Floristic Diversity and Pastoral Value of Permanent Grassland Fertilized in Conventional and Organic System

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Abstract

Permanent grassland is the most complex natural ecosystem due to the biodiversity of the structural and functional elements that characterize the space and time unit of this ecosystem. From this point of view, in the case of this ecosystem, biodiversity is manifested by the richness of species as a result of the interactions between species and the biotope, the interspecific relations and the effects of the technology and usage applied to the improvement of these surfaces. The paper presents the results obtained in an experimental device placed on a permanent grassland of *Festuca valesiaca* + *Festuca rupicola*, from Caraș-Severin County, under conditions of mineral and organic fertilizers application (sheep manure and direct fertilization by sheep folding).

Keywords: permanent pasture, production, botanical composition, biodiversity indices, pastoral value

INTRODUCTION

Permanent grassland is the most complex natural ecosystem due to the biodiversity of the structural and functional elements that characterize the space and time unit of this ecosystem. From this point of view, in the case of this ecosystem, biodiversity is manifested by the richness of species as a result of the interactions between species and the biotope, of the interspecific relations and the effects of the technology and usage applied to the improvement of these surfaces.

The total surface of permanent grasslands in the world is 3.40 billion hectares (25.7% of the total land area and 69.3% of the agricultural area of the Earth). From this area Europe has an area of 184 million hectares (5.6%), 7.7% of the total area of a continent and 34.6% of the agricultural area (White, 1983, Smit *et al.* 2008). Total phytomass

output of Terra's grasslands is estimated at 1000 million tons, which directly or indirectly provides much of the resources needed to the lives of over 800 million inhabitants.

The structure of permanent grassland areas per vegetation area is as follows: 0.63 million hectares (13%) plain and plateau grassland, 1.44 million hectares (30%) high hills and high plateaus grasslands; 2.16 million hectares (45%) mountain grasslands; 0.10 million hectares (2%) alpine grasslands; 0.48 million hectares (10%) interzonal and zonal grasslands (river meadows, halophiles and psamophiles grasslands). The total area affected by natural limiting factors (erosion, slope, excess moisture, invasive species, etc.) is over 600 thousand hectares representing 10-15% of the area of each type of grassland, structured on vegetation areas (Dragomir *et al.*, 2018).

The paper presents the results obtained in an experimental device placed on a permanent grassland of *Festuca valesiaca* + *Festuca rupicola*, from Caraş-Severin County, under conditions of mineral and organic fertilizers application (sheep manure and direct fertilization by sheep folding).

MATERIALS AND METHODS

The research was carried out during 2015-2017 on a permanent grassland of *Festuca valesiaca* + *Festuca rupicola* in Caraş-Severin county, used exclusively with sheep.

The experimental device included four experimental variants, fertilized with mineral and organic fertilizers: V1 - unfertilized grassland (control), V2 - fertilization with complex mineral fertilizers (300 kg + N₁₀₀), V3 - organic fertilization (sheep manure, 30 T/ha), V4 - fertilization by sheep folding + over-sowing + P₁₀₀.

The variants were established in 2015: organic fertilizers, complex mineral fertilizers and phosphorus were applied only at establishment, and nitrogen fertilizers were applied during vegetation. In case of V4, after fertilization through sheep folding (1 sheep/m²) for four nights, over-sowing with a mixture of grasses and legumes was carried out (*Lolium perenne* 40% + *Festuca pratensis* 30% + *Festuca arundinacea* 10% + *Lotus corniculatus* 10% + *Trifolium repens* 10%)

During the 2015-2017 years, the following parameters were determined: phytomass production, grazing capacity (GC), floral composition,

pastoral value (PV), the value of some biodiversity indices (Shannon-Weaver - H', Simpson - D, echitability - EH').

RESULTS AND DISCUSSIONS

Following conventional fertilization (by application of mineral fertilizers) of the studied permanent grassland, the production of phytomass increased from 7.29 - 7.83 t/ha, on the unfertilized variant, to 15.65 - 18.36 t/ha. In the case of organic fertilization (sheep manure), green mass production increased to 13.37 - 15.48 t/ha. The variant fertilized through sheep folding and over-sowing recorded the highest production increase of 18.21 - 20.46 t/ha. The increase of the phytomass production also led to an increase of the grazing capacity, from 0.61 - 0.66 UVM/ha, on the unfertilized variant, to 1.34 - 1.57 UVM/ha, on the mineral fertilized variant, to 1.14 - 1.32 UVM/ha, on organically fertilized variant and to 1.59 - 1.79 UVM/ha on the variant fertilized through sheep folding and over-seeded (Tab. 1).

