ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN – POLONIA

VOL. LXIII (2) SECTIO E 2008

[1] Department of Agroecology, University of Rzeszów, Ćwiklińskiej 2/D3, 35-601 Rzeszów,
e-mail: wolanski@univ.rzeszow.pl
[2] Department of Botany, University of Rzeszów, Cegielniana 12, 35-959 Rzeszów

CZESŁAWA TRĄBA [1], PAWEŁ WOLAŃSKI[1],
KRZYSZTOF OKLEJEWICZ [2]

# Floristic diversity and sward use value of *Lolio-Cynosuretum* association in the San river valley

Zróżnicowanie florystyczne i wartość użytkowa runi zespołu *Lolio-Cynosuretum* w dolinie Sanu

**Summary**. In the present paper the floristic composition, species richness and sward use value of five subassociations distinguished within the *Lolio-Cynosuretum* association (*typicum, trifolietosum repentis, festucetosum pratense, dactylidosum glomeratae* and *anthoxanthosum odoratae*) are studied depending on the selected ecological factors. Phytosociological releves, samples of soil and samples of sward were taken for analysis. Floristic diversity and use value of the *Lolio-Cynosuretum* pasture sward depended on habitat conditions, fertilizing and use intensity.

**Key words**: *Lolio-Cynosuretum*, fodder value scores (SVS), floristic diversity, San valley

## INTRODUCTION

*Lolio-Cynosuretum cristati* pastures are widespread in Poland (especially in the lowlands and hills) on mesic sites. They are most abundant in Wielkopolska region (up to 30% of all the permanent grassland), whereas in other regions they usually constitute only a few percent. This association has a broad ecological scale as far as climatic, edaphic, zoogenic and anthropogenic factors are concerned [Trąba and Grzegorczyk 2003]. Much research shows that preserving semi-natural pastures and meadows is of paramount importance for the preservation of the biodiversity of agricultural systems [Loster 1991]. The aim of this work was to assess the floristic diversity and fodder value of *Lolio-Cynosuretum* pastures, which occur on flood-plain soils in the San valley (SE Poland), taking into account soil moisture, acidity and fertility.

## MATERIALS AND METHODS

In 2003–2004 sixty-one phytosociological releves were taken in *Lolio-Cynosuretum* pastures (each time on/from the area of 100 $m^2$), using the Braun-Blanquet method.

Collective samples of soil and above-ground biomass were taken for analysis. In the soil, pH and accessible P, K and Mg content were measured. Soil moisture (F) and nitrogen content (N) were estimated using Ellenberg indicator values [Ellenberg *et al*. 1992]. Fodder value (FVS) were assessed on the basis of weighed floristic content using the Filipek [1973] approach. Subassociations of *Lolio-Cynosuretum* were identified using the PROFIT 2 computer programme package. For each of the distinguished communities the following indices were calculated: constancy degree and cover coefficient [Szafer 1977], number of *Poaceae* and *Fabaceae*, mean number of species per releve and Shannon-Wiener diversity index - H' [Magurran 1996] according to the formula:

$$H' = -\Sigma\, pi \cdot \ln pi; \quad pi = ni : N$$

ni – the coverage coefficient of every species,
N – sum of the coverage coefficients of all species in a given subassociations.

The floristic table contains all species with at least II constancy degree in one of the identified subassociation. The species occurring sporadically are listed under the table. The information on fertilizing and use intensity was provided by the farmers/owners of the pastures.

## RESULTS AND DISCUSSION

Five subassociations of *Lolio-Cynosuretum* were identified in the study area: *L.-C. typicum, L.-C. trifolietosum repentis, L.-C. festucetosum pratense, L.-C. anthoxanthosum odoratae* and *L.-C. dactylidosum glomeratae* (tab. 1). *Lolio-Cynosuretum dactylidosum glomeratae* and *L.-C. festucetosum pratense* were found in pastures fertilised with a small amount of NPK and managed as enclosures, with one hay-making per year. Other subassociations occurred in free-range cattle and horse pastures, where no fertilisation except for remaining animal manure was used.

