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THE INFLUENCE OF THE APPLIED MANAGEMENT ON THE PHYTODIVERSITY OF A *Festuca valesiaca* Schleich. EX GAUDIN PERMANENT MEADOW

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Abstract

The problem of diversity has reached the top of current concerns, because modern agriculture has recently been focused on the development of methods and procedures that allow the administration of a relatively small number of species, with the aim of immediate economic interest. The objective of this study was to determine the effect of the applied management on the phytodiversity of a Festuca valesiaca permanent meadow in the Moldovian forest-steppe. The experimental factor was: fertilization with seven graduations: V_1- unfertilized (control), V_2- $N_{50}P_{50}$ kg/ha annually, V_3- $N_{75}P_{75}$ kg/ha annually, V_4- $N_{100}P_{100}$ kg/ha annually, V_5-10 t/ha sheep manure annually, V_6-20 t/ha annually and V_7-30 t/ha annually sheep manure applied at two years. The applied fertilizers influenced the floristic composition, producing, quantitative and qualitative changes in the vegetal cover. The dominance and frequency of the species, as well as the variation of the Shannon diversity index, were largely influenced by the amount of mineral N, the amount of manure, but also by the number of years of the fertilization period.

Key words: *permanent grasslands, organic and mineral fertilization, plant diversity, species frequency.*

INTRODUCTION

Grassland areas described as green oceans are important for the ecosystem services they provide, with an essential role in the balance of the global ecosystem (Hopkins & Holz, 2005; Carlier et al., 2005; Lemaire et al., 2011; O'Mara, 2012). Currently, four ecosystem services are distinguished that grasslands provide, such as: support, supply, adjustment and cultural (Vîntu et al., 2004; Nábrádi, 2007; Boval & Dixon, 2012; Iacob et al., 2015; Duthie, 2015; Goliński et al., 2012; Avondo et al., 2013; Smit et al., 2015). In addition to the production of fodder for animals, the focus of current attention is the relationship of grasslands with climate and erosion control. Over time, the interaction between orographic, climatic, edaphic factors and applied management has determined a great diversity of grassland systems in our country. The *Festuca valesiaca* grasslands studied in the experiment are Natura 2000 habitats (Ponto-Pannonian *F. valesiaca* grasslands - R3415) and are specific to the steppe and forest-steppe areas, which have recently gained increasing importance in the face of climate change and biodiversity conservation, imposing their maintenance and sustainable use through the PAC. The development of these meadows depends to a large extent on the intensity of the applied management (Samuil et al., 2009; 2010a; 2010b; Samuil & Vîntu, 2012; Ciobanu et al., 2012, Vîntu et al., 2017). Fertilization, regardless of its nature (mineral or organic), determines together with the increase in production and the improvement of the main qualitative indices and the modification of the structure of the vegetal cover, something that has been demonstrated by numerous specialists, both nationally and internationally (Samuil et al., 2008; Rotar et al., 2004; Vîntu et al., 2006; Ciobanu, 2014; Molnár et al., 2020). Maintaining biodiversity through sustainable management of grassland ecosystems is a necessity and a major concern of researchers in this field (Jankowski et al., 2003).

Phytodiversity can be positively influenced at moderate intensification (Cŏp et al., 2010), and a minimum of intensity is needed to maintain the characteristic of floristic composition (Tonn & Briemle, 2010). In this context, to knowing to what extent the level of intensification influences the phytodiversity of a permanent meadow of *F. valesiaca* Schleich. ex Gaudin, during 2019-2020 observations were made regarding the changes in the floristic composition that occurred in the tested variants.

MATERIALS AND METHODS

This study presents the results of an experience organized in 2018 on a permanent meadow of *F. valesiaca* Schleich. ex Gaudin from the Moldavian forest-steppe, between the geographical coordinates 47°05'-47°10' North latitude and 27°28'-27°33' Eastern longitude, on a slightly sloped ground, with NE exposition. The climatic conditions in the area are characterized by an average temperature of 9.6°C and 517.8 mm of total annual precipitation. Between April and September, the average temperature is 17.3°C, and the precipitation amounts to 337.5 mm. As a result of the diversity of physical-geographical factors and, first of all, of the relief, the dynamics of the atmosphere is very active and complex and gives the researched area a climate with thermal and hydrous characteristics specific to temperate-continental regions.

The experiment was organized according to the method of randomized plots in three repetitions, and the experimental factor was fertilization with seven gradations: V_1 - unfertilized (control), V_2 - $N_{50}P_{50}$ kg/ha annually, V_3 - $N_{75}P_{75}$ kg/ha annually, V_4 - $N_{100}P_{100}$ kg/ha annually, V_5 - 10 t/ha sheep manure annually, V_6 - 20 t/ha annually and V_7 - 30 t/ha annually sheep manure applied at two years.

