PRODUCTIVITY ASSESSMENT OF THE FESTUCO - BROMETEA CLASS GRASSLAND PHYTOCOENOSES EXISTING IN THE SOUTH MEHEDINȚI PLATEAU AND THE IRON GATES NATURAL PARK

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Abstract. *The Southern Mehedinți Plateau and Iron Gates grasslands from Romania, from a phytosociological point of view, belong to the Festuco-Brometea class with xerophilous vegetation. They are spread over an altitudinal difference of 70-630 m in the Mehedinti Plateau and 70-320 m at the Iron Gates, with the Danube River as the lower limit. They are mostly located on average slopes of 31 degrees of inclination, on sunny exposures. In the grassy carpet, on average, 81 species of cormophytes were recorded in the 12 phytosociological associations, of which Danthonio-Chrysopogonetum grylli with 155 species and Fumano - Stipetum (eriocaulis) praemoesicum with 110 species are distinguished. The average degree of vegetation cover is 70%, of which 20% are forage species and 50% harmful species, with no forage value. Average production of green mass production is 2.42 t/ha, with variation from 1.46 t/ha in the associations in the south of Mehedinți Plateau, to 4.32 t/ha at Iron Gates. The grasslands productivity in the area taken in the analysis is lower than in Dobrogea, respectively, by 68% for the green mass production and barely 39% for the pastoral value. As a result, the cow's milk production possible to obtain in Dobrogea is 2,720 litters/ha, 254% higher than that of the analyzed area, where it is estimated a milk production of 1,070 litters/ha in 160 days of the optimal grazing season. These data on the grasslands production and quality further serve to draw up the pastoral arrangements and grasslands management.*

Keywords: *Festuco-Brometea* class, grasslands, pastoral value, green mass production, milk production.

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1. Introduction

Knowledge of grassland productivity (green mass production, pastoral value, animal products, etc.) is the main economic factor on the basis of which management is further developed.

Determining grass production can be done by harvesting in protected areas in the case of grazing with animals or before mowing in the hay regime.

An easier method for evaluating the productivity of grasslands is based on the floristic survey [6, 11].

Through this method, it is possible to make better use of the geobotanical studies carried out up to now to determine the animal loading of pastures [7, 8, 9, 10, 14, 16] and in some cases of milk production per hectare in the grazing season [13, 16].

In Romania, the productivity of mountain, hill and plain grasslands was evaluated in a first approximation, according to the new method, with data that serve to draw up pastoral development projects [12].

The present work is a continuation of the evaluation of the productivity of the grasslands in the southern part of the Mehedinți Plateau, less studied from this point of view until now.

2. Materials and Methods

For the evaluation of productivity, two synthesis works were taken into study, namely:

1. "Flora and vegetation from the South of the Mehedinți Plateau", author Nicolae Roman, Publishing House of the RS Romania Academy, Bucharest, 1974 [18];

2. "Iron Gates Natural Park; Flora, Vegetation and Nature Protection", author Sorina Ștefania Matacă, Craiova University Publishing House, 2005 [17].

The working method for setting up the releveurs and vegetation classification is the one used in Phyto-sociology [1, 2, 3, 4, 5]

The outline of the grassland associations was as follows:

SOUTH MEHEDINȚI PLATEAU

CI. ***FESTUCO - BROMETEA*** B r .- B l . et Tx . 1943

Ord. *FESTUCETALIA VALESIACAE* Br.- Bl. et Tx. 1943

Al. ***Festucion rupicolae*** Soó 1964

1. As. *Botriochloetum ischaemi* Krist 1937
2. As. *Medicago (minima) - Aegilopsetum triaristati* nova ass.

3. As. *Chrysopogonetum grylli praemoesicum* nova ass.
4. As. *Fumano - Stipetum (eriocaulis) praemoesicum* nova ass.
5. As. *Cachrysetum ferulaceae* nova ass. prov.
6. As. *Alysso (pulvinare) - Gypsophiletum glomeratae* nova ass.
7. As. *Melico - Festucetum dalmaticae* nova ass. prov.
8. As. *Zernetum (Brometum) fibrosis danubiale* nova ass.

IRON GATES NATURAL PARK

Cl. ***FESTUCO - BROMETEA*** B r .- B l . et Tx . 1943

Ord. *FESTUCETALIA VALESIACAE* Br.- Bl. et Tx. 1943

Al. ***Festucion valesiacae*** Klika 1931

9. As. *Stachyo nitens-Cachrysetum ferulaceae* Sanda et Popescu 1999

Ord. *STIPO PULCHERRIMAE-FESTUCETALIA PALLENTIS* Pop 1968

Al. **Seslerio-Festucion pallentis** Klika 1931

10. As. *Melico-Phleetum montani* Boşcaiu et al. 1966

11. As. *Convolvulo cantabricae-Stipetuin eriocaulis* ass. nova

Ord. *BRACHYPODIO-CHRYSOPOGONETALIA* (Horvatic 1958) Boşcaiu 1972

Al. ***Danthonio-Brachypodion*** Boşcaiu 1972

12. As. *Danthonio-Chrysopogonetum grylli* Boşcaiu (1970) 1972

The working method was widely presented in a largely circulated magazine [6] and in Academy of Romanian Scientists Series on Agriculture, Silviculture and Veterinary Medicine Sciences [15], so it is not revisited.