*Lolio-Cynosuretum* is well-developed in the San valley. In all the plots numerous characteristic and differentiating species of the *Cynosurion* alliance occurred, especially *Lolium perenne* and *Trifolium repens* (tab. 1). *Lolio-Cynosuretum typicum* differed from other subassociations the most. It had the lowest fodder value and the highest floristic diversity expressed as the total number of species, mean number of species per releve and Shannon-Wiener (H′) index (tab. 2). The *L.-C. trifolietosum repentis* subassociation had the highest *Trifolium repens* cover (from 30 to 60%). In this community *Lolium perenne, Poa pratensis* and *Taraxacum officinale* were more abundant, and *Festuca rubra* less abundant than in *L.-C. typicum*, whereas *Agrostis capillaris, Achillea millefolium* and *Prunella vulgaris* had similar cover. It had a higher fodder value than *L.-C. typicum* (tab. 2). The high cover of *Trifolium repens* is attributed to excess grazing, which causes the disappearance of taller grasses, replaced by *Trifolium repens* and low rosette-forming dicots, and impoverishes the floristic diversity of the community [Wilson 1994].

This work confirms this view. *Lolio-Cynosuretum festucetosum pratense* and *L.-C. dactylidosum glomeratae* have a higher number and cover of *Poaceae* than the previously discussed communities. Tall grasses and *Trifolium pratense* are particularly abundant. Out of lower grasses, *Festuca rubra* is more frequent and *Lolium perenne* and *Poa*

Table 1. The constancy degree and cover coefficient of plant species in *Lolio-Cynosuretum* subassociations

Tabela 1. Stałość i współczynnik pokrycia gatunków roślin w podzespołach zespołu *Lolio-Cynosuretum*

