

## Floristic composition, nature value and productivity of the community with couch grass (*Agropyron repens* = *Elymus repens* (L.) P. Beauv.)

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**Abstract.** Couch grass (*Agropyron repens* L.) was the dominant species in 5 investigated communities with stability class 5, while its share in the community *Agropyron repens* + *Festuca rubra* was as high as 42.2%. Communities with the dominance of *Agropyron repens* + *Deschampsia caespitosa* and *Agropyron repens* + *Avenula pubescens* represent the greatest variety of their constituent species, a total of 43 vascular plant species from 15 botanical families having been recorded and 7 accompanying species. Due to the advantageous floristic composition and the fodder value score FVS of 6 or even higher, most analyzed communities are of considerable fodder value, although the value of the sward is reduced by taxa of low nutritive value and of low yielding potential. Semi-heliophilous plant species are dominant in that community, occupying partially dry, fresh and even moist habitats indicating acid soils with a high content of nitrogen compounds (N = 6.6). In Polish literature there is no synthetic study of a community with the dominance of true wheat grass *Agropyron repens* (L.) P. Beauv. that would focus on floristic composition, yield as well as natural and production value.

**Keywords:** *Agropyron repens*, floristic composition, biomass, grass community

### INTRODUCTION

Couch grass (*Agropyron repens* (L.) P. Beauv.) syn. *Elymus repens* (L.) Gould, *Triticum repens* (L.), is a perennial belonging to the family *Poaceae*, formerly *Gramineae* (Szczepaniak, 2009; Szczepaniak et al., 2009). The taxonomic status *Agropyron* Gaertn., *Elymus* L. is especially controversial according to Mizianty et al. (2001). It is a common herbaceous plant found throughout Poland, a weed infesting orchards and gardens, barren land and fallows, land excluded from agricultural use. The plant may reach a height of 30–150 cm. In English it is also

called common couch, twitch, quick grass, quitch grass, dog grass, quackgrass, scutch grass and witchgrass (Majtkowski, 1995). This community frequently develops in areas with mechanically damaged turf, in moderately moist habitats that are subject to occasional periodical overdrying. When found in very small quantities it is a desirable species in grasslands due to its high palatability. In grass communities under varying habitat conditions and land use type it is sometimes abundant or even dominant (Grzelak, Bocian, 2011) and at the same time intensively develops at low stocking rate of grazing animals (Amiaud et al., 2008). According to Filipek (1973), the value in use *Agropyron repens* is at LVS = 7. The plant also contains considerable amounts of chlorophyll, crude fat as well as potassium, phosphorus and calcium. Thanks to the high content of soluble sugars in green mass it is a favourite with horses. This species is found on various types of soils, except for sandy and extremely dry soils (Kulik et al., 2007). However, it definitely prefers fertile soils, with regulated water/air relations. Couch grass is a species with an exceptionally well-developed root system (with roots of 100–200 cm in length). Its characteristic feature is connected with the presence of long underground light yellow stolons, located in the subsurface soil layer (up to 12 cm deep). One specimen may develop stolons with a total length of 100 m. The plant mainly propagates through sprouts from those underground runners. It can be also produced from seeds, with one plant producing as many as 100–500 seeds that remain viable in the soil for a period of up to 10 years. It is a highly expansive species, highly competitive and frost-resistant. It easily colonises the sward and in some communities it is dominant (Janicka, Pawluśkiewicz, 2017), but exhibits greatest vigor in dry years. It is not sensitive to treading. Many herbicides are recommended to destroy unwanted vegetation in areas not utilised agriculturally – all of them have the same active substance, i.e. glyphosate.

For ages couch grass has been used in folk medicine. Knowledge accumulated over centuries on traditional uses

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of couch grass provides arguments supporting the use of extracts from this plant, mainly in urinary tract diseases and in diabetes (Czapska-Pietrzak et al., 2017). The medicinal raw material is provided by couch grass rhizomes, in pharmacology referred to as *Graminis rhizoma* (FP X), syn. *Agropyri repentis rhizoma* (European Medicines Agency....., 2017), harvested in the spring or autumn, typically in the course of cultivation operations.

The aim of this study was to analyse the floristic composition, yielding, nature value and productivity of the community with the dominance of couch grass (*Agropyron repens* = *Elymus repens* (L.) P. Beauv.).

