulch, cutting, aerial biomass

5.8 Vliv vertikutace na strukturu drnu *Festuca rubra commutata* a *Festuca rubra trichophylla*

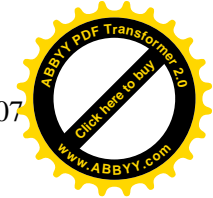
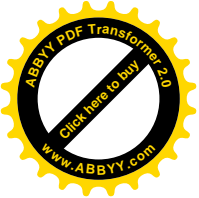
A verticutation effect on the sod structure of *Festuca rubra commutata* and *Festuca rubra trichophylla* species

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Abstract

A verticutation effect on the sod structure of *Festuca rubra commutata* and *Festuca rubra trichophylla* species was assessed in Research unit of Forage production in Vatin in 2003-2005. Growth was cut periodically on 40 mm height. A verticutation was being done twice a year, always in spring and autumn. Samples were taken right after each cut from 200mm depth. Assessed was dry aerial part of biomass and underground part of biomass. Aerial biomass was divided into dead and live matter. Underground biomass was fragmented to the part from 0-20 mm and the part from 21-200 mm. The verticutation significantly lowered the total sod mass weight especially for *Festuca rubra trichophylla* species. All *Festuca rubra commutata* (F.r.c.) samples had on average a total sod weight $1695,29 \text{ g.m}^{-2}$, *Festuca rubra trichophylla* (F.r.t.) sod had this weight $1629,56 \text{ g.m}^{-2}$. Verticuted variations of *Festuca rubra commutata* samples had this weight lower by 4.1%, *Festuca rubra trichophylla* samples by 8.4%. The verticutation lowered total weight of aerial and underground biomass. For aerial biomass the whole matter was lowered by 7.8% for F.r.c. and by 6.6% for F.r.t. For underground biomass was the verticuted average sample total weight lower by 7.8% for F.r.c. and by 9.3% for F.r.t.



Differences in sod structure (particular components) are not significant. F.r.c. variations with no verticulation done had aerial biomass 36.7% from total weight, F.r.t. 34.2%; F.r.c. verticulated samples had this aerial biomass 35.3% from total matter and F.r.t. samples had 34.8%.

Keywords: *Festuca rubra commutata*, *Festuca rubra trichophylla*, sod, verticulation, dry biomass

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5.9 Zatrávnenie medziradov ovocných stromov, krov a viniča v nížinnej oblasti

Grassing of interrows of fruit-trees, shrubs and vine in lowland region

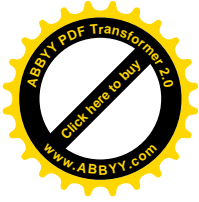
H. Gregorová¹, J. Vološin²

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Abstract

In warm and dry climatic region (orchard and vineyard at the Faculty of horticulture and landscape engineering of Slovak agricultural university in Nitra, stand Nitra) the interrows of fruit-trees (apple trees, pear trees, black cherry trees, apricot trees), blackcurrant shrubs and vine were grassed in the spring of year 1992. Grassing was made by monoculture of *Festuca rubra* cv. Ferota (F) and Táboorská (T), *Poa pratensis* cv. Krasa (K), *Festuca ovina* cv. Jana (J), *Dactylis glomerata* cv. Niva (N) and by mixtures of F+T+K+J, F+T+J, K+T, K+J, F+T. In vineyard were used clover-grass mixtures of *Trifolium repens* cv. Dúbrava (D)+T+J and D+N. In this paper we evaluate the grass covering during the years 1993-1998, number of shoots, yields formation, heights increasing (1993-1995), roots production (1994 and 1997) and at selected swards some soil characteristics. Over 7 years the mixtures were better in grass cover than monocultures of grasses, within monocultures was the best *Festuca rubra* cv. Táboorská. For the grassing of interrows in vineyard was more suitable mixture of *Trifolium repens* with *Festuca rubra* and *Festuca ovina* than mixture of *Trifolium repens* with *Dactylis glomerata*. The least average height increases and yield green matter increases had *Festuca ovina* (632,7 mm, 16,9 t.ha⁻¹) and their mixture with *Poa pratensis* (738,1 mm, 15,2 t.ha⁻¹), the most of shoots formed *Festuca rubra* cv. Ferota (141,5. 0,1m⁻²), the most root production had *Dactylis glomerata* (13,3 t.ha⁻¹). After 7 years of grassing decreased soil pH in



depth 0-300 mm from 7,36 to 6,93. The humus content increased from 1,88% to 2,66% and the C:N ratio was wider in comparison with bare soil (7,56 and 5,61, respectively). Machinery pressure on the grassed interrows did not caused expressive changes in reduced soil volume weight. Differences in soil physical characteristics were found between swards and between spring and autumn soil samplings.