Two types of fertilizers were used within the experiment: organic, represented by a well fermented sheep manure (older than two years) and mineral, represented by a complex fertilizer with nitrogen and phosphorus ($N_{20}P_{20}$). The sheep manure had the following chemical composition: N - 0.692%, P_2O_5 - 0.320% and K_2O - 0.811%. Fertilizers were applied manually in early spring before the start of active vegetation growth. Each plot was 4 m × 2.5 m in size. Harvesting was done at earing-flowering stage of the dominant grasses, and the floristic composition was established using the Braun-Blanquet method (Cristea et al., 2004). Floristic data have been processed with Excel and PC-ORD. Within the PC-ORD multivariate analysis program (McCune & Grace, 2002), various methods were used to order the floristic relevés, namely: Summary (to determine the Shannon Index and the number of species), average frequency and dominance, and multidimensional NMDS Autopilot scaling (Păcurar & Rotar, 2014).

The statistical data was analyzed by SPSS using ANOVA and the Lowest Significant Difference test (LSD 5%).

RESULTS AND DISCUSSIONS

Biodiversity of meadows is the result of colonization and disappearance of species, influenced by different factors. In the management of meadows, the laws of ecology and evolution must be taken into account, in order to preserve biodiversity (Partel et al., 2005). The phytodiversity of grasslands is affected by several factors, including natural or anthropogenic actions (Duru et al., 2010; Lehman & Tilman., 2000; Mauz & Rémy, 2004; Pasho et al., 2011).

During the 2 experimental years (2019-2020), we followed how the type of fertilizer and the amount applied (mineral with $N_{50}P_{50}$, $N_{75}P_{75}$ and $N_{100}P_{100}$ kg/ha applied annually and organic with 10, 20 t/ha sheep manure applied annually and 30 t/ha sheep manure applied at two years) influences the floristic composition of the meadow under study.

Ordering the floristic composition with the help of NDMS Autopilot (multidimensional scaling), shows us the changes produced by the administration of mineral and organic fertilizers on the biodiversity of the vegetal cover in the period 2019-2020. In 2019, the analysis of the floristic composition of the *F. valesiaca* meadow revealed that the studied phytocoenoses do not overlap clearly, which shows that there is no great similarity, which shows a different floristic diversity from one fertilization option to another (Figure 1). The ordering chart of the floristic composition

(Figure 1) from 2019 confirms that the application of organic and mineral fertilizers produced important changes in the floristic composition of the vegetal cover. The fact that the phytocenosis of the control variant does not overlap in the graphic representation with the fertilized variants, and the distance between them is large, shows us that we have a low similarity in terms of floristic composition. As it can be observed within the Figure 1, a overlap between certain variants, such as the case of variant V_2 ($N_{50}P_{50}$) with V4 ($N_{100}P_{100}$) and respectively V_6 (20 t/ha of sheep manure applied annually), which proves that the similarity between them it could be a high one (Figure 1).

