

RESEARCH ON THE INFLUENCE OF SOME PRATOTECHNICAL FACTORS ON THE PRODUCTIVITY AND QUALITY OF *Festuca valesiaca* Schleich. ex Gaudin PERMANENT MEADOW

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Abstract

The exploitation of the permanent meadows in the Moldavian forest-steppe, encountered in natural conditions completely different from those found in the other regions of the country, is not possible without a thorough knowledge of the ecosystems of the meadows. Mineral and organic fertilization of grasslands is the main way to increase the yield of dry matter and forage quality in Moldavian forest steppe. The *Festucetum valesiaca* associations from the are in most part of low quality, with inadequate floristic composition, situated on soils with low natural fertility. The main ways to improve these grasslands consist in the correction of the soil fertility with mineral and organic fertilizers. The objective of our work is to analyze the effect of manure in combination with mineral fertilizers on biomass productivity and forage quality of *Festuca valesiaca* grasslands. From the results obtained during the experimentation period on the *Festuca valesiaca* meadow, it was found that their productivity and quality is very poor in the absence of improvement elements and can be substantially increased if the necessary measures for improvement and use are applied.

Key words: permanent grasslands, organic and mineral fertilization, dry matter, crude protein

Grasslands should be given higher priority in the future as they play important roles and provide many benefits to society. Thus, according to research, worldwide meadows are essential for approximately 800 million people, a population that is directly connected to the grass on the meadows for their livelihood and practically everyone consumes or uses the products obtained from meadow grass (White R. *et al*, 2000).

In the complex of measures regarding increasing the production of meadows and improving their quality, fertilization is a lever of the greatest importance, unanimously verified in all countries (Rotar I. *et al*, 2003; Vîntu V. *et al*, 2017).

The quantity and quality of the vegetation of the permanent *Festuca valesiaca* meadows are largely conditioned by the characteristics of the seasonal conditions, to which are added the anthropogenic influences through the exploitation system. Quantitative knowledge and their weight is an increasingly important concern in the research carried out on these meadows (Vîntu V. *et al*, 2004; Samuil C. *et al*, 2019).

Fertilization, regardless of its nature (mineral or organic), determines with the increase of production and the improvement of its main quality indices: floristic composition, content of

nutrients, digestibility and palatability (Cardașol V. *et al*, 1993; Vîntu V. *et al*, 2006; Samuil C. *et al*, 2008).

The influence of organic or mineral fertilization on forage quality is also known in the literature. Some studies from the country and abroad have investigated the long-term effects of different fertilization systems on the quality of forage from permanent meadows (Salis L., Vargiu M., 2008; Yu Y.W. *et al*, 2011; Ciobanu C., 2014; Vîntu V. *et al*, 2017).

The application of nitrogen positively influences the crude protein content of the feed, the amount of protein increasing with the increase of the nitrogen application rate (Vîntu V. *et al*, 2011; Delevatii L.M. *et al*, 2019; Simić A. *et al*, 2020; Mrázková M. *et al*, 2020).

Knowing the fact that mineral and organic fertilizers generally provide large increases in production on meadows, being used for a long time, in increasingly large doses, throughout the world, as well as in our country, to know to what extent influences the organic and mineral fertilization of the studied meadow, in 2022 observations were made regarding the productivity and the forage quality.

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MATERIAL AND METHOD

This study presents the results of an experience organized in 2007 on a *Festuca valesiaca* Schleich. ex Gaudin permanent meadow, type plant association located in Moldavian forest-steppe, on a slightly inclined ground, with NE exposition, cambic chernozem soil type, low leachability, silt- clay texture, humus content 4,2-4,8% medium supplied with phosphorus (30-37 ppm.) and well supplied with potassium (235-320 ppm.), pH 6.5 to 6.9 in the 0-20 cm layer of soil.

The experiment is monofactorial, set up by the method of randomized blocks in three replicates with the objective of studying the role of organic and mineral fertilizers combined in different doses in increasing forage production and improving the forage quality.

We used the following fertilization rates: V₁ - unfertilized (control), V₂ - 10 t ha⁻¹ cattle manure annually + P₃₆N₅₀, V₃ - 10 t ha⁻¹ cattle manure annually + N₅₀₊₅₀P₇₂; V₄ - 20 t ha⁻¹ cattle manure applied at 2 years + N₅₀P₃₆, V₅ - 20 t ha⁻¹ cattle manure applied at 3 years + N₅₀₊₅₀P₇₂, V₆ - 30 t ha⁻¹ cattle manure applied at 3 years + N₅₀P₃₆, V₇ - 30 t ha⁻¹ cattle manure applied at 3 years + N₅₀₊₅₀P₇₂, V₈ - 40 t ha⁻¹ cattle manure applied at 3 years + N₅₀P₃₆, V₉ - 40 t ha⁻¹ cattle manure applied at 3 years + N₅₀₊₅₀ P₇₂.