| Subassociation<br>Podzespół | *Typicum* | | *Trifolieto-sum repentis* | | *Festucetosum pratense* | | *Dactylidosum glomeratae* | | *Anthoxanthosum odoratae* | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| ***Ch.D.All. Cynosurion*** | | | | | | | | | | |
| *Trifolium repens* | V[1] | 1679[2] | **V** | **4917**[*] | V | 2068 | V | 1944 | V | 1862 |
| *Lolium perenne* | IV | 1539 | V | 1923 | IV | 800 | IV | 1117 | V | 1167 |
| *Cynosurus cristatus* | IV | 953 | II | 150 | I | 50 | IV | 789 | V | 1612 |
| *Bellis perennis* | IV | 582 | III | 87 | III | 109 | III | 79 | II | 17 |
| *Phleum pratense* | IV | 242 | III | 128 | III | 89 | III | 27 | III | 177 |
| *Leontodon autumnalis* | II | 329 | II | 160 | II | 214 | III | 128 | II | 92 |
| *Veronica filiformis* | II | 164 | I | 33 | II | 323 | II | 111 | - | - |
| *Veronica serpyllifolia* | II | 11 | - | - | - | - | - | - | - | - |
| *Ranunculus sardous* | I | 71 | III | 493 | - | - | - | - | - | - |
| ***Ch. O. Arrhenatheretalia*** | | | | | | | | | | |
| *Achillea millefolium* | V | 1254 | V | 1390 | IV | 805 | V | 628 | V | 454 |
| *Taraxacum officinale* | V | 357 | V | 710 | V | 595 | IV | 428 | IV | 250 |
| *Carum carvi* | III | 300 | II | 47 | IV | 155 | II | 67 | - | - |
| *Bromus hordeaceus* | III | 150 | II | 160 | II | 350 | I | 5 | II | 196 |
| *Dactylis glomerata* | III | 54 | II | 80 | IV | 155 | **V** | **1972**[*] | III | 388 |
| *Leucanthemum vulgare* | II | 400 | I | 7 | III | 736 | - | - | I | 145 |
| *Trisetum flavescens* | I | 254 | I | 3 | II | 209 | III | 22 | - | - |
| *Daucus carota* | II | 75 | I | 3 | II | 14 | III | 72 | II | 54 |
| *Crepis biennis* | II | 11 | I | 37 | II | 100 | III | 28 | III | 58 |
| *Heracleum sphondylium* | II | 11 | - | - | II | 18 | II | 11 | III | 21 |
| *Trifolium dubium* | II | 11 | I | 40 | I | 45 | III | 439 | III | 367 |
| *Galium mollugo* | I | 7 | I | 10 | I | 9 | II | 11 | III | 29 |
| *Geranium pratense* | I | 7 | I | 7 | II | 95 | - | - | - | - |
| *Arrhenatherum elatius* | I | 40 | - | - | II | 18 | III | 28 | II | 50 |
| *Pastinaca sativa* | I | 7 | - | - | II | 14 | - | - | - | - |
| *Campanula patula* | I | 7 | - | - | I | 45 | I | 5 | II | 12 |
| ***Sporadical species:*** *Alchemilla monticola 2, 6; Knautia arvensis 2, 5, 6; Pimpinella major 2; Rhinanthus serotinus 2, 3; Tragopogon pratensis 3, 4.* | | | | | | | | | | |
| ***Ch. O. Trifolio fragiferae-Agrostietalia stoloniferae*** | | | | | | | | | | |
| *Carex hirta* | II | 114 | II | 127 | I | 50 | II | 11 | I | 8 |
| *Potentilla reptans* | II | 50 | III | 117 | II | 173 | II | 306 | - | - |
| *Carex distans* | II | 43 | - | - | - | - | - | - | - | - |
| *Rorippa sylvestris* | II | 11 | II | 13 | I | 5 | I | 5 | II | 12 |
| *Rumex crispus* | II | 11 | II | 15 | II | 14 | II | 17 | II | 12 |
| *Agrostis stolonifera* | - | - | II | 337 | I | 5 | - | - | II | 12 |
| *Lysimachia nummularia* | I | 7 | I | 3 | I | 5 | II | 11 | II | 12 |
| ***Sporadical species:*** *Mentha longifolia 2, 3; Alopecurus geniculatus 3; Festuca arundinacea 3, 4; Juncus compressus 3, 4; Juncus inflexus 3; Trifolium fragiferum 3.* | | | | | | | | | | |
| ***Ch. O. Plantaginetalia majoris*** | | | | | | | | | | |
| *Plantago major* | III | 211 | III | 257 | III | 23 | II | 11 | II | 12 |
| *Poa annua* | II | 132 | II | 263 | I | 2 | I | 5 | - | - |
| ***Sporadically species:*** *Juncus tenuis 2* | | | | | | | | | | |
| ***Ch. Cl. Molinio-Arrhenatheretea*** | | | | | | | | | | |
| *Festuca rubra* | V | 1786 | IV | 853 | V | 1891 | V | 2222 | IV | 799 |
| *Poa pratensis* | V | 957 | V | 1637 | V | 755 | V | 589 | IV | 288 |
| *Ranunculus acris* | V | 650 | IV | 107 | V | 855 | IV | 517 | III | 208 |
| *Plantago lanceolata* | V | 389 | III | 147 | III | 105 | IV | 378 | IV | 367 |
| *Trifolium pratense* | V | 326 | III | 87 | V | 659 | IV | 617 | V | 442 |
| *Cerastium holosteoides* | V | 232 | IV | 123 | IV | 77 | IV | 39 | V | 42 |
| *Prunella vulgaris* | IV | 486 | III | 400 | II | 100 | II | 11 | III | 25 |
| *Festuca pratensis* | IV | 350 | IV | 577 | **V** | **2000**[*] | IV | 478 | IIII | 96 |
| *Lotus corniculatus* | IV | 254 | I | 40 | II | 55 | III | 78 | III | 238 |
| *Ranunculus repens* | III | 214 | IV | 550 | V | 400 | III | 417 | IV | 471 |
| *Potentilla anserina* | III | 157 | IV | 240 | II | 255 | III | 128 | II | 12 |
| *Centaurea jacea* | III | 57 | I | 3 | I | 9 | II | 11 | II | 12 |
| *Leontodon hispidus* | V | 46 | I | 67 | I | 5 | II | 206 | IV | 700 |
| *Vicia cracca* | V | 44 | I | 1 | I | 50 | - | - | III | 21 |
| *Poa trivialis* | IV | 43 | III | 263 | III | 150 | II | 11 | II | 154 |
| *Holcus lanatus* | IV | 18 | I | 40 | II | 69 | II | 17 | III | 200 |