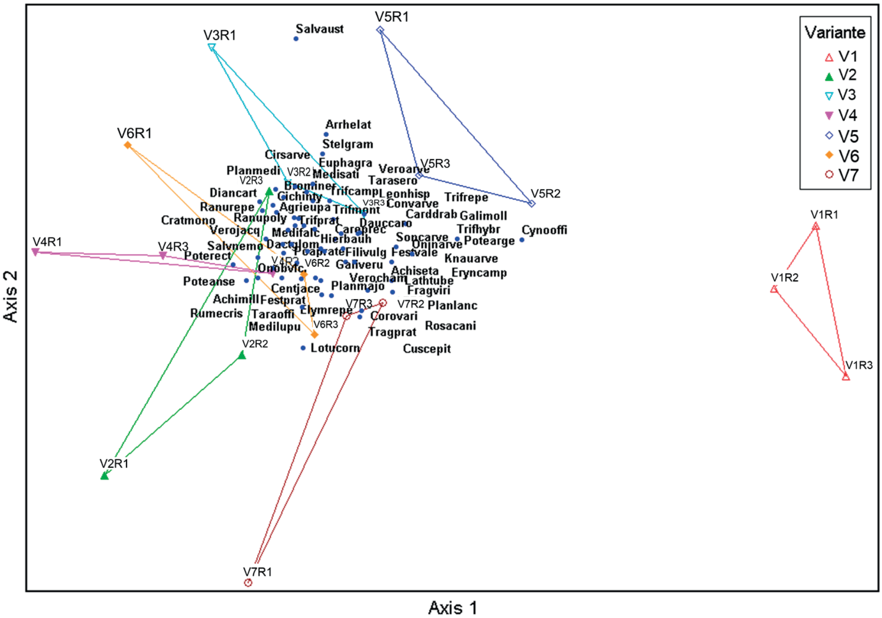

Figure 1. Ordination of floristic composition in 2019, influenced by fertilization (V_1 - unfertilized (control); V_2 - $N_{50}P_{50}$; V_3 - $N_{75}P_{75}$; V_4 - $N_{100}P_{100}$ kg/ha annually; V_5 - 10 t/ha ha of sheep manure applied annually, V_6 - 20 t/ha of sheep manure applied annually and V_7 - 30 t/ha of sheep manure applied at 2 years; R_1, R_2, R_3 - replicates)

(Legend: Species name: *Arrhenatherum elatius* (L.) J. Presl. et C. Presl = *Arrhelat*, *Bromus inermis* Leyss. = Brominer, *Dactylis glomerata* L. = Dactglom, *Elymus repens* (L.) Gould. = *Elymrepe*, *Festuca pratensis* Huds. = Festprat, *Festuca valesiaca* Schleich. ex Gaudin = Festvale, *Poa pratensis* L. ssp. *pratensis* = Poaprat, *Coronilla varia* L. =Corovari, *Lotus corniculatus* L. = Lotucorn, *Medicago falcata* L. = Medifalc, *Medicago lupulina* L. = Medilupu, *Medicago sativa* L. = Medisati, *Onobrychis viciifolia* Scop. = Onobvic, *Trifolium campestre* L. = Trifcamp, *Trifolium pratense* L. = Trifprat, *Trifolium repens* L. Trifrepe, *Trifolium montanum* L. = Trifmont, *Trifolium hybridum* L. = Trifhybr, *Ononis arvensis* L. = Ononarve, *Carex praecox* Schreb. = Careprae, *Agrimonia eupatoria* L. = Agrieupt, *Achillea millefolium* L. = Achimile, *Achillea setacea* Waldst. et Kit. = Achiseta, *Cardaria draba* (L.) Desv. = Carddrab, *Convolvulus arvensis* L. = Convarve, *Centaurea jacea* L. = Centjace, *Cichorium intybus* L. = Cichinty, *Cirsium arvense* (L.) Scop. = Cirsarve, *Cuscuta epithymum* (L.) L. ssp. *trifolii* (Bab.) Behrer = Cuscepit, *Crataegus monogyna* L. = Cratmono, *Cynoglossum officinale* L. = Cynooffi, *Daucus carota* L. ssp. *carota* = Dauccaro, *Dianthus carthusianorum* L. = Diancart, *Eryngium campestre* L. = Eryncamp, *Euphorbia agraria* M. Bieb. = Euphagra, *Fragaria viridis* Duchesne = Fragviri, *Filipendula vulgaris* Moench. = Filivulg, *Galium verum* L. = Galiveru, *Galium mollugo* L. = Galimoll, *Hieracium bauhinii* Besser = Hierbauh, *Knautia arvensis* L. = Knauarve, *Leontodon hispidus* L. = Leonhisp, *Plantago lanceolata* L. = Planlanc, *Plantago media* L. = Planmedi, *Plantago major* L. = Planmajo *Potentilla anserina* L. = Poteanse, *Potentilla argentea* L. = Potearge, *Potentilla recta* L. = Poterect, *Ranunculus repens* L. = Ranurepe, *Ranunculus polyanthemos* L. ssp. *polyanthemoides* (Borreau) Ahlfv. = Ranupoly, *Rosa canina* L. = Rosacani, *Rumex crispus* L. = Rumecris, *Salvia nemorosa* L. = Salvnemo, *Salvia austriaca* Jacq. = Salvaust, *Sonchus arvensis* L. = Soncarve, *Stellaria graminea* L. = Stelgram, *Taraxacum officinale* Weber. = Tragoffi, *Taraxacum serotinum* (Waldst. & Kit.) Fisch. = Tarasero, *Tragopogon pratensis* L. ssp. *pratensis* = Tragprat, *Veronica arvensis* L. = Veroarve, *Veronica chamaedrys* L. = Verocham, *Veronica jacquinii* Baumg. = Verojacq nomenclature after Sârbu et al., 2013; Ciocârlan, 2009)

There are, however, some species that entered the floristic composition of the phytocenosis following the application of certain doses of mineral and organic fertilizers, as follows: *Arrhenatherum elatius* (L.) J. Presl. et C. Presl, L., *Bromus inermis* Leyss., *Medicago sativa* L., *Trifolium campestre* L. when applying $N_{75}P_{75}$ (V_3), *Coronilla varia* L., *Lotus corniculatus* L. and the species *Tragopogon pratensis* L. ssp. *pratensis* when fertilizing with 30 t/ha of sheep manure applied at 2 years (V_7) (Figure 1).