## MATERIAL AND METHODS

Studies on the plant community with the dominance of couch grass (*Agropyron repens*) were conducted in 16 points in the years 2015–2017 in communities differing in their habitat conditions and land use, located in the valley of the rivers Bukówka and Noteć in the communes of Białośliwie, Wieleń and Krzyż Wielkopolski in the Czarnków-Trzcianka county in the Wielkopolskie voivodeship. A total of 16 relevés were prepared according to Braun-Blanquet method (1964). The relevés ranged in area from 10 to 100 m<sup>2</sup> depending on the community structure and homogeneity of the phytocenosis. The plant community was subjected to floristic and phytosociological analyses and classified applying the syntaxonomic system according to Matuszkiewicz (2017). The community was described in terms of its systematics, floristic composition of the association and the percentage shares of species in the association. The material for laboratory analyses was collected from plots of 1 m<sup>2</sup> in three replications. Only phytocenoses with a definite dominance of the species characteristic of the community were selected for analyses. Based on the collected plant samples yield was assessed in t ha<sup>-1</sup> d.m., while, based on the species composition of the sward, the fodder value score was assessed according to the scale developed by Filipek (1973) together with the Shannon-Wiener diversity index (1949). The current status of habitat conditions was evaluated on the basis of Ellenberg's indicator values (1992): F – moisture content, R – reaction and N – nitrogen content in the soil, applying the phytoidication method according to Klapp, as modified by Oświt (1992).

## RESULTS AND DISCUSSION

In the opinion of Ratyńska (2001) the systematic position of the community with the dominance of couch grass is problematic. The species composition in individual syntaxa and degrees of constancy in the community with the dominance of couch grass and its diversity are presented in Table 1. A total of 43 vascular plant species, mainly common species were recorded. No rare or protected species

were reported. Couch grass (*Agropyron repens* L.) was the dominant species with constancy class 5. The greatest number of characteristic taxa, as high as 12, was recorded in class ChCl. *Molinio-Arrhenatheretea* R.Tx. 1937. It had the highest of the 5 constancy class of the *Avenula pubescens* L. Species characteristic of this syngenetic group were reported in all studied phytocenoses over the entire study areas. A large group was composed of species characteristic of fresh meadow communities of from the order *Arrhenatheretalia* – 4. In the order ChO. *Trifolio fragiferae-Agrostietalia stoloniferae* and the association All. *Agropyro-Rumicion crispi* – 7 species were recorded, of which *Ranunculus repens* was found at constancy class 5, while *Lysimachia nummularia* L. and *Potentilla reptans* L. at constancy class 4. Similarly, in the order ChO. *Plantaginietalia majoris* ruderal species from the class *Artemisietea vulgaris* Lohm., Prsg et R. Tx. 1950 were found, represented by 3 species characteristic of the contact zone of woody and herbaceous formations, from the class *Agropyretea intermedio-repentis* as well as species not constituting specific diagnostic elements in any syntaxon. Moreover, in the sward 7 accompanying species were reported.

*Agropyron repens* was dominant in the biomass of all analysed communities, while the greatest shares of 42.2% and 40.1% were recorded in *Agropyron repens* + *Festuca rubra* and *Agropyron repens* + *Deschampsia caespitosa*, respectively (Table 2). The share of the second dominant species in the community varied within a wide range from 16.8% (*Bromus inermis*) to as much as 23.3% (*Deschampsia caespitosa*). In *Agropyron repens* + *Festuca rubra* low grasses were dominant, while in *Agropyron repens* + *Dactylis glomerata* and *Agropyron repens* + *Avenula pubescens* a high share of tall grasses was recorded. The analysed communities were also characterised by a very high share of herbs and weeds in the sward ranging from 17.9% to 41.6%, while the share of legumes and sedges was slight.

In the community 43 species classified to 15 botanical families were reported (Table 3). Overall, in the case of the family *Poaceae* 14 species were recorded which accounts for a 32.6% share in the sward. Tree species were reported from the family *Fabaceae*, while there was only 1 species from *Cyperaceae*, which accounts for as little as a 2.3% share in the sward.

Three greatest proportion in the community in terms of the number of species is found for the group of dicotyledonous plants “herbs and weeds”, including as many as 25 species from 12 families, while the family *Asteraceae* is the most numerous family in terms of the number of species in that group.

Habitat conditions for the community calculated according to Ellenberg (1992) (Table 4) indicate that this is a community with the dominance of semi-heliophilous species forming a low sward of the community (L = 6.2). According to that author, the habitat is “dry and partly

Table 1. Species composition of individual syntaxa and constancy classes.

