THE INFLUENCE OF DIFFERENTIATED FERTILIZATION OF PERMANENT PASTURES ON FLORISTIC COMPOSITION AND PASTORAL VALUE

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Abstract

In the last decades in the countries of Eastern Europe, a region of which Romania is also a part, political transformations of the late 1980s triggered the large-scale abandonment of permanent meadows, many being left unused and subsequently subjected to degradation. This study investigated the effect of differential fertilization of permanent pastures used with sheep in the Moldavian Plateau area on their floristic composition and pastoral values. The experiences began in 2023 and were carried out within RDSSGB Secuieni Bacău. Four lots of meadows were established with an area of 1.4 ha each, which were fertilized as follows: unfertilized meadow (control lot), meadow fertilized with chemical and organic fertilizers, meadow fertilized with organic fertilizers, and meadow fertilized with organic fertilizers plus overseeding. The obtained results attest the net superiority of the experimental lots compared to the control lot both in terms of floristic composition and pastoral value.

Key words: *floristic composition, fertilization, permanent meadows, sheep, pastoral value*

INTRODUCTION

Permanent grasslands cover 34% of agricultural land in the European Union and are vital for a wide variety of ecosystem services essential to our society. In recent decades, in many EU countries the area of permanent pastures has suffered significant losses (30-50%), and land use change continues to threaten its expansion [1,2,3].

In Eastern Europe, a region of which Romania is also a part, the political transformations of the late 1980s triggered the large-scale abandonment of permanent grasslands, many being left unused and subsequently subject to degradation [4,5]. As a result, the area of pastures and hayfields in our country decreased by 17.4% between 2010 and 2020 [6].

Current research in permanent grasslands focuses on improving their management and protection through approaches that include soil health, carbon sequestration and production efficiency. To ensure a sustainable and sustainable use of grasslands, interdisciplinary research that integrates climate, soil and vegetation and animal management factors is needed [7,8].

This study aimed to investigate the effect of differentiated fertilization of permanent pastures used with sheep in the Moldavian Plateau area on the floristic composition and pastoral value. The present research work was carried out within Research and Development Station for Sheep and Goats Breeding (RDSSGB) Secuieni Bacău, with the aim of improving and sustainable utilization with sheep of the permanent meadows in the Moldavian Plateau area, in order to increase their productive and qualitative potential. In

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addition, the research will bring ecological benefits, such as the conservation of biodiversity and the improvement of the pastoral landscape. All these improvements will contribute to increasing the income of sheep farmers and to the efficient and sustainable exploitation of grasslands.

MATERIAL AND METHOD

The researches started in 2023 with the development of a study of the natural conditions of the area where the experiences are carried out (the Moldavian Plateau), they continued with the identification of the area of permanent meadows for the realization of the experiences, the establishment of the experimental variants and the installation of the experimental device (the demarcation, fencing and establishment of the fields experimental).

In order to achieve the objectives and activities proposed within the work, 4 plots of pasture were established with an area of 1.4 ha each, being fertilized as follows:

- Lot 1 – unfertilized pasture (control lot);
- Lot 2 (experimental lot) – pasture fertilized with chemical fertilizers ($N_{80}P_{50}K_{50}$/hectare) + organic fertilizers (7.5 tons of manure/hectare);
- Lot 3 (experimental lot) - pasture fertilized with organic fertilizers (25 tons of manure/hectare);
- Lot 4 (experimental lot) - pasture fertilized with organic fertilizers (15 tons of manure/hectare) + overseeding.

Experimental lots 3 and 4 also benefited from a fertilization with simple phosphate P_2O_5 in the amount of 30 kg per hectare, knowing that the manure is low in phosphorus. In the framework of experimental lots 2, 3 and 4, agro-ecological maintenance works were carried out, such as collecting stones, clearing woody vegetation, fighting weeds, etc., in order to better value the green mass on the pasture.

Study of permanent meadow vegetation. The phytocenological survey or elevation is a basic method in the study of vegetation and consists of a floristic inventory (qualitative structure) of the sample area (of the phytocenosis) completed with quantitative (abundance, frequency, dominance), topographical, geomorphological, climatological information etc) [9].

The size of the sample area varies with the type of vegetation, and has values of 25 - 100 m^2 in the case of meadows, pastures and hay. The shape of the surface varies depending on the stage of development of the phytocenosis [10].