The floristic diversity of the control variant (V_1) is highlighted in 2019 by a number of 36 species and a value of the Shannon - Wiener index (H') of 1.587, which shows us that the phytocoenosis of the control variant has a low diversity (Table 1). In 2019, it appears that in the variants fertilized with mineral fertilizers, the values of the Shannon – Wiener diversity index (H') varied between 2.234 and 2.510, indicating a low to medium diversity. The number of species in the case of the mineral fertilized variants varied between 45 and 50. In the case of the variants fertilized with sheep manure, the values of the Shannon Wiener diversity index (H') depending on the amount applied, were between 2.291 and 2.630, indicating low to medium diversity. The number of species in the case of organically fertilized variants varied between 43 and 50 (Table 1).

Regarding the frequency of species in the phytocenosis of the control variant (type *Festuca valesiaca* Schleich. ex Gaudin) in 2019, in addition to the dominant species, other species appear with a greater coverage and frequency, such as: *Achillea setacea* Baumg., *Centaurea jacea* L, *Fragaria viridis* Duchesne, *Galium verum* L., *Poa pratensis* L., *Elymus repens* (L.) Gould., *Lotus corniculatus* L., *Plantago lanceolata* L. etc., but also species with medium coverage and frequency: *Ranunculus polyanthemos* L. ssp. *polyanthemoides* (Borreau) Ahlfv., *Potentilla argentea* L., etc. (Figure 2).

Table 1. Relationships between experimental variants and some diversity indices in 2019 and 2010

Fertilization variants	Phytodiversity			
	2019		2020	
	H'	S	H'	S
V_1	1.587 ^{Mt}	36 ^{Mt}	1.875 ^{Mt}	33 ^{Mt}
V_2	2.234 *	45 *	2.352 *	47 *
V_3	2.510 *	49 *	2.638 *	53 *
V_4	2.493 *	50 *	2.612 *	48 *
V_5	2.291 *	50 *	2.160	40
V_6	2.630 *	53 *	2.594 *	50 *
V_7	2.296 *	43 *	2.386 *	46 *
LSD 5%	0.318	9	0.287	13

(H' = Shannon Index, S = number of species, Mt. = control,* = p <0.05)

There are also species in the phytocenosis of the control variant, especially those with high fodder value, such as: *Arrhenatherum elatius* (L.) J. Presl. et C. Presl, L., *Bromus inermis* Leyss., *Dactylis glomerata* L., *Trifolium pratense* L., *Medicago lupulina* L., which had a very low coverage and frequency (Figure 2).

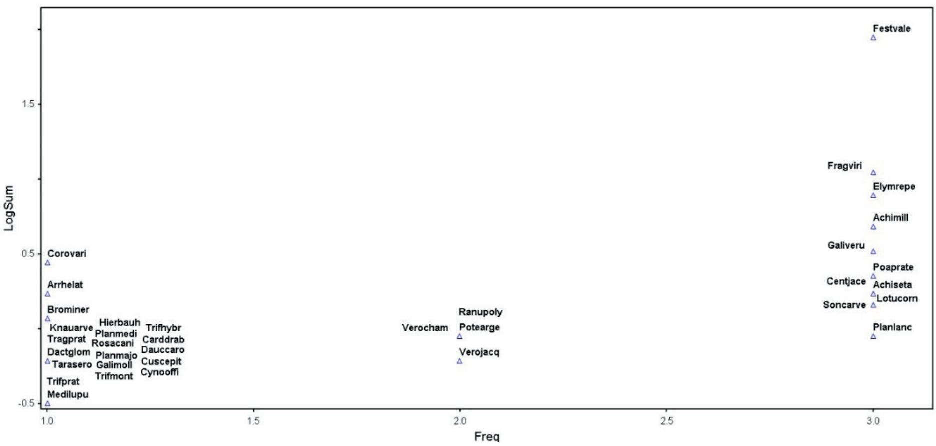

Figura 2. Dominant frequency diagram of control variant phytocoenosis *F. valesiaca* Schleich. ex Gaudin in 2019 (Legend: Freq= Species frequency, Logsum = Log base 10 of species dominance, for species name see the legend from Figure 1)

Comparing the floristic composition of the control variant with that of the variants on which mineral and organic fertilizers were applied, we find that certain species change their dominance and frequency (Figure 3).