3. Results and Discussions

A total of 151 floristic surveys were evaluated, of which 120 in the Mehedinti Plateau from the level of the Danube up to 830 m altitude and 31 surveys at Iron Gates between 70-320 m (Table 1).

Almost all grasslands analysed are located on sunny slopes with an average slope of 31 degrees, from relatively flat terrain to 60 degrees in the Danube Gorge.

Table 1. General data regarding the season and the vegetation of the phytocoenoses from the *Festuco - Brometea* class

No.	Grassland association	No. of surveys	Exposition	Slope (degree)	Cormophyte (nr)	Coverage %
	A. SOUTH MEHEDINTI PLATEAU (70 - 630 m altitude)					
	Al. ***Festucion rupicolae***					
1	*Botriochloetum ischaemi*	18	S,SE,W,Flat	20(0-40)	91	63
2	*Medicago (minima) - Aegilopsetum triaristati*	15	S.W.SE.SW	20(5-40)	60	79
3	*Chrysopogonetum grylli praemoesicum*	10	S,SW,SE	30 (5-45)	52	79
4	*Fumano - Stipetum (eriocaulis) praemoesicum*	17	S,SE,SW, E	32 (15-60)	110	45
5	*Cachrysetum ferulaceae*	19	S,SW,E,SE	18 (5-45)	90	81
6	*Alysso (pulvinare) - Gypsophiletum glomeratae*	18	SE,SW,S,W	24 (10-45)	81	63
7	*Melico - Festucetum dalmaticae*	11	S,SE,SW	30 (15-50)	55	57
8	*Zernetum (Brometum) fibrosis danubiale*	12	Plan,S,E,SW,SE	26 (10-60)	78	70
	TOTAL AVERAGE A	**120**	**S,SE,SW,E,W,Flat**	**26 (0-60)**	**77**	**67**
	B. IRON GATES NATURAL PARK (70 m altitude)					
	Al. ***Festucion valesiacae***					
9	*Stachyo nitens-Cachrysetum ferulaceae*	5	SE	45	43	68
	Al. ***Seslerio-Festucion pallentis***					
10	*Melico-Phleetum montani*	9	S, SE. E,W	41 (15-50)	87	81
11	*Convolvulo cantabricae-Stipetuin eriocaulis*		S	60	68	71
	Al. ***Danthonio-Brachypodion***					
12	*Danthonio-Chrysopogonetum grylli*		S,SE,E,SW,NW	31 (10-60)	155	85
	TOTAL AVERAGE B		**S,SE,E,EV,V,NV**	**44 (10-60)**	**88**	**76**
	TOTAL AVERAGE 1-12		**S,SE,E,SW,W,NW,Flat**	**31 (0-60)**	**81**	**70**

Phytodiversity is very high, with an average of 77 cormophyte species in the 8 associations of the Mehedinți Plateau, of which *Fumano - Stipetum (eriocaulis) praemoesicum* includes 110 cormophyte species.

The general degree of vegetation coverage of these grassland associations is only 70%, lower in the Mehedinți Plateau and higher in Iron Gates.

Regarding the participation of forage species in the grassy carpet on average it is 20% and harmful ones 50% (Table 2).

Table 2. Participation of forage species, green mass production and pastoral value of phytocoenoses in *Festuco – Brometea* class

No.	Grassland association	Species structure (%)		Green mass (GM)		Pastoral value (PV)		Appreciation
		Forager	Harmful	t/ha	%	ind.	%	
	A. SOUTH MEHEDINTI PLATEAU							
	Al. ***Festucion rupicolae***							
1	*Botriochloetum ischaemi*	5	58	0.40	16	2.3	21	Degraded
2	*Medicago (minima) - Aegilopsetum triaristati*	7	72	0.21	9	5.2	48	Very low
3	*Chrysopogonetum grylli praemoesicum*	55	24	9.50	383	24.7	227	Low
4	*Fumano - Stipetum (eriocaulis) praemoesicum*	1	44	0.10	4	0.7	6	Degraded
5	*Cachrysetum ferulaceae*	1	80	0.12	5	0.7	6	Degraded
6	*Alysso (pulvinare) - Gypsophiletum glomeratae*	2	61	0.10	4	0.9	8	Very low
7	*Melico - Festucetum dalmaticae*	26	31	1.20	50	11.5	11	Degraded
8	*Zernetum (Brometum) fibrosis danubiale*	1	69	0.07	3	0.4	4	Degraded
	TOTAL AVERAGE A	**12**	**55**	**1.46**	**60**	**5.8**	**53**	**Very low**
	B. IRON GATES NATURAL PARK							
	Al. ***Festucion valesiacae***							
9	*Stachyo nitens-Cachrysetum ferulaceae*	19	49	0.36	14	10.6	97	Very low
	Al. **Seslerio-Festucion pallentis**							
10	*Melico-Phleetum montani*	59	22	3.85	159	30.9	283	Mediocre
11	*Convolvulo cantabricae-*	8	63	0.67	28	3.9	35	Degraded