Nitrogen fertilizers were applied in spring, at the start of vegetation, and the phosphorus in the fall. Cattle manure used had the following composition: N-0.445%, P₂O₅- 0.212% and K₂O-0.695%. Sampling and vegetation studies were done at the ear formation-flowering of dominant

grasses; production was expressed in dry matter; nitrogen content was determined by Kjeldahl method; the results were interpreted statistically by analysis of variance and limit differences.

RESULTS AND DISCUSSIONS

One of the priority problems of the fertilization of meadows in the current stage is the rational use, in such a way that it contributes to obtaining higher and higher productions, of good quality, determines an appropriate evolution of the vegetation and contributes more substantially to the improvement of the condition of grassland soil fertility. The improvement of the nutrition regime in the soil, as a result of the application of mineral and organic fertilizers, had a positive effect on the growth of the phytomass of the *Festuca valesiaca* meadow during the studied period, the level of productions obtained being differentiated, depending on the doses applied, as well as due to the climatic conditions of the years experimentation.

Analyzing the influence of the studied factors on the production of dry matter in 2022 (table 1), it is found that the level of production is different depending on the type of fertilizer and the fertilization options used.

In the year 2022, the results of the study on the dynamics of dry matter production recorded in the *Festuca valesiaca* Schleich. ex Gaudin meadow indicated that the productions achieved varied between 2.36 and 4.49 t ha⁻¹ DM (table 1).

Table 1

The influence of organic and mineral fertilization rates on dry matter (DM) yield in 2022

Variant	DM t ha ⁻¹	Difference		Significance
		%	t ha ⁻¹	
V ₁ – Unfertilized (control)	2.36	100.0	Control	Control
V ₂ - 10 t ha ⁻¹ manure every year + N ₅₀ P ₃₆	4.31	182.6	1.95	***
V ₃ - 10 t ha ⁻¹ manure every year + N ₅₀₊₅₀ P ₇₂	4.47	190.3	2.11	***
V ₄ – 20 t ha ⁻¹ manure every 2 years + N ₅₀ P ₃₆	3.25	137.7	0.89	***
V ₅ - 20 t ha ⁻¹ manure every 2 years + N ₅₀₊₅₀ P ₇₂	3.69	156.2	1.33	***
V ₆ - 30 t ha ⁻¹ manure every 3 years + N ₅₀ P ₃₆	4.24	179.8	1.88	***
V ₇ - 30 t ha ⁻¹ manure every 3 years + N ₅₀₊₅₀ P ₇₂	4.48	190.0	2.12	***
V ₈ - 40 t ha ⁻¹ manure every 3 years + N ₅₀ P ₃₆	4.40	186.3	2.04	***
V ₉ - 40 t ha ⁻¹ manure every 3 years + N ₅₀₊₅₀ P ₇₂	4.51	190.1	2.15	***
	LSD 5%		0.42 t ha ⁻¹	
	LSD 1%		0.58 t ha ⁻¹	
	LSD 0.1%		0.80 t ha ⁻¹	

The highest production, recorded at 4.51 t ha⁻¹ DM, was obtained in the variant fertilized with 40 t ha⁻¹ manure every 3 years + N₅₀₊₅₀P₇₂, followed by fertilization with 30 t ha⁻¹ manure

every 3 years + N₅₀₊₅₀P₇₂, which produced 4.48 t ha⁻¹ DM. Both results were statistically significant (table 1).

Regarding the fertilized variants, the lowest

production, amounting to 3.25 t ha⁻¹ DM, was obtained in the variant with 20 t ha⁻¹ manure every 2 years + N₅₀P₃₆. The results obtained were also affected by the long-term effect of the applied organic and mineral fertilizers. By using a combination of annual doses of fertilizers and applying once every two or three years, a residual effect of the fertilizers was observed which influenced the productive potential of the studied meadow. The impact of animal manure as a way to improve the productivity of permanent meadows in Romania, as well as abroad, was studied under very different conditions and on different types of meadows. All studies, without exception, highlighted the positive impact of animal manure on the productivity of meadows (Marușca T., Frame J., 2003; Djukic D. *et al*, 2007; Čunderlík J., Kizeková M., 2012; Tong Z. *et al*, 2019; Mrázková M. *et*, 2020; Dragomir N. *et al*, 2020) which was also confirmed in the current study. Application of organic and mineral fertilizers on the *Festuca valesiaca* Schleich. ex Gaudin permanent meadow

had an impact on the chemical composition of the forage obtained. The application of manure, a complete fertilizer, in combination with nitrogen and phosphorus fertilizers results in a change in the trophic regime, bringing about improvements in the plant nutrition process. This change influences the development of nutrient consuming species, which accumulate different nutrients from fertilizers in their production.