Therefore, some species that in the control variant had a very low coverage and frequency, such as the case of the species: *Arrhenatherum elatius* (L.) J. Presl. et C. Presl, L., *Bromus inermis* Leyss., *Dactylis glomerata* L., *Trifolium pratense* L., *Medicago lupulina* L., *Plantago media* L. etc., are now found in a higher percentage with a medium to high frequency (Figure 3). Valuable species from a fodder point of view, such as *Medicago sativa* L. şi *M. falcata* L., which were absent in the phytocenosis of the control variant, we observe that they increase their frequency-dominance as a result of mineral and organic fertilization (Figure 3).

Other species such as: *Salvia austriaca* Jacq., *Cynoglossum officinale* L., *Potentilla recta* L., *Leontodon hispidus* L., *Filipendula vulgaris* Moench. etc., presents a low frequency-dominance in most of the variants studied (Figure 3).

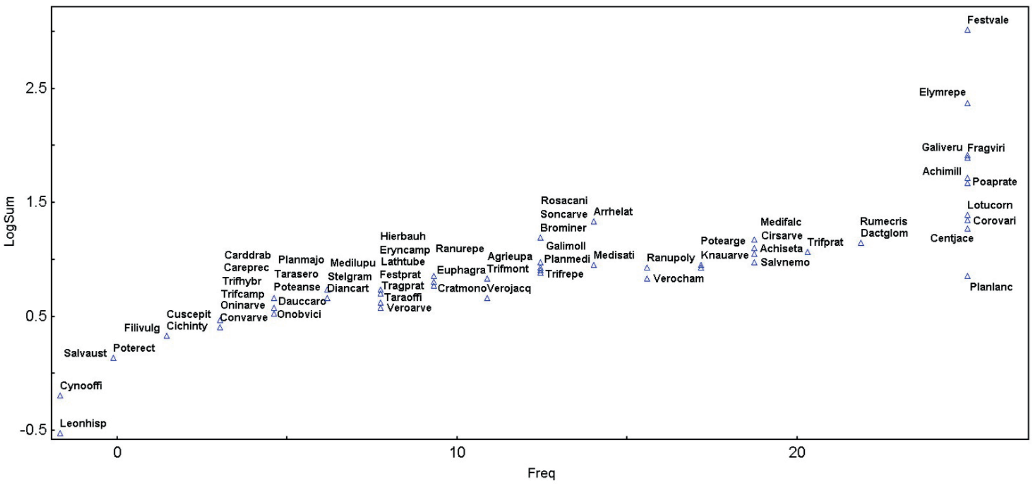

Figure 3. Dominant frequency diagram of organic and mineral fertilized variants phytocoenosis, without control variant, in 2019 (Freq= Species frequency, Logsum = Log base 10 of species dominance, for species name see the legend from Figure 1)

As in the previous year (2019), mineral and organic fertilization in 2020 determined major changes in the floristic composition, as can be seen from the graphic representation, the distance between the floristic composition of the control variant and that of the fertilized variants is very large, which indicates a different floristic diversity from one fertilization variant to another (Figure 4).

From Figure 4, it emerged that in the case of the unfertilized variant (control), there was a visible difference compared to that of the variants fertilized with mineral and organic fertilizers, and at small doses applied (V_2 - $N_{50}P_{50}$) or at (V_5 - 10 t/ha ha of sheep manure applied annually) the changes recorded in the structure of the vegetal cover were less.

In the variants fertilized with the maximum doses of fertilizers (V_4 - $N_{100}P_{100}$ and V_7 - 30 t/ha of sheep manure applied at 2 years) the ordering of the floristic composition was more distant from the homogeneous group of species. There was a homogeneous distribution of species within the variants fertilized with average doses of organic or mineral fertilizers, respectively the variants V_3 - $N_{75}P_{75}$ and V_6 - 20 t/ha of sheep manure applied (Figure 4).

The administration of fertilizers favored the installation of new species, at certain doses of fertilization, such as: *Lathyrus tuberosus* L., *Festuca pratensis* Huds. and *Prunus spinosa* L. in the variant V_3 ($N_{75}P_{75}$), *Trifolium montanum* L. şi *Teucrium chamaedrys* L. in the variant V_6 (20 t/ha of sheep manure applied annually) the

Agrimonia eupatoria L. species in the V_4 variant ($N_{100}P_{100}$).

Analyzing the phytodiversity of the control variant (V_1), in 2020, we observe that the average value of the number of species is 33 and that of the Shannon - Wiener index of 1.875, which indicates a low biodiversity (Table 1).