Permanent grassland are considered the most complex natural ecosystem due to the biodiversity of existing species. Thus, the richness of species, expressed by its number, varies greatly from one variant to another. As compared to the control variant, with a number of 56 species in 2016 and 51 species in 2017, the richness of species decreases to 28-37 species in the mineral fertilized variant and to 30-45 species in organic fertilized variant. In case of the variant fertilized through sheep

Table. 1. Influence of mineral and organic fertilization on production and grazing capacity (GC)

Variant	Phytomass production		Grazing capacity			
			2016		2017	
	2016	2017	Real GC ¹	Usable GC ²	Real GC ¹	Usable GC ²
V1 - unfertilized	7.83	7.29	0.82	0.66	0.76	0.61
V2 - fertilization with chemical fertilizers (NPK ₃₀₀ , N ₁₀₀)	15.65	18.36	1.63	1.34	1.91	1.57
V3 - organic fertilization (sheep manure, 30 T/ha)	13.37	15.48	1.39	1.14	1.61	1.32
V4 - fertilization by sheep folding and over-sowing (P ₁₀₀)	18.21	20.46	1.89	1.59	2.13	1.79

¹) Real GC – depending on total production of phytomass

²) Usable GC – depending on the quantity of consumed phytomass

Table. 2. The influence of mineral and organic fertilization on the number of species, pastoral value (PV) and biodiversity indices (2016)

Variant	No. of species	PV	Biodiversity indices		
			H'	D	EH'
V1 - unfertilized	56	34.4	4.6321	0.262	0.263
V2 - fertilization with chemical fertilizers (NPK ₃₀₀ , N ₁₀₀)	37	44.4	3.1673	0.346	0.355
V3 - organic fertilization (sheep manure, 30 T/ha)	45	47.2	3.8606	0.408	0.412
V4 - fertilization by sheep folding and over-sowing (P ₁₀₀)	10	87.0	1.5848	0.921	0.874

Table. 3. The influence of mineral and organic fertilization on the number of species, pastoral value (PV) and biodiversity indices (2017)

Variant	No. of species	PV	Biodiversity indices		
			H'	D	EH'
V1 - unfertilized	51	31.4	4.3592	0.369	0.341
V2 - fertilization with chemical fertilizers (NPK ₃₀₀ , N ₁₀₀)	28	48.0	2.9060	0.698	0.780
V3 - organic fertilization (sheep manure, 30 T/ha)	30	49.6	3.0157	0.583	0.702
V4 - fertilization by sheep folding and over-sowing (P ₁₀₀)	12	71.4	1.6312	0.843	0.912

folding and over-seeding, the floral structure is formed in proportion of over 50% of grasses and leguminous species introduced into the grassland by over-seeding. Depending on the fodder value of the species in the floristic composition, the pastoral value (VP) of the grassland was determined, which recorded higher values for all fertilized or over-seeded variants compared to the control (Tab. 2&3).

The analysis of the biodiversity indices has revealed the following characteristics of the floristic structure: V1 - high diversity of species with very uneven distribution, V2 - medium diversity with relatively uniform distribution, V3 - high diversity with relatively uniform distribution, V4 - low diversity with very uniform distribution species (Tab. 2&3).

These results are similar to other researches carried out under the same type of permanent grassland (Păcurar and Rotar, 2014; Marusca *et al.*, 2010, 2016; Samfira *et al.*, 2011).

CONCLUSION

Improvement of floristic degraded permanent grassland can be achieved by different methods of conventional fertilization (mineral fertilizers) or organic fertilization (manure), taking into account the natural and stationary conditions.

Considering the use of permanent meadows by direct grazing with sheep, it is advisable to improve them by applying the sheep folding and over-sowing method, which, in case of the experimental device used, has led to an increase in the production and quality of the feed.

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