On the pasture chosen in the experiments, the floristic composition was determined by the geobotanical method in a square sample area, the number of sample areas being 3-5 as stipulated in the methodology for meadow areas of up to 100 hectares. The surfaces were chosen by crossing the meadow diagonally, being delimited with stakes in portions as uniform as possible from a floristic point of view. After delimiting the sample areas, the metric frame was used to identify the plant species found within each sample area, being then recorded in the geobotanical file by groups according to the botanical-economic criterion, namely grasses, legumes and other botanical families. Next to each species, the main characteristics were listed, namely abundance, dominance, frequency and phenophase.

By equating the phytosociological assessment scale in percentages of participation, the data already collected can be used with good results, which can thus be used further to assess the pastoral value of the respective meadow. The pastoral value is a synthetic index characterizing the quality of a meadow, determined by floristic assessment methods. The next step is the application of a formula for determining the pastoral value, namely [11]:

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$$V.P. = \sum PC\ (\%) \times IC / 5;$$

VP = pastoral value indicator (0-100);

PC = participation in the grass carpet (%) regardless of the determination method (AD, P, Cs, G);

IC = forage quality index.

Having available the floristic survey with the percentage participation of the species, the forage quality index (IC) is placed next to each plant, with values ranging from "0", no value to "5", excellent value. The grazing value indicator is then determined by dividing by 5 the total score obtained by multiplying PC x IC, the grazing value being assessed as follows: 0-5 degraded grassland; 5-15 very poor; 15-25 poor; 25-50 average; 50-75 good; 75-100 very good.

RESULTS AND DISCUSSIONS

The results regarding the influence of differentiated fertilization of permanent pastures used with sheep in the Moldavian Plateau area on the floristic composition and pastoral value are presented in Tables 1-4. As for the control lot, the pastoral value indicator (VP) had the value of 21.72, the meadow being in the weak category (VP values weak category: 15-25) (Table 1). From the data in Table 1, it can also be seen that gramnineous had a participation in the grass carpet of 13.09%, leguminous 1.77%, and the category of plants from other botanical families 86.14%. Thus, with these low percentages for valuable plants, the value of the meadow is small, according to the pastoral value mentioned previously.

Also, the existence of 4 species of plants that have no fodder value (the fodder quality index has the value 0) is noted, and among them Rubus caesius is even a plant that damages animal products in the case of sheep, i.e. impures the wool [11] .

Table 1 Calculation of floristic composition and pastoral value in the control lot

Species	% PC (participation in the grass carpet)	IC (forage quality index)	PC x IC
Gramineous	**13.09**	-	-
Festuca pratensis	8.64	5	43.20
Festuca ovina	1.33	1	1.33
Agrostis capillaries	3.12	3	9.36
Leguminous	**1.77**	-	-
Trifolium pratense	1.77	4	7.08
Other botanical families	**85.14**	-	-
Convolvulus arvensis	11.66	2	23.32
Plantago media	2.99	2	5.98
Plantago major	10.91	1	10.91
Plantago lanceolata	0.93	2	1.86
Artemisia absinthium	20.60	0	0
Daucus carota	2.78	2	5.56
Cardaria draba	8.36	0	0
Chenopodium album	11.70	0	0
Rubus caesius L.	15.21	0	0
Total	**100**	x	**108.60**
Pastoral value (VP)	x	x	**21.72**
Appreciation of the pastoral value of the meadow:	**WEEK**		

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In the case of lot 2, the pastoral value (VP) indicator had a value of 45.84, the grassland being classified in the medium category (VP values medium category: 25-50) (Table 2). Thus, there was a significant improvement in the pastoral value of lot 2 compared to the control lot (an increase of 211% or 2.11 times), which shows the beneficial influence of the fertilization and agro-ecological maintenance works carried out in lot 2.

The data in Table 2 also show that gramnineous and leguminous have had a higher participation in the grass cover of 22.75% and 11.43%, respectively, and the category of plants of other botanical families decreased from 85.14% to 65.82%, which makes the quality class of the grassland of lot 2 medium, in accordance with the above-mentioned assessment of the pastoral value.

From these results it can be concluded that in the case of lot 2 the combined fertilization produced a significant improvement in the floristic composition and consequently in the quality of the meadow.