As in the previous year, in 2020, the phytodiversity of the fertilized phytocenoses registered an increase depending on the type of fertilizer and the dose applied, compared to the phytocenose of the control variant. Therefore, in the case of the variants fertilized with mineral fertilizers, the values of the Shannon - Wiener diversity index (H') varied between 2.352 and 2.638, indicating a low to medium diversity. The number of species in the case of mineral fertilized variants varied between 47 and 53 (Table 1).

Organic fertilization in its doses determined the increase in the number of species, the values being between 40 and 50, depending on the amount of sheep manure applied. The values of the Shannon - Wiener diversity index (H') varied between 2.160 and 2.594, indicating a low to medium diversity (Table 1).

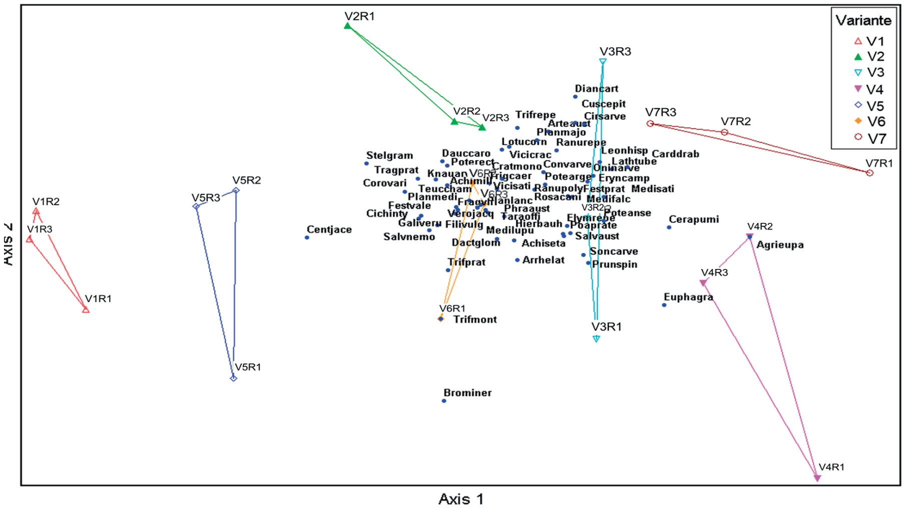

Figure 4. Ordination of floristic composition in 2020, influenced by fertilization (V_1 - unfertilized (control); V_2 - $N_{50}P_{50}$; V_3 - $N_{75}P_{75}$; V_4 - $N_{100}P_{100}$ kg/ha annually; V_5 - 10 t/ha ha of sheep manure applied annually, V_6 - 20 t/ha of sheep manure applied annually and V_7 - 30 t/ha of sheep manure applied at 2 years; R_1, R_2, R_3 – replicates)

(Legend: Species name: *Arrhenatherum elatius* (L.) J. Presl. et C. Presl = *Arrhelat*, *Bromus inermis* Leyss. = Brominer, *Dactylis glomerata* L. = Dactglom, *Elymus repens* (L.) Gould. = *Elymrepe*, *Festuca pratensis* Huds. = Festprat, *Festuca valesiaca* Schleich. ex Gaudin = Festvale, *Poa pratensis* L. ssp. *pratensis* = Poaprat, *Phragmites australis* (Cav.) Trin. ex Steud. = Phraaust, *Coronilla varia* L. = Corovari, *Lotus corniculatus* L. = Lotucorn, *Medicago falcata* L. = Medifalc, *M. lupulina* L. = Medilupu, *M. sativa* L. = Medisati, *Trifolium pratense* L. = Trifprat, *Trifolium repens* L. Trifrepe, *Trifolium montanum* L. = Trifmont, *Trigonella caerulea* (L.) Ser. = Trigcaer, *Vicia sativa* L. = Vicisati, *Ononis arvensis* L. = Ononarve, *Carex praecox* Schreb. = Careprae, *Agrimonia eupatoria* L. = Agrieupt, *Achillea millefolium* L. = Achimile, *Achillea setacea* Waldst. et Kit. = Achiseta, *Cardaria draba* (L.) Desv. = Carddrab, *Cerastium pumilum* Curtis. = Cerapumi, *Convolvulus arvensis* L. = Convarve, *Centaurea jacea* L. = Centjace, *Cichorium intybus* L. = Cichinty, *Cuscuta epithymum* (L.) L. ssp. *trifolii* (Bab.) Behrer = Cuscepit, *Crataegus monogyna* L. = Cratmono, *Daucus carota* L. ssp. *carota* = Dauccaro, *Dianthus carthusianorum* L. = Diancart, *Eryngium campestre* L. = Eryncamp, *Euphorbia agraria* M. Bieb. = Euphagra, *Fragaria viridis* Duchesne = Fragviri, *Filipendula vulgaris* Moench. = Filivulg, *Galium verum* L. = Galiveru, *Hieracium bauhinii* Besser = Hierbauh, *Knautia arvensis* L. = Knauarve, *Lathyrus tuberosus* L. = Lathtube, *Leontodon hispidus* L. = Leonhisp, *Plantago lanceolata* L. = Planlanc, *Plantago media* L. = Planmedi, *Plantago major* L. = Planmajo, *Potentilla anserina* L. = Poteanse, *Potentilla argentea* L. = Potearge, *Potentilla recta* L. = Poterect, Prunus spinosa L. = Prunspin, *Ranunculus polyanthemos* L. ssp. *polyanthemoides* (Borreau) Ahlfv. = Ranupoly, *Rosa canina* L. = Rosacani, *Rumex crispus* L. = Rumecris, *Salvia nemorosa* L. = Salvnemo, *Salvia austriaca* Jacq. = Salvaust, *Sonchus arvensis* L. = Soncarve, *Stellaria graminea* L. = Stelgram, *Taraxacum officinale* Weber. = Tragoffi, *Teucrium chamaedrys* L. = Teuccham, *Tragopogon pratensis* L. ssp. *pratensis* = Tragprat, *Veronica jacquinii* Baumg. = Verojacq nomenclature after Sârbu et al., 2013; Ciocârlan, 2009).