Table 1 continued – cd. tabeli 1

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Rumex acetosa* | IV | 11 | I | 7 | I | 5 | III | 122 | III | 167 |
| *Alopecurus pratensis* | II | 71 | II | 107 | III | 260 | - | - | I | 8 |
| *Deschampsia caespitosa* | I | 7 | II | 47 | II | 55 | II | 17 | III | 21 |
| ***Sporadical species:*** *Juncus conglomeratus 2, 3; Lathyrus pratensis 2, 3, 4, 5; Lychnis flos-cuculi 2, 3, 4; Lythrum salicaria 2; Rhinanthus minor 2, 6; Trifolium hybridum 2, 4; Equisetum palustre 3, 4; Myosotis palustris 3; Angelica sylvestris 4; Agrostis gigantea 4; Lysimachia vulgaris 5, 6; Avenula pubescens 6* | | | | | | | | | | |
| ***Ch. Cl. Nardo-Callunetea*** | | | | | | | | | | |
| *Luzula campestris* | II | 43 | I | 10 | I | 5 | III | 78 | III | 62 |
| *Hieracium pilosella* | - | - | - | - | - | - | - | - | II | 125 |
| *Veronica officinalis* | - | - | - | - | - | - | - | - | II | 50 |
| ***Sporadical species:*** *Veronica officinalis 2; Hieracium umbellatum 6; Polygala vulgaris 6; Carex pilulifera 6.* | | | | | | | | | | |
| ***Ch. Cl. Artemisietea i Agropyretea*** | | | | | | | | | | |
| *Cirsium arvense* | IV | 254 | II | 193 | II | 59 | III | 178 | II | 12 |
| *Agropyron repens* | II | 79 | II | 223 | II | 95 | II | 61 | I | 8 |
| *Glechoma hederacea* | II | 46 | II | 217 | III | 64 | I | 11 | I | 4 |
| *Cirsium vulgare* | I | 7 | II | 130 | I | 5 | - | - | - | - |
| *Equisetum arvense* | I | 7 | I | 7 | II | 59 | II | 17 | III | 58 |
| ***Sporadical species:*** *Arctium lappa 2, 3, 4; Armoracia rusticana 2, 3; Artemisia vulgaris 2, 6; Carduus crispus 2, 3, 6; Cichorium intybus 2, 4, 5; Lamium album 2, 3; Rumex obtusifolius 2, 3; Solidago gigantea 2; Urtica dioica 2, 3; Convolvulus arvensis 2, 3, 6; Tanacetum vulgare 3, 5, 6; Carduus acanthoides 3, 4, 5; Anthriscus sylvestris 4; Chaerophyllum aromaticum 4; Epilobium hirsutum 4; Linaria vulgaris 6.* | | | | | | | | | | |
| **Other** | | | | | | | | | | |
| *Agrostis capillaris* | IV | 793 | IV | 780 | II | 14 | II | 67 | IV | 1025 |
| *Veronica chamaedrys* | IV | 164 | IV | 63 | III | 23 | IV | 33 | III | 100 |
| *Medicago lupulina* | III | 175 | II | 73 | III | 391 | IV | 239 | I | 4 |
| *Stellaria graminea* | III | 21 | II | 14 | II | 14 | III | 22 | III | 67 |
| *Plantago media* | II | 18 | I | 10 | I | 5 | III | 72 | - | - |
| *Anthoxanthum odoratum* | I | 39 | I | 117 | I | 91 | III | 244 | **V** | **2417*** |
| *Hypericum perforatum* | - | - | - | - | - | - | II | 67 | III | 58 |
| *Vicia angustifolia* | I | 3 | - | - | I | 5 | II | 67 | I | 8 |
| *Vicia sepium* | - | - | - | - | - | - | II | 17 | I | 8 |
| *Carex pairae* | - | - | I | 10 | I | 5 | II | 17 | - | - |