No.	Grassland association	Species structure (%)		Green mass (GM)		Pastoral value (PV)		Appreciation
		Forager	Harmful	t/ha	%	ind.	%	
	Stipetuin eriocaulis							
	Al. ***Danthonio-Brachypodion***							
12	*Danthonio-Chrysopogonetum grylli*	77	8	12.40	512	39.3	361	Mediocre
	TOTAL AVERAGE B	**41**	**35**	**4.32**	**179**	**21.2**	**194**	**Low**
	DIFFERENCE B - A	**29**	**-20**	**+ 2.86**	**119**	**- 115.4**	**x**	**x**
	TOTAL AVERAGE 1-12	**20**	**50**	**2.24**	**100**	**10.9**	**100**	**x**

The most valuable grasslands are part of the associations *Danthonio-Chrysopogonetum grylli* (77%) and *Chrysopogonetum grylli praemoesicum* (55% participation), where are recorded the highest productions of forage green mass (MV) of 12.4 t/ha and 9 .5 t/ha as well as highest indices of pastoral value (VP) of 39.3 and 247 respectively.

In the remaining 10 associations the production of GM and the PV index varies from degraded to poor forage productivity.

On average the GM production of 2.42 t/ha and the PV index of 10.9 are rated as very poor.

Compared to the grassland phytocoenoses of the *Festuco - Brometea* class in the north of Dobrogea, those of Mehedinți Plateau and Iron Gates have a GM production by approximately 20% and a PV index by 44% lower than the average (Table 3).

The average milk production evaluated on these phytocenoses is 1,900 liters/ha, higher in Dobrogea compared to Mehedinți.

The optimal animal load is 0.29 LU/ha in 160-day grazing season.

The milk production of 2,720 litters/ha possible to achieve in Dobrogea can be due to the climate with higher air humidity near the Black Sea, compared to the drier one in the Mehedinți Plateau.

Table 3. Evaluation of green mass production, animal load and cow milk production of *Festuco - Brometea* class grasslands in 160 days grazing season

Location	Green mass production		Optimal animal loading (LU/ha)	Pastoral value (ind.)	Milk production		Coverage
	t/ha	%			L/ha	%	
A. Dobrogea (Măcin Mountains, North Plateau, Casimcea, Babadag)	3.55	119	0.34	27.8	2,720	144	Mediocre
B. Mehedinți (South Plateau, Iron Gates)	2.42	81	0.23	10.9	1,070	56	Very low
AVERAGE (Class *Festuco-Brometea*)	2.99	100	0.29	19.4	1,900	100	Low

In general, the productivity of phytocoenoses in the Festuco - Brometea class is quite low, barely reaching 3 t/ha GM, approx. 20 PV index, which allows an optimal load of 0.3 LU/ha in 160 days grazing season.

These economic data are further used for the preparation of pastoral arrangements and the appropriate management of the grasslands.

Conclusions

(1) The permanent grasslands of the *Festuco - Brometea* class in the Mehedinți Plateau and Iron Gates have a high phytodiversity and low productivity.

(2) The GM production of 2.42 t/ha and the average index of 10.9 PV allow a loading of barely 0.23 LU/ha which can achieve 1,070 liters/ha of cow's milk in 160 days of grazing.

(3) The grasslands of Dobrogea from the same phytosociological class are more productive due to the wetter climate, influenced by the Black Sea.

R E F E R E N C E S

[1] Anghel, Gh., Răvăruţ, M., Turcu, Gh. 1971. Geobotanica, "Ceres"Publishing House, Bucureşti.

[2] Coldea, Gh., Oprea, A., Sîrbu, I., Sîrbu, C., Șterfan, N. 2012. Les associations végétales de Roumanie, Tome 2, Le associations anthropogènes, Presa Universitară Clujeană Publishing House.

[3] Cristea, V., Gafta, D., Pedrotti, F., 2004. Fitosociologie, Presa Universitară Clujeană Publishing House.