The increase of the number of species is due to the application of fertilizers, which changed the state of soil fertility.

This change in soil fertility allowed other mesotrophic and/or eutrophic species to establish in the fertilized variants.

This study demonstrated that fertilization with mineral and organic fertilizers in moderate doses contributed significantly to the increase in the number of species present in the vegetal cover.

Different other researchers, in similar experiments, have shown that fertilization regardless of its nature, applied in moderate quantities stimulates floristic diversity of meadows (Mrkvièka & Veselá, 2002; Rotar et al., 2003; Păcurar & Rotar, 2004; Chytrý et al., 2009; Ciobanu et al., 2013a; 2013b; Nettier et al., 2010; Samuil et al., 2013; Vîntu et al., 2017; Molnár et al., 2020). Fertilization applied in high doses causes the loss of species richness, results confirmed in some studies carried out by Dragomir et al., 2020; Boch et al., 2021; Ranta et al., 2021.

Analyzing the species frequency diagram in the control variant (type *F. valesiaca* Schleich. ex Gaudin), in the year 2020, we notice that in addition to the dominant species, other species are found with a high coverage and frequency, such as: *Elymus repens* (L.) Gould., *Poa pratensis* L., *Achillea millefolium* L., *Fragaria viridis* Duchesne, *Centaurea jacea* L, *Galium verum* L., *Trifolium pratense* L, *Plantago media* L., *P. lanceolata* L., *Coronilla varia* L., *Lotus corniculatus* L. etc., but also species with medium coverage and frequency: *Achillea setacea* Waldst. et Kit., *Filipendula vulgaris* Moench. and *Taraxacum officinale* Weber.

Species such as: *Dactylis glomerata* L., *Arrhenatherum elatius* (L.) J. Presl. et C. Presl., *Bromus inermis* Leyss., *Medicago lupulina* L., *Vicia sativa* L., *Daucus carota* L., *Cichorium intybus* L. etc., had a very low coverage in the control variant (Figure 5).