| *Origanum vulgare* | - | - | - | - | - | - | II | 11 | I | 4 |
| *Medicago sativa* | - | - | - | - | - | - | II | 11 | - | - |
| *Medicago x varia* | - | - | - | - | - | - | II | 11 | - | - |
| *Pimpinella saxifraga* | - | - | - | - | - | - | I | 5 | II | 17 |
| *Rumex acetosella* | I | 3 | - | - | - | - | - | - | II | 12 |
| *Solidago virgaurea* | - | - | - | - | - | - | I | 5 | II | 12 |
| *Vicia grandiflora* | I | 3 | - | - | I | 5 | I | 5 | II | 12 |
| ***Sporadical species:*** *Aegopodium podagraria 2, 3, 5, 6; Briza media 2, 6; Capsella bursa-pastoris 2, 3, 4, 6; Dianthus delthoides 2, 6; Erigeron annuus 2, 3, 5, 6; Euphorbia cyparissias 2, 3, 6; Galium verum 2, 5, 6; Hypochoeris radicata 2, 6; Medicago falcata 2, 5; Mentha arvensis 2; Ononis arvensis 2; Phalaris arundinacea 2; Ranunculus auricomus 2; Senecio jacobaea 2, 5, 6; Stachys sylvatica 2; Matricaria inodora 2, 3; Carex ovalis 2, 3, 4, 6; Carex gracilis 3; Eryngium planum 3; Euphorbia esula 3; Geranium dissectum 3; Helianthus tuberosus 3; Lolium multiflorum 3, 5; Polygonum amphibium 3, 4; Ranunculus flammula 3; Rorippa palustris 3, 4; Rumex confertus 3; Stellaria media 3, 5; Symphytum officinale 3, 4; Tussilago farfara 3, 5; Veronica arvensis 3; Carex pallescens 4, 5, 6; Lathyrus tuberosus 4, 5; Polygonum hydropiper 4; Trifolium medium 5; Fragaria vesca 5; Centaurium erythraea 6; Myosotis arvensis 6; Thymus pulegioides 6; Vicia hirsuta 6; Vicia tetrasperma 6; Viscaria vulgaris 6; Rosa canina 6.* | | | | | | | | | | |

Explanations: [1] constancy degree, [2] cover coefficient, [*]differential species of subassociations

Wyjaśnienia: [1] stopień stałości, [2] współczynnik pokrycia, [*]gatunki wyróżniające się w podzespołach

*pratensis* less. in *L.-C. festucetosum pratense*, *Ranunculus acris* also had high cover. Fodder value of these two taxa was nearly identical, and higher than for *L.-C. typicum* and *L.-C. trifolietosum repentis* (tab. 1). *Lolio-Cynosuretum anthoxanthosum odoratae* occurred mainly in higher elevations. It can be differentiated by the highest cover of *Anthoxanthum odoratum, Agrostis capilaris* and *Cynosurus cristatus*. Out of dicots, *Leontodon hispidus* was more frequent than in other communities. The diversity index H′ for *L.-C. anthoxanthosum* was similar to that of *L.-C. dactylidosum glomeratae* and *L.-C. festucetosum pratense*, whereas its FVS was lower (tab. 2). In the whole 61 releve set, 166 species of vascular plants were found. A long list of species representing *Ar-*

*temisietea* and *Agropyretea* classes, including 21 sporadic species deserves attention. It gives evidence that a less intensive use of the studied pastures has a positive influence on their floristic diversity [Kryszak 2004].