From the analysis of the forage quality obtained from the permanent meadow of *Festuca valesiaca* Schleich. ex Gaudin in 2022, it appears that the crude protein content was 8.6% in the unfertilized variant, and in the case of the fertilized variants it was higher, between 10.4% and 11.9%. The highest value of crude protein was recorded in the version fertilized with 40 t ha⁻¹ manure every 3 years + N₅₀₊₅₀P₇₂ (11.9%), followed by the variant fertilized with 20 t ha⁻¹ manure every 2 years + N₅₀₊₅₀P₇₂ (11.7%), and the variants fertilized with 30 t ha⁻¹ manure every 3 years + N₅₀P₃₆ (table 2).

Table 2

The influence of organic and mineral fertilization on the content of crude protein (CP) in 2022

Variant	CP %	Difference		Significance
		%	% CP	
V ₁ – Unfertilized (control)	8.6	100.0	Control	Control
V ₂ - 10 t ha ⁻¹ manure every year + N ₅₀ P ₃₆	11.2	130.3	2.6	**
V ₃ - 10 t ha ⁻¹ manure every year + N ₅₀₊₅₀ P ₇₂	10.4	121.1	1.8	*
V ₄ – 20 t ha ⁻¹ manure every 2 years + N ₅₀ P ₃₆	11.2	130.4	2.6	
V ₅ - 20 t ha ⁻¹ manure every 2 years + N ₅₀₊₅₀ P ₇₂	11.7	136.2	3.1	***
V ₆ - 30 t ha ⁻¹ manure every 3 years + N ₅₀ P ₃₆	11.5	134.2	2.9	***
V ₇ - 30 t ha ⁻¹ manure every 3 years + N ₅₀₊₅₀ P ₇₂	10.8	126.3	2.3	**
V ₈ - 40 t ha ⁻¹ manure every 3 years + N ₅₀ P ₃₆	11.2	130.3	2.6	**
V ₉ - 40 t ha ⁻¹ manure every 3 years + N ₅₀₊₅₀ P ₇₂	11.9	138.2	3.3	***
		LSD 5%	1.4 %	
		LSD 1%	2.0 %	
		LSD 0.1%	2.7 %	

The application of organic and mineral fertilizers had a significant impact on the values of the amount of crude protein obtained. In all

fertilization variants, these values were higher compared to the unfertilized control, registering an increase between 161.3 and 329.7 kg/ha (table 3).

Table 3

The influence of organic and mineral fertilization on the amount of crude protein (CP) in 2022

Variant	CP kg/ha	Difference		Significance
		%	kg/ha	
V ₁ – Unfertilized (control)	202.7	100.0	Control	Control
V ₂ - 10 t ha ⁻¹ manure every year + N ₅₀ P ₃₆	482.2	237.9	279.5	***
V ₃ - 10 t ha ⁻¹ manure every year + N ₅₀₊₅₀ P ₇₂	466.8	230.3	264.1	***
V ₄ – 20 t ha ⁻¹ manure every 2 years + N ₅₀ P ₃₆	364.0	179.6	161.3	***
V ₅ - 20 t ha ⁻¹ manure every 2 years + N ₅₀₊₅₀ P ₇₂	431.3	212.8	228.7	***
V ₆ - 30 t ha ⁻¹ manure every 3 years + N ₅₀ P ₃₆	489.1	241.3	286.4	***
V ₇ - 30 t ha ⁻¹ manure every 3 years + N ₅₀₊₅₀ P ₇₂	486.4	240.0	283.7	***
V ₈ - 40 t ha ⁻¹ manure every 3 years + N ₅₀ P ₃₆	491.9	242.7	289.2	***
V ₉ - 40 t ha ⁻¹ manure every 3 years + N ₅₀₊₅₀ P ₇₂	532.3	262.7	329.7	***
LSD 5% = 18.3 kg/ha; LSD 1% = 25.2 kg/ha; LSD 0.1% = 34.8 kg/ha				

The highest amount of crude protein was obtained in the variant with 40 ha⁻¹ manure every 3 years + N₅₀₊₅₀P₇₂ (532.3 kg/ha), followed by fertilization with 40 t ha⁻¹ manure every 3 years + N₅₀P₃₆ (491.9 kg/ha), while the lowest amount was recorded in the variant with 20 t ha⁻¹ manure every 2 years + N₅₀P₃₆ (364.0 kg/ha).

CONCLUSIONS

The improvement of the nutrition regime in the soil as a result of the application of mineral and organic fertilizers had a positive effect on the growth of phytomass on the *Festuca valesiaca* meadow during the studied period, the level of productions obtained being differentiated, depending on the doses applied, as well as due to the climatic conditions in years of experimentation.

Organic and mineral fertilization also determined an improvement in the quality of the fodder, and the effect of the application of fertilizers on the quality of the fodder is due on the one hand to the changes that occur in the floristic composition, and on the other hand to the changes that occur in the chemical composition of the plant.

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