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THE INFLUENCE OF ORGANIC FERTILIZATION COMBINED WITH MULCHING ON MEADOWS PHYTODIVERSITY

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Abstract

Biodiversity is not a stranger term to any social category (from ordinary peasant to political class) and became the main topic in any actual problem. Climate change is beginning to affect biodiversity and how it is expected it will cause a significant loss of biodiversity in the near future. Key drivers of change of biodiversity are land use change (including urbanization and land abandonment, climate change, fragmentation, etc nitrogen deposition.). Fertilization is itself a method of reducing the phytodiversity of meadows. Our experience was conducted in the village Ocoale from Gîrda de Sus commune, Alba county and seeks organic fertilization effect on phytodiversity of mountain meadows. Manure fertilizer is recommended to be used on permanent grassland with a high specific richness, but should be given in small quantities. The organic growth contributing to biodiversity conservation and regeneration of soil, water and other resources is urgently needed to meet the widest possible range of socio-economic challenges and environmental.

Keywords: low-input, management, meadows, biodiversity, organic fertilization.

1. Introduction

Agricultural intensification of grassland management and production of goods and services to their environment are affected by global markets, international developments resulting global information sharing but equally to climate change [4]. It is known that organic fertilization influences vegetation composition and experiences undertaken, both nationally and internationally, have shown that the intensive grassland systems greatly reduce specific richness [3].

On grasslands fertilizers are applied on canopy which is why they cannot be incorporate, leading to a delay in action, especially for the less soluble [6, 7].

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2. Material and Method

The experimental field was located in the village Ocoale (Garda de Sus commune, Alba county), in a place called Poienile Ursului in 2009.

The experiment was placed based on randomized block method, in five replication (blocks) with seven experimental variants. Surface of experimental plots is 6 m^2. The experimental variants were set taking into account the experiences conducted earlier in Romania, especially in the Gîrda area, the following experimental variants: **V 1** –control (mowed 1/year); **V 2** – mulch 1/year; **V 3** – mulch 1/year + 5 t/ha manure /year; **V 4** – mulch 1/year + 5 t/ha manure /2 years; **V 5** - mulch 1/year + 10 t/ha manure/2 years; **V 6** - mulch 1/year + 10 t/ha manure/3 years; **V 7** – abandonment.

Manure originates from cattle and horses in the area, with the following composition: pH 8.06, Dry matter 16.7 [m/m%]; Σ P 3850 [mg/kg];Σ K 11370 [mg/kg]; Kjeldahl-N 18235 [mg/kg]; P_2O_5

17420 [mg/kg]; K_2O_5 14830 [mg/kg] (Balint Analitika Laboratory, Hungary).

Floristic studies were performed before mowing, based on the vegetation interpretation scale given by Braun-Blanquet, when *Poaceae* were in flowering phase [1]. Typological classification of grasslands was done after ȚUCRA et al. [5].

For interpretation of floristic data we used the program PC-ORD, program that performs multivariate analysis of ecological data entered in spreadsheets [2]. For variance analysis and to evaluate the effect of treatments applied on canopy we used a statistical program created by the company *StatSoft* [8].

3. Results and Discussions

After determining the floristic composition of grasslands in the experiences studied, the type determined is *Agrostis capillaris* L. - *Festuca rubra* L., which is part of the type *Agrostis capillaris* L. - *Festuca rubra* L., specific series nemoral floor, beech forest undergrowth and beech and resinous mixture [5].

Effect of organic inputs combined with mulching on grassy carpet in 2012 is very little sensed (fig. 1). Floristic composition caused by treatments overlap and not too in the graphical representation which shows the similarity and at the same time some differences of phytocoenosis.

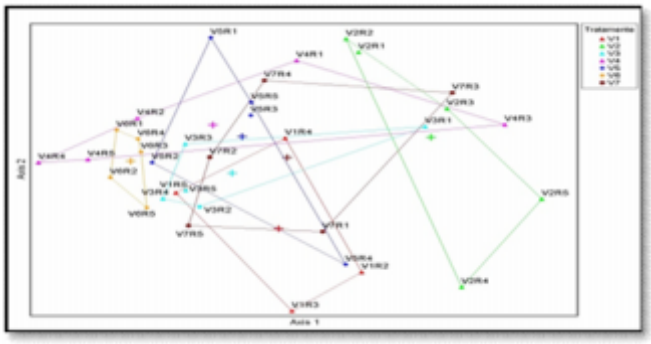

Figure 1. Ordering floristic composition in 2012, according to combined organic mulching treatments (treatments V, V1 - control, V2 mulching / year, V3-mulching / year + 5 t / ha manure, applied annually, V4 - mulching / year 5 t / ha manure, applied once to 2 years, V5-mulching / year + 10 t / ha manure, applied once to 2 years, V6-mulching / year + 10 t / ha manure, applied once to 3 years, V7-meadow abandoned, R-repetitions)