Keywords: grass cover, grasses, grassing, interrows of fruit-trees, shrubs and vine

5.10 Vliv mulčování na podíl leguminóz v luční píce

Effect of mulching on rate of legumes in meadow forage

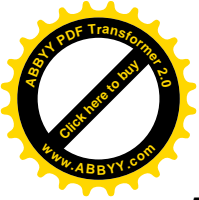
J. Gaisler, V. Pavlů, M. Hejcman

Crop Research Institute Prague, Department of Plant Ecology and Herbology, Rolnická 6, CZ-46011, Liberec, Czech Republic, gaisler@vurv.cz

Abstract

Effect of different mulching frequency on rate of legumes in forage was studied on upland meadow from 2000 to 2006. There were observed following treatments: unmanaged grassland, mulching once, twice and three-times per year. There was recorded the cover of legumes species and sampled forage biomass, where total weigh rate of legumes was studied. During experiment legumes spread in frequently managed plots, on other hand almost disappeared in once mulching or unmanaged grassland. Significant changes were found in cover of *Trifolium repens*, its coverage increased from 1 to more than 20% in some years and its abundance was highest in summer. Other legumes did not react so markedly.

Keywords: grassland; white clover; mulching frequency, aboveground biomass



5.11 Number of shoots in lawn sod depends on its botanical composition

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e-mail: laki@ap.siedlce.pl*

Abstract

Investigation was realized on the base of two lawn experiences which were put in the arrangement split - plot in four replicates. In the clean sowing four varieties of red fescue ADIO, LIBANO, CORAIL, SIMONE were studied. On mixture lawns four mixtures prepared on the base of red fescue Adio were studied. From every plot of the ground was taken the samples of the sod. To this aim the steel tester was used. From so taken samples the quantity of green, alive shoots were counted.

Keywords: red fescue, number of shoots, lawn

5.12 Vhodnost vybraných odrůd trav pro neprodukční účely

Suitability of selected grass varieties for non-productive purposes

R. Macháč, B. Cagaš

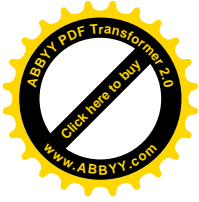
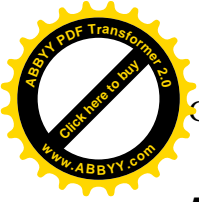
*OSEVA PRO s.r.o., VST Rožňov – Zubří, Hamerská 698, Zubří 756 54, the Czech Republic,
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Abstract

Large area of grassland is not using for grazing or conserve fodder production in the Czech Republic. This grassland are often treated only by mulching, but relatively small information about behaviour grass species and their varieties under this regime of treatment is known.

Non-productive properties of selected grass varieties are verifying in small-plot field trials (established 2004) in Grassland Research Station at Zubří. In this trial 25 varieties of perennial ryegrass, 10 varieties of meadow fescue, 21 varieties of red fescue, 5 varieties of timothy and 5 varieties of Kentucky bluegrass is tested. Sward stand, persistence and resistance against saprophytic fungi of these grass varieties are evaluated under mulching conditions. The evaluation in first two years did not show any significant differences between varieties of one species. The occurrence of mould and saprophytic fungi on the mulched material was minimal with respect to the weather pattern, and there was no significant difference between varieties or rather grass species.

Keywords: mulching, grasses, varieties, state of grass sod



5.13 Konzervovaná fytomasa ako vhodný kosubstrát pre výrobu bioplynu

Conserved phytomass as a suitable substrate for biogas production

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Abstract

This paper presents results from substrate co-fermentation from plant and animal biomass at a 20/80 ratio in liquid-state biogas production. The animal biomass co-substrate is liquid cattle manure. The grass phytomass contains grass ensiled at 40 - 50 % of dry matter, in a variant composition from permanent grassland, alfalfa, and grass-clover mixture. The results show parameters evaluating biogas energetic potential (CH₄, CO₂ content), heat, power, production (d/m³), pollutant content (H₂S), and reactor efficiency. The experiment results were achieved due to the active cooperation between the Grassland and Mountain Agriculture Research Institute in Banská Bystrica and the Slovak Agricultural University in Nitra in an experimental bioenergy plant VPP (University Agricultural Plant) SPU Koliňany using semi-continual liquid-state fermentation process.

5.14 Rozdíly ve struktuře drnu golfového greenu

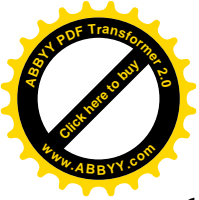
Differences in sod structure of golf turf

J. Vrzalová, F. Hrabě, P. Knot

Department of Animal Nutrition and Forage Production, Faculty of Agronomy, Mendel University of Agriculture and Forestry in Brno, Zemědělská 1, 61300 Brno, Czech republic, e-mail: jennifra@seznam.cz, hrabe@mendelu.cz, knot@mendelu.cz