[4] Doniță, N., Popescu, A., Paucă-Comănescu, M., Mihăilescu, S., Biriș, I.A., 2005. Habitatele din România (Habitats of Romania), Tehnică Silvică Publishing House, București.

[5] Gafta, D., Mountford, J.O. - Coord., 2008. Manual de interpretare a habitatelor Natura 2000 din România (Textbook for interpreting the Natura 2000 habitats of Romania), Risoprint Publishing House, Cluj Napoca.

[6] Marușca, T., 2019. Contributions to the evaluation of pasture productivity using the floristic releve, Romanian Journal of Grassland and Forage Crops No. 19, pp. 33- 47 Cluj – Napoca.

[7] Marușca, T., Taulescu, E., Roșca, V., Bajenaru, B., Memedemin, D., 2019. Contributions to the evaluation of grassland productivity on the Macinului Mountains National Park, Romanian Journal of Grassland and Forage Crops No. 20, Iași, pp. 17- 26.

[8] Marușca, T., Memedemin, D., Groza, A., Pop, O. G., Simion, I., Tibirnac, M., Maftei, D.I., Maruntiu, M., Taulescu, E., Marin, N. 2020a. Indicator species for soil ecological factors found in the natural habitat 62C0* Ponto-Sarmatic steppe from ROSCI 0201, North Dobrogean Plateau, Romanian Journal of Grassland and Forage Crops , No. 21, Iași, pp. 7- 17.

[9] Marușca, T., Oprea, A., Memedemin, D., Pop, O.G., Tibirnac, M.N., Maftei, D.I., Simion, I., Taulescu, E. 2020b. Assesssement of phytodiversity and productivity of steppic grasslands from ROSCI 0201 Podișul Nord-Dobrogean/Evaluarea fitodiversității și productivității pajiștilor stepice din ROSCI0201 Podișul Nord-Dobrogean, în relație cu unele caracteristici ale solului, Delta Dunării, VIII, pp. 63-82.

[10] Marușca, T., Dihoru, Gh., Doniță, N., Memedemin, D., Păşcuț, C.Gh., 2020c. Contributions to the evaluation of the productivity of permanent grasslands from the Babadag Plateau (Dobrogea), Annals of the University of Oradea, Fascicle: Environmental Protection, Vol. XXXV.

[11] Marușca, T., Taulescu, E. 2021. The need for grassland productivity assessment for the economical development of mountain area (Case study, Ciucaș Mountains), Journal of Mountain Agriculture on the Balkans, 24 (6), pp. 313-329 ISSN1311-0489 (Print) Research Institute of Mountain Stockbreeding and Agriculture, Troyan, Bulgaria.

[12] Marușca, T., 2022. Evaluation of the Natura 2000 grasslands habitats productivity of the Romanian Plains and hills, Journal of Grassland and Forage Crops , Cluj Napoca, no.26 pp. 67-76.

[13] Marușca T., 2023. Evaluation of Cow Milk Production during the Grazing period of Natura 2000 Grassland Habitats, Academy of Romanian Scientists Series on Agriculture, Silviculture and Veterinary Medicine Sciences, Volume 12, No. 2, pp. 38-44.

[14] Marușca, T., Dragoș, M.M.M., Comșia, C.C., Porr, I. C., Zevedei, P., Ahghelus-Olenici, Gh., Dumea, R., 2023a. Evaluation of grasslands productivity from the Fagaras Depression, Romanian Journal of Grassland and Forage Crops, Cluj Napoca, no.27 pp. 75-82.

[15] Marușca, T., Dragoș, M. M., Comșia, C. C., Porr I. C., Zevedei, P., 2023b. Contribution to the Assessment of Grasslands Productivity between Jiu – Deznățui – Craiova and Danube, Academy of Romanian Scientists Series on Agriculture, Silviculture and Veterinary Medicine Sciences, Vol. 12, No. 2, pp. 45-50.

[16] Marușca, T., Păcurar, F., Memedemin, D., Oprea, A., Vaida, I., Taulescu, E., Nicola, N. 2022. Ecological, Agronomic and Anthropogenic Characterization of the Habitat 62 C0* Ponto-

Sarmatian Steppes in the North of Dobrogea (Romania), Buletin of University of Agricultural Sciences and Veterinary Medicine Cluj Napoca, Agriculture, Vol. 79, pp. 42-55.

[17] Matacă, S.Ș., 2005. Parcul Natural Porţile de Fier floră, vegetație și protecţia naturii. Muzeul Regiunii Porților de Fier, Drobeta Turnu Severin, (Flora, vegetation and nature protection of the Iron Gates Natural Park, Drobeta Turnu Severin, Universitaria Publishing House, Craiova, p.554.

[18] Roman, N., 1974. Flora și vegetația din sudul Podișului Mehedinți (Flora and vegetation of the South Mehedinti Plateau), Romanian Academy Publishing House.