In some cases very different floristic composition, recorded significant distinct differences when comparing the control (V1) with abandonment variant, when compared V2 - mulching once a year with variant V3 - mulching once a year + 5 t/ha manure applied annually and with the V6 variant, mulching once a year + 10 t/ha manure applied to three years, respectively, when comparing V6 variant with abandon ($p < 0.01$, table 1). Significant differences are recorded in other comparisons between phytocenosis, such as variant control with V3 and V6 variants ($p < 0.05$); variant mulching once a year (V2) compared with variants V4 - mulching once a year 5 t/ha manure, applied every two years, the variant V5 - mulching once a year + 10 t/ha manure applied two years and variant V7 - meadow abandoned.

When comparing V3 mulching once a year + 5 t/ha manure, applied and V5 annual mulching once a year + 10 t/ha manure, applied every two years, both V6 mulching once a year + 10 t/ha manure, applied once every 3 years, statistically significant differences ($p < 0.05$).

Table 1. Comparing floristic composition in 2012 experimental variants (mulching + organic fertilizer) with MRPP (T - t test, A - homogeneous group, p - statistical significance)

Comparison between variants	T	A	*p*	Significance
V1 vs. V2	-1.592	0.051	0.071	ns
V1 vs. V3	-2.663	0.097	0.014	*
V1 vs. V4	-1.632	0.066	0.069	ns
V1 vs. V5	-2.666	0.101	0.019	*
V1 vs. V6	-3.002	0.130	0.013	*
V1 vs. V7	-2.814	0.112	0.008	**
V2 vs. V3	-3.320	0.137	0.010	**
V2 vs. V4	-2.254	0.091	0.034	*
V2 vs. V5	-2.385	0.078	0.019	*
V2 vs. V6	-5.089	0.227	0.002	**
V2 vs. V7	-2.481	0.087	0.018	*
V3 vs. V4	-0.642	0.025	0.223	ns
V3 vs. V5	0.584	-0.018	0.695	ns
V3 vs. V6	-2.827	0.118	0.018	*
V3 vs. V7	-1.033	0.045	0.145	ns
V4 vs. V5	0.389	-0.012	0.591	ns
V4 vs. V6	-0.477	0.016	0.303	ns
V4 vs. V7	-0.949	0.041	0.160	ns
V5 vs. V6	-3.062	0.102	0.011	*
V5 vs. V7	-1.681	0.050	0.059	ns
V6 vs. V7	-4.404	0.170	0.002	**

Dominant species *Agrostis capillaris* L. amend their weight under the action of experimental factors, reaching 35.5%, the variant mulching once a year + 10 t/ha manure applied at three years (V6, $p < 0.01$, table 2). If other treatments expands slightly participation, but the differences were not statistical assurance, however, the variant mulching once a year (V2) slightly reduces its weight, but still without insurance statistics ($p > 0.05$).

Co-dominant species *Festuca rubra* L. increases its participation compared with control up

to 20.25% at variant mulching once a year + 5 t/ha manure applied two years (V4, $p < 0.01$).

With the other treatments there is an increase in weight compared with the control, but no statistical assurance.

Poaceae compared with the control changes its share from 40% (control) to 55.30% (variant mulching once a year + 10 t/ha manure applied to three years, $p < 0.01$). Also there is a significant difference and the variant with mulching once a year + 5 t/ha manure applied two years (V4, $p < 0.05$).

The other treatments there was a slight increase in the share, but without statistical assurance.

At once a year mulching variant (V2) there is even a decrease in participation, but the difference is not meaningful.

Fabaceae have some changes by increasing or decreasing it depending on the treatment applied, but the results should be considered with reserve because the insurance statistics ($p > 0.05$).