Table 2. Floristic diversity and fodder value of sward in *Lolio-Cynosuretum* subassociations in San valley
Tabela 2. Zróżnicowanie florystyczne i wartość użytkowa runi podzespołów zespołu *Lolio-Cynosuretum* w dolinie Sanu

| Subassociations<br>Podzespoły | *Typicum* | *Trifolietosum repentis* | *Festucetosum pratense* | *Dactylidosum glomeratae* | *Anthoxanthosum odoratae* |
|---|---|---|---|---|---|
| Number of releves<br>Liczba zdjęć | 14 | 15 | 11 | 9 | 12 |
| Number of plant species<br>Liczba gatunków roślin | 108 | 102 | 88 | 83 | 94 |
| Percentage of grasses<br>Procent traw | 17,6 | 19,6 | 21,6 | 20,5 | 20,2 |
| Percentage of legumes<br>Procent strączkowych | 11,1 | 7,8 | 12,5 | 16,9 | 11,7 |
| Mean number in one releves<br>Średnia liczba w jednym zdjęciu | 33,2 | 27,0 | 27,0 | 31,0 | 31,0 |
| H′ | 3,39 | 3,07 | 3,23 | 3,17 | 3,21 |
| FVS | 6,2 | 6,9 | 7,6 | 7,6 | 6,5 |

*L.-C. dactylidosum glomeratae* and *L.-C. festucetosum pratense* had the highest proportion of grasses. The characteristic feature of the *L.-C. dactylidosum glomeratae* subassociation was the highest share of legumes in the flora, which, however, did not correspond with the surface coverage by those plants (tab. 2).

Table 3. Fertility and moisture of habitat of *Lolio-Cynosuretum* association in the San valley (mean sample value)
Tabela 3. Żyzność i uwilgotnienie siedlisk zespołu *Lolio-Cynosuretum* w dolinie Sanu (średnie z prób)

| Syntaxonomic units of *Lolio-Cynosuretum*<br>Syntaksonomiczne jednostki *Lolio-Cynosuretum* | pH in KCl<br>pH w KCl | P | K | Mg | Ellenberg index value<br>Wartość indeksu Ellenberga | |
|---|---|---|---|---|---|---|
| | | | | | Moisture<br>Wilgotność | Soil nitrogen<br>Azot w glebie |
| | | mg · kg$^{-1}$ D.M. of soil<br>mg · kg$^{-1}$ s.m. gleby | | | F | N |
| *Typicum* | 6,6 | 58 | 66 | 219 | 5,2 | 5,7 |
| *Trifolietum repentis* | 6,8 | 62 | 90 | 234 | 5,3 | 6,2 |
| *Festucetosum pratense* | 7,2 | 84 | 136 | 143 | 5,8 | 6,7 |
| *Dactylidosum glomeratae* | 6,3 | 71 | 142 | 85 | 5,0 | 6,2 |
| *Anthoxanthosum odoratae* | 5,0 | 24 | 68 | 114 | 5,2 | 5,3 |

*Lolio-Cynosuretum* occurred in versatile habitat. *L.-C. festucetosum pratense* occupied the soils, which were moistest and richest in phosphorus and nitrogen and with the highest pH. *L.-C. anthoxanthosum odoratae* occupied the least fertile and most acidic soils. *L.-C. trifolietosum repentis* occurred in most magnesium-rich soils. *Lolio-Cynosuretum dactylidosum glomeratae* occupied the driest sites, which were simultaneously rich in potassium and poor in magnesium (tab. 3). Kryszak and Kryszak [2001] distinguished as many as 12 subdivisons in the *Lolio-Cynosuretum* of the river valleys in Wielkopolska. Similarly as in the San valley, *L.-C. typicum* had the highest biodiversity and *L.-C. dactylidosum glomeratae* and *L.-C. festucetosum pratense* had the highest fodder value. The same subassociations had the lowest biodiversity in Wielkopolska as in the San valley.

## CONCLUSIONS

1. Floristic diversity and fodder value of *Lolio-Cynosuretrum* depended on habitat conditions, application of fertiliser and intensity of use.

2. *L.-C. typicum* and *L.-C. anthoxanthosum odoratae,* occupying the most acidic and poor in P, K and N sites, revealed the highest floristic diversity.

3. The most humid, neutral and richest in nutrients soils were occupied by *L.-C. festucetosum pretense*, floristically poor, with sward being additionally sowed and systematically harvested.

4. *L.-C. dactylidosum glomeratae* subassociation was the highest share of *Fabaceae* in the flora, which, however, did not correspond to the surface coverage by those plants. A reverse situation was found for *L.-C. trifolietum repentis*.

5. The best fodder was provided by the *L.-C. dactylidosum glomeratae* and *L.-C. festucetosum pratense* pastures with a high share of valuable grass species. The lowest use value was revealed by *L.-C. anthoxanthosum odoratae* pastures, extensively used and unfertilized except for the excrements of grazing animals.

## REFERENCES

Ellenberg H., 1992. Zeigerwerte von Pflanzen in Mitteleuropa. Scr. Geobot. 18, 5–258.

Filipek J., 1973. Projekt klasyfikacji roślin łąkowych i pastwiskowych na podstawie liczb wartości użytkowej. Post. Nauk Rol. 4, 59–68.

Kryszak A., 2004. Synantropizacja wybranych zbiorowisk łąkowych. Woda – Środowisko – Obszary Wiejskie 4, 1(10), 201–208.

Kryszak A., Kryszak J., 2001. Effects of utilisation of *Lolio-Cynosuretum* pastures on plants species diversity and yield. Grassland Sci. Europe. 6, 167–169.

Loster S., 1991. Różnorodność florystyczna w krajobrazie rolniczym i znaczenie dla niej naturalnych i półnaturalnych zbiorowisk wyspowych. Fragm. Flor. Geobot. 36(2), 427–457.

Magurran A.E., 1996. Ecological diversity and its measurement. Chapman & Hall. London.

Szafer W., 1977. Szata roślinna Polski. T. I. PWN, Warszawa, 237–279.

Trąba C., Grzegorczyk S., 2003. Występowanie *Lolium perenne* w runi trwałych użytków zielonych Polski. Łąkarstwo w Polsce 6, 165–178.

Wilson D., 1994. The contribution of grasing to plant diversity in alpine grassland and heath. Austral. J. Ecol. 19(2), 137–140.

**Streszczenie.** W niniejszej pracy porównano skład florystyczny, bogactwo gatunkowe oraz wartość użytkową runi 5 podzespołów wyróżnionych w obrębie pastwiskowego zespołu *Lolio-Cynosuretum* (*typicum, trifolietosum repentis, festucetosum pratense, dactylidosum glomeratae* i *anthoxanthosum odoratae*) w zależności od niektórych czynników ekologicznych. Przedmiotem analiz były zdjęcia fitosocjologiczne oraz próbki gleby i runi. Różnorodność florystyczna i wartość użytkowa runi zależały od warunków siedliskowych, nawożenia oraz intensywności użytkowania.

**Słowa kluczowe:** *Lolio-Cynosuretum*, wartość użytkowa, zróżnicowanie florystyczne, rzeka San

*Project: KBN 6 PO6R 08321*