Syngenetic group	Constancy					Total species
	I	II	III	IV	V	
<b>ChO., All. <i>Trifolio fragiferae</i>-<i>Agrostietalia stoloniferae</i>; <i>Agropyro-Rumicion crispi</i>:</b> <i>Agropyron repens</i> , <i>Lysimachia nummularia</i> , <i>Agrostis stolonifera</i> , <i>Ranunculus repens</i> , <i>Potentilla reptans</i> , <i>Carex hirta</i> , <i>Rumex crispus</i>	1	1	-	2	3	7
<b>ChO. <i>Molinietalia</i></b> <i>Cirsium palustre</i> , <i>Taraxacum palustre</i> , <i>Deschampsia caespitosa</i>	-	1	2	-	-	3
<b>ChO. <i>Arrhenatheretalia</i></b> <i>Dactylis glomerata</i> , <i>Taraxacum officinale</i> , <i>Achillea millefolium</i> , <i>Heracleum sphondylium</i>	1	-	2	-	1	4
<b>ChO. <i>Plantaginietalia majoris</i></b> <i>Plantago major</i> , <i>Poa annua</i>	-	2	-	-	-	2
<b>ChO. <i>Glechometalia hederacea</i></b> <i>Glechoma hederacea</i> , <i>Geum urbanum</i>	-	-	-	2	-	2
<b>ChCl. <i>Molinio-Arrhenatheretea</i></b> <i>Festuca rubra</i> , <i>Avenula pubescens</i> , <i>Poa pratensis</i> , <i>Agrostis gigantea</i> , <i>Poa trivialis</i> , <i>Rumex acetosa</i> , <i>Ranunculus acris</i> , <i>Festuca pratensis</i> , <i>Vicia cracca</i> , <i>Phleum pratense</i> , <i>Plantago lanceolata</i> , <i>Prunella vulgaris</i>	3	2	1	2	4	12
<b>ChCl. <i>Artemisietea vulgaris</i>, ChO. <i>Artemisietalia vulgaris</i></b> <i>Artemisia vulgaris</i> , <i>Cirsium arvense</i> , <i>Urtica dioica</i> , <i>Lamium album</i>	1	-	1	-	2	4
<b>ChCl. <i>Agropyretea intermedio-repentis</i></b> <i>Bromus inermis</i> , <i>Poa angustifolia</i>	-	1	-	-	1	2
Total	6	7	6	6	11	36
<b>Accompanying species</b> <i>Veronica chamaedrys</i> , <i>Vicia sepium</i> , <i>Stellaria graminea</i> , <i>Ajuga reptans</i> , <i>Filipendula ulmaria</i> , <i>Pimpinella saxifraga</i> , <i>Trifolium repens</i>	3	-	2	1	1	7
Total species + accompanying species	9	7	8	7	12	43

Constancy class (number of characteristic species in classes): I – 1–20%, II – 21–40%, III – 41–60%, IV – 61–80%, V – 81–100%

Source: authors' study

Table 2. Diversity of useful groups in syngenetic groups in the community.

Plant community with the dominant			% proportion of useful groups			
a	b	% dominant a / b	other grass species	leguminous	sedges	herbs and weeds
<i>Agropyron repens</i>	<i>Deschampsia caespitosa</i>	40.1 / 23.3	14.7	1.9	2.1	17.9
<i>Agropyron repens</i>	<i>Avenula pubescens</i>	33.8 / 19.8	14.9	1.1	-	30.4
<i>Agropyron repens</i>	<i>Bromus inermis</i>	28.8 / 16.8	8.9	-	3.9	41.6
<i>Agropyron repens</i>	<i>Festuca rubra</i>	42.2 / 20.1	9.8	2.1	0.4	25.4
<i>Agropyron repens</i>	<i>Dactylis glomerata</i>	25.6 / 23.0	16.7	1.8	-	32.9

Source: authors' study

fresh" ( $F = 2.9$ ), while according to Oświt (1992) – "fresh and moist" ( $L_{\text{moist}} = 5.6$ ). The community is found on soils with an acid reaction ( $R = 2.7$ ) and a high nitrogen content ( $N = 6.6$ ).

In order to determine nature value and fodder value in five communities with a marked dominance of *Agropyron repens* + a grass species, in which the discussed taxon was dominant, the number of species was calculated (species richness) and floristic diversity was measured based on the Shannon-Wiener index (1949). Analyses showed that the

communities with the dominance of *Agropyron repens* + *Deschampsia caespitosa* and *Agropyron repens* + *Avenula pubescens* were the richest in terms of the number of species. These communities also were characterised by a high floristic diversity measured by the Shannon-Wiener index  $H' = 3.2$ . Also *Agropyron repens* + *Bromus inermis* had a high Shannon-Wiener diversity index of  $H' = 2.9$ . In turn, the poorest community with the lowest floristic diversity was that with the dominance of *Agropyron repens* + *Dactylis glomerata*, in which only fourteen species were

Table 3. The botanical structure of the community with the dominance of *Agropyron repens*.