Table 2. Floristic structure types of grassland in 2012 under the influence of organic inputs combined with mulching (Ac = *Agrostis capillaris* L., *Festuca rubra* L. Fr = P = *Poaceae*, *Fabaceae* F = CJ = *Cyperaceae* and *Juncaceae*, AFB = other botanical families, T = treatment, *S**. = Meaning, H = Shannon Index, S = number of species, Ac-Fr = *Agrostis capillaris* L. - *Festuca rubra* L. D=Dominant, CD=Codominant, Phytodiv.=Phytodiversity, Typ=Meadow type, Mt. = control, * = p <0.05, ** = p <0.01, *** = p <0.001, 0 = p <0.05, 00 = p <0.01, 000 = p <0.001, ns - not significant)

		Sp. D. and CD		Economic groups				Phytodiv.	
	Typ	**A.c.**	**F.r.**	**P**	**F**	**CJ**	**AFB**	**S**	**H**
V1	A.c	**23.5**	**12.5**	**40.0**	**5.3**	**0.4**	**38.9**	**30.0**	**2.49**
***S**.**	-F.r	**Mt.**	**Mt.**	**Mt.**	**Mt.**	**Mt.**	**Mt.**	**Mt.**	**Mt.**
V2	A.c	**17.0**	**12.5**	**33.15**	**4.1**	**0.6**	**40.65**	**30.6**	**2.60**
***S**.**	-F.r	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**
V3	A.c	**25.5**	**16.25**	**45.40**	**8.7**	**0.2**	**32.15**	**26.8**	**2.41**
***S**.**	-F.r	**ns**	**ns**	**ns**	**ns**	**ns**	**0**	**ns**	**ns**
V4	A.c	**31.5**	**20.25**	**50.95**	**8.25**	**0.5**	**32.07**	**29.8**	**2.32**
***S**.**	-F.r	**ns**	******	*****	**ns**	**ns**	**0**	**ns**	**ns**
V5	A.c	**25.5**	**17.5**	**46.2**	**9.05**	**0.3**	**33.6**	**27.4**	**2.39**
***S**.**	-F.r	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**
V6	A.c	**35.5**	**17.5**	**55.3**	**8.00**	**0.30**	**29.45**	**28.8**	**2.30**
***S**.**	-F.r	******	**ns**	*******	**ns**	**ns**	**00**	**ns**	**ns**
V7	A.c	**23.5**	**17.5**	**43.75**	**4.1**	**0.7**	**41.3**	**28.0**	**2.41**
***S**.**	-F.r	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**	**ns**

V1 - control, V2 mulching / year, V3-mulching / year + 5 t / ha manure, applied annually, V4 - mulching / year 5 t / ha manure, applied once to 2 years, V5-mulching / year + 10 t / ha manure, applied once to 2 years, V6-mulching / year + 10 t / ha manure, applied once to 3 years, V7- abandoned meadow.

The same situation is recorded for *Cyperaceaelor* and *Juncaceaelor*.

Plants from other botanical families have a tendency to decrease the weight of almost all treatments applied, except for the variant mulching once a year (V2) and abandoned pasture variant (V7), which increases slightly, but the differences are not statistically ($p > 0.05$).

The lowest weight compared with control plants from other botanical families are recorded variant mulching once a year + 10 t/ha manure applied at three years (V6) of 29.45 % ($p < 0.01$).

Significant difference compared with the control is registered with option mulching once a year + 5 t/ha manure applied annually (V3) and mulching option once per year + 5 /ha manure applied two years (V4), where plants from other botanical families have a share of 32% ($p < 0.05$).

Phytodiversity is reduced from 30 species for 26.8 control to the variant species mulching once a year + 5 t/ha manure applied annually (V3), but have not obtained statistics insurance. The same trend is found when we consider the Shannon diversity index.

Regarding frequency control phytocoenosis species *Agrostis capillaris* L. - *Festuca rubra* L. as in previous years, there are some species coverage and high frequency, such as *Anthoxanthum odoratum* L., *Trifolium pratense* L., *Trifolium repens* L., *Trolius europeaeus* L., *Thymus pulegiodes* L., *etc.* (figure 2). The lower frequency is remarkable species*: Hypericum maculatum* Crantz*, Veronica chamaedrys* L., *Ranunculus sour* L., *Rumex acetosa* L., *Centaurea mollis* Waldst. et Kit. and so on And with less frequency than those species have: *Alchemilla vulgaris* L. *Anthyllis vulneraria* L., *Cirsium erisithales* Jacq., *Silene nutans* DC *and so on.*

Lowest frequency is found dominance and species*: Achillea distans* Waldst et Kit., *