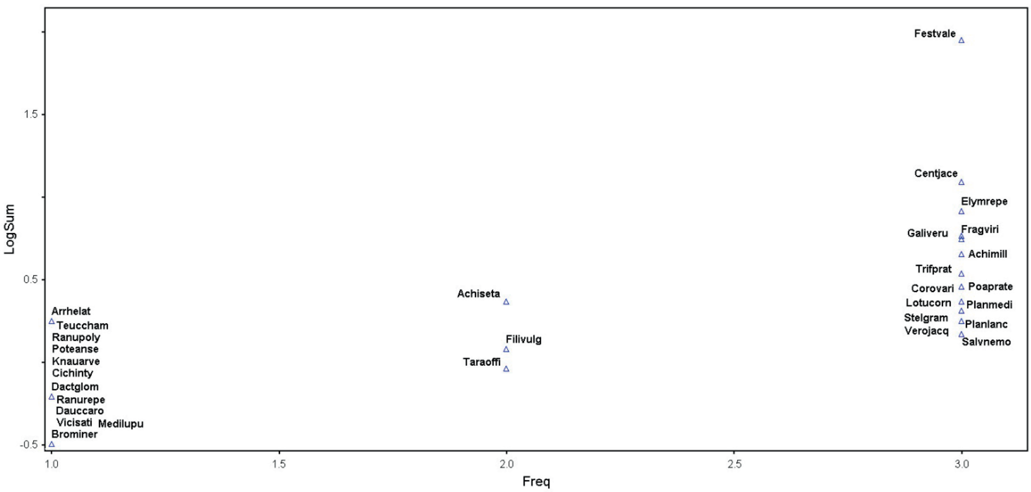

Figura 5. Dominant frequency diagram of control variant phytocoenosis *F. valesiaca* Schleich. ex Gaudin in 2020
(Legend: Freq= Species frequency, Logsum = Log base 10 of species dominance,
for species name see the legend from Figure 4)

In 2020, comparing the floristic composition of the unfertilized variant with that of the variants where organic and mineral fertilizers were applied, we find, as in the previous year, that certain species change their dominance and frequency (Figure 6).

Therefore, some species that in the control had a large coverage such as the *Festuca valesiaca* Schleich species. ex Gaudin and *Elymus repens* (L.) Gould., are now found in a lower percentage (Figure 6). In the case of other species, such as *Arrhenatherum elatius* (L.) J. Presl. et C. Presl, and *Medicago falcata* L. we observed that their frequency has increased significantly and they are classified as dominant species, an aspect that is explained by their abundance in most of the studied variants. Other species that change their dominance and frequency are: *Dactylis glomerata* L., *Festuca pratensis* Huds., *Knautia arvensis* L., *Cichorium intybus* L., *Potentilla argentea* L., and so on. The species with the lowest abundance and frequency in most experimental variants are: *Agrimonia eupatoria* L., *Trifolium montanum* L., *Cerastium pumilum* Curtis., *Teucrium chamaedrys* L., *Euphorbia agraria* M. Bieb, etc. (Figure 6).

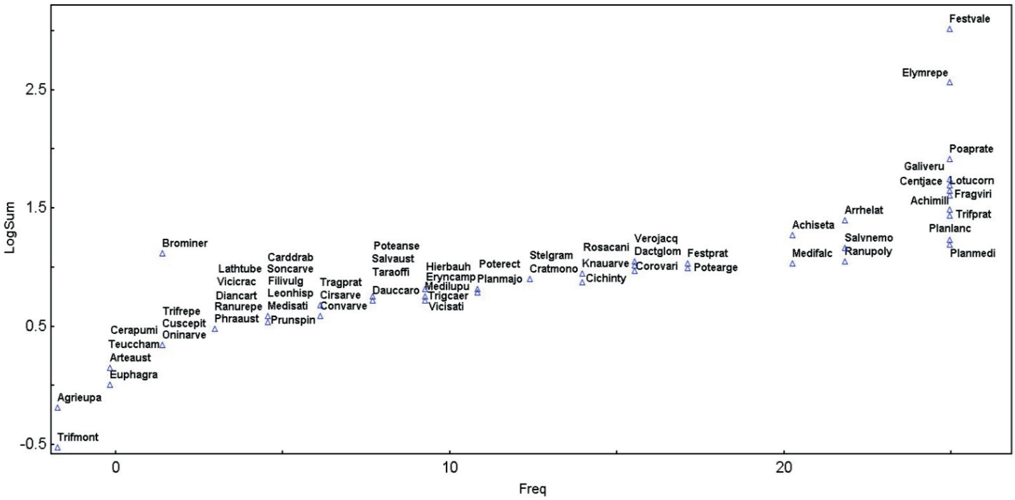

Figure 6. Dominant frequency diagram of organic and mineral fertilized variants phytocoenosis, without control variant, in 2020 (Freq= Species frequency, Logsum = Log base 10 of species dominance, for species name see the legend from Figure 4)

CONCLUSIONS

The administration of fertilizers on these permanent *F. valesiaca* meadows, in any form, causes obvious changes in the structure of phytocenoses compared to the unfertilized variant. The changes in the floristic composition of the vegetal cover, as well as the variation of the Shannon diversity index, were largely influenced by the amount of mineral N, the amount of manure, but also by the number of years of the fertilization period.

The increase of the number of species as well as their different way of dispersal in the studied variants could have been caused by the improvement of the soil nutrient content after fertilization.

As a result of our research it is found that the using a management based on fertilization with moderate amounts of organic and mineral fertilizers can help to preserve the biodiversity of *F. valesiaca* meadows, while high amounts of fertilizers can negatively influence it.

To maintain a high level of floristic diversity, we recommend the application of 20 t/ha of manure administered annually, and in the absence of manure, the application of a moderate dose of mineral fertilizer with $N_{75}P_{75}$.

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