No.	Family	Number of species	Percentage share in the sward
1.	<i>Poaceae</i>	14	32.6
2.	<i>Cyperaceae</i>	1	2.3
3.	<i>Fabaceae</i>	3	7.0
4.	Herbs and weeds, in that: <i>Asteraceae, Ranunculaceae, Polygonaceae, Lythraceae, Lamiaceae, Plantaginaceae, Geraniaceae, Chenopodiaceae, Caryophyllaceae, Brassicaceae, Rubiaceae, Urticaceae</i>	25	58.1
Total		43	100.0

Source: authors' study

Table 4. Habitat conditions for the community with the dominance of *Agropyron repens*.

Ecological factor	Factor value	Factor intensity
Insolation according to Ellenberg	L = 6.2	semi-heliophilous plants
Moisture content according to Ellenberg	F = 2.9	dry and partly fresh
Moisture content according to Oświt	L <sub>moist</sub> = 5.6	fresh and moist
Reaction according to Ellenberg	R = 2.7	acid
Nitrogen abundance according to Ellenberg	N = 6.6	high

Source: authors' study

Table 5. Characteristics of nature values and production value of grass communities.

Community	Number of species in phytocenosis	H' – Shannon-Wiener floristic diversity index	Yield DM [t ha <sup>-1</sup> ]	FVS Fodder value score
<i>Agropyron repens</i> + <i>Deschampsia caespitosa</i>	29	3.2	2.8 a	3.9
<i>Agropyron repens</i> + <i>Avenula pubescens</i>	28	3.2	3.4 a	4.2
<i>Agropyron repens</i> + <i>Bromus inermis</i>	24	2.9	4.3 bc	5.4
<i>Agropyron repens</i> + <i>Festuca rubra</i>	24	2.4	3.8 b	6.4
<i>Agropyron repens</i> + <i>Dactylis glomerata</i>	14	2.3	4.5 c	6.3
NIR ( $\alpha = 0.05$ )			0.628	

Source: authors' study

a, b, c – values followed by the same letters do not differ significantly

reported. The most productive community among the investigated ones was that with the dominance of *Agropyron repens* + *Dactylis glomerata* at 4.5 t ha<sup>-1</sup> d.m. and *Agropyron repens* + *Bromus inermis* at 4.3 t ha<sup>-1</sup> d.m., while the lowest yielding community was the community with the dominance of *Agropyron repens* + *Deschampsia caespitosa*, at as little as 2.8 t ha<sup>-1</sup> d.m. (Table 5).

The analysed communities differ considerably in terms of the fodder value of the sward FSV (Table 5). The best value was recorded for phytocenoses of *Agropyron repens* + *Festuca rubra* and *Agropyron repens* + *Dactylis glomerata* (FVS = 6.4 and 6.3 respectively). The lowest fodder value of the sward was calculated for the community of *Agropyron repens* + *Deschampsia caespitosa* (FVS = 3.9). The value of the sward is reduced by taxa with a low nutritional value: *Deschampsia caespitosa* and *Avenula pubescens*, as well as *Carex hirta* and poisonous species, ra-

pidly lignifying, thorny or even prickly: *Ranunculus acris*, *Rumex crispus*, *Rumex acetosa*, *Heracleum sphondylium*, *Pimpinella saxifraga*, *Artemisia vulgaris* (Table 1).

## CONCLUSIONS

1. In the investigated communities couch grass (*Agropyron repens* L.) was the dominant species with constancy class 5, with the highest share of 42.2% recorded in *Agropyron repens* + *Festuca rubra*. A total of 43 vascular plant species were recorded, representing 15 botanical families.

2. Species richness and floristic diversity measured based on the Shannon-Wiener index, showed that the communities with the dominance of *Agropyron repens* + *Deschampsia caespitosa* and *Agropyron repens* + *Avenula pubescens* had the highest floristic diversity index ( $H' = 3.2$ ).

3. Thanks to the advantageous floristic composition the analysed communities may be used for fodder, although the value of the sward is reduced by taxa of low nutritional value.

4. Habitat conditions according to Ellenberg indicate that, in terms of moisture content, it is a community with the dominant species classified as “dry and partly fresh”, as well as moist, indicating acid soil and a high nitrogen content of N = 6.6.

5. The floristic composition of the studied communities is the result of improper use and indicates the need to take action to stop their degradation processes

#### ACKNOWLEDGEMENT

Research funded under grants to maintain research potential of Department of Grassland and Natural Landscape Sciences 508.108.00 “Multi-functionality of grassland and grass communities in agriculture, environmental protection and natural landscape”.

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received – 5 September 2019

revised – 5 November 2019

accepted – 8 November 2019