Abstract

In this presentation there are reported research results regarding aerial and underground biomass structure in golf putting green. Experimental works have been implementing since 2006 on model putting green in botanical garden and arboretum within MZLU Brno. Turfs are being regularly watered. Turf is nourished in 7 shots during a year, which contents 31g N/m², 6 g P₂O₅/m², 20 g K₂O/m² a 4 g MgO /m². There are presented differences in sod structure in two types of green: Golf green1, which has been founded by direct seeding of *Agrostis stolonifera* 100%; golf green2, which has been founded by direct seeding with grass seed mix, which consists of 40% of *Festuca rubra commutata*, 40% of *Festuca rubra trichophylla* and 20% of *Agrostis tenuis*. Taking of samples was made with soil pit of size 20 x 100 x 200 mm. A root



biomass sample was taken off each plot, which was further being stratified to 0-20mm and 21-200mm layers. The height of cut before sampling was 10mm. Terms of assessment were on spring 18.4.2006 and on autumn 10.10.2006. The total weight of Golf green1 biomass sod increased from 670 g.m⁻² in spring to 1213,7 g.m⁻² in autumn, growth was +81,1 rel.%. The total weight of Golf green2 biomass sod increased from 493,75 in spring to 1045 g.m⁻² in autumn, growth was +111,6 rel.%. The part of aerial biomass in spring was 62.7%, the same for both greens. In autumn it was for G1 42.5% and for G2 60.4%. In autumn was the growth of aerial biomass of Golf green formed by A.s. in comparison with spring higher by 23.6% and by 106.1% for Green2.

Keywords: green, biomass weight, sod structure

5.15 Uplatnenie vybraného sortimentu brusníc v horských oblastiach Slovenska

Cultivation of selected lingonberry varieties in mountain regions in Slovakia

D. Šimala

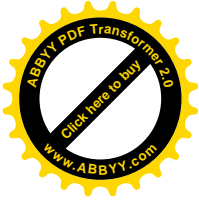
SCPV – Výskumný ústav trávnych porastov a horského poľnohospodárstva Banská Bystrica, Výskumná stanica, 027 55 Krivá, Slovensko, e-mail: simala@vutphp.sk

Abstract

During 2003 – 2006 an ecological experiment was conducted in a mountain region (Krivá na Orave) in Slovakia to evaluate the possibilities of cultivation and to test six varieties of lingonberry (Ida, Koralle, Runo Bielawskie, Linna, Sanna and Sussi) for productivity and adaptability. The experiment site is situated at an altitude of 645 m. Mean annual temperature is 6°C and total annual rainfall ranges from 800 to 900 mm (with max. monthly rainfall in June and July). The soil is sandy loam, illimeric brown with strongly acidic reaction (pH-KCl 3.63).

Over the experiment years, the plant height, flowering time, harvesting time, yield per a plant, hundred berry weight, occurrence of diseases and pests, and winter hardiness were monitored.

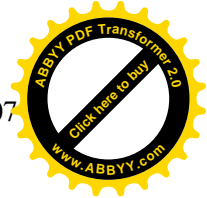
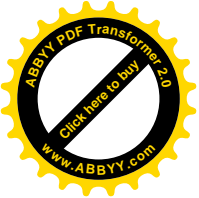
The results have shown that plants of varieties Runo Bielawskie and Linnea are the most vigorous in growth. Linnea variety starts to flower and ripen considerably later compared to other varieties. Varieties exhibiting two flowering periods per a growing season – Ida and Koralle (except for Runo Bielawskie) – produce higher yields than varieties flowering once, and minimum or no rotten berries (at second harvest) was found. Sanna and Linnea, once-flowering varieties, produced very high yields.

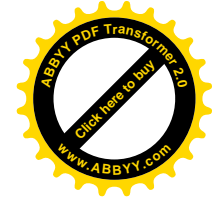
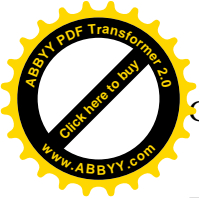


In Slovakia, an altitude from 650 to 700 m is a top limit for satisfactory ripening of two-crop varieties (Ida, Koralle, and Runo Bielawskie) which are less suitable for mechanised harvest for possible injury to flower buds, or to developing berries during the first harvest period. Practically, the most suitable varieties for mechanised harvest are highly productive one-crop varieties Sanna and Linnea which may be also cultivated at higher altitudes.

The results also showed that Ida variety had considerably heavier berries than other varieties. The occurrence of a fungal disease (*Allantophomopsis cytisporea*, L.) causing the leaves turn black and fall off was most frequent with Ida, Sanna, Koralle and Sussi varieties.

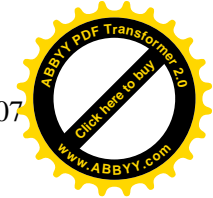
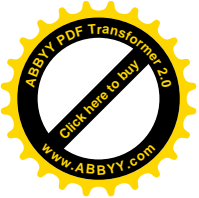
Keywords: growing, lingonberry, mountain region, variety, yield



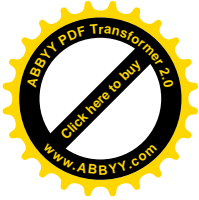
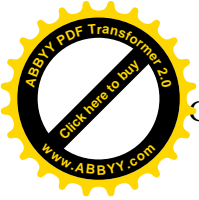


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