Table 2 Calculation of floristic composition and pastoral value in lot 2

Species	% PC (participation in the grass carpet)	IC (forage quality index)	PC x IC
Gramineous	**22.75**	-	-
Festuca pratensis	19.40	5	97.00
Arrhenatherum elatius	1.04	4	4.16
Festuca ovina	2.31	1	2.31
Leguminous	**11.43**	-	-
Trifolium pratense	11.43	4	45.72
Other botanical families	**65.82**	-	-
Convolvulus arvensis	15.29	2	30.58
Plantago media	6.54	2	13.08
Plantago major	2.67	1	2.67
Plantago lanceolata	16.83	2	33.66
Artemisia absinthium	17.67	0	0
Cardaria draba	1.82	0	0
Rumex acetosa	5.00	0	0
Total	**100**	x	**229.18**
Pastoral value (VP)	x	x	**45.84**
Appreciation of the pastoral value of the meadow:	**MEDIUM**		

In the case of lot 3 of the research work, the pastoral value (VP) indicator had a value of 54.03, the grassland being classified in the good category (VP values good category: 50-75) (Table 3). In Table 3 it can be seen that gramnineous and leguminous had a higher participation in the grass cover of 42.82% and 7.86%, respectively, while the category of plants of other botanical families decreased from 85.14 (control) to 49.32%. Thus, the quality class of the meadow of lot 3 is good, according to the calculated pastoral value, and from these results we can conclude that in the case of the meadow of lot 3, fertilization based only on organic fertilizers (manure), brought a significant improvement in the floristic composition and consequently in the quality of the meadow compared to the control lot and even higher compared to the calculated pastoral value for lot 2. Concerning the pastoral value of lot 4 of the research work, the pastoral value (VP) indicator had a value of 87.76, the grassland being classified in the very good category (VP values very good category: 75-100) (Table 4).

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Table 3 Calculation of floristic composition and pastoral value in lot 3

Species	% PC (participation in the grass carpet)	IC (forage quality index)	PC x IC
Gramineous	**42.82**	-	-
Festuca pratensis	27.76	5	138.8
Dactylis glomerata	11.40	5	57.00
Festuca vaginata	3.66	1	3.66
Leguminous	**7.86**	-	-
Trifolium pratense	7.86	4	31.44
Other botanical families	**49.32**	-	-
Convolvulus arvensis	9.67	2	19.34
Plantago major	7.47	1	7.47
Plantago lanceolata	6.21	2	12.42
Capsella bursa pastoris	12.60	0	0
Cardaria draba	6.94	0	0
Chenopodium album	6.43	0	0
Total	**100**	x	**270.13**
Pastoral value (VP)	x	x	**54.03**
Appreciation of the pastoral value of the meadow:	**GOOD**		

From the data in Table 4 it can also be seen that gramnineous and leguminous had the highest participation in the grass cover among all the lots (98.13%), while the category of plants of other botanical families decreased to only 1.87%, which led to the grassland of this plot being classified in the very good quality class in terms of pastoral value.

From these results it can be concluded that, in the case of the specific meadow of lot 4, fertilization based solely on organic fertilizers (manure), together with over-seeding with valuable perennial grasses and leguminous perennials, led to a very significant improvement in the pastoral value and thus in the quality of the meadow compared to the control lot (an increase of 404% or 4.04 times) and even significantly higher than the pastoral value calculated for the other experimental plots.

Table 4 Calculation of floristic composition and pastoral value in lot 4

Species	% PC (participation in the grass carpet)	IC (forage quality index)	PC x IC
Gramineous	**90.54**	-	-
Lolium Perenne	23.06	5	115.30
Lolium Multiflorum	23.85	5	119.25
Festuca rubra	12.88	3	38.64
Festuca arundinacea	19.44	4	77.76
Phleum pratense	11.31	5	56.55
Leguminous	**7.59**	-	-
Trifolium pratense	4.17	4	16.68
Medicago sativa	3.42	4	13.68
Other botanical families	**1.87**	-	-
Convolvulus arvensis	0.48	2	0.96
Rumex acetosa	1.39	0	0
Total	**100**	x	**438.82**
Pastoral value (VP)	x	x	**87.76**
Appreciation of the pastoral value of the meadow:	**VERY GOOD**		

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CONCLUSIONS

Following the study carried out on the influence of differentiated fertilization of permanent pastures used with sheep in the Moldavian Plateau area on the floristic composition and pastoral value, we can draw the following conclusions:

1. Regardless of the type of fertilization performed, the value of permanent meadows is significantly improved in terms of quality.

2. The best results in terms of floristic composition and pastoral value are found in the case of using manure fertilization and overseeding with valuable forage plants (perennial gramnineous and leguminous).

3. The application of agro-ecological maintenance works such as collecting stones, removing woody vegetation and fighting weeds in the experimental pasture lots 2, 3 and 4 led to a better value of the green mass on the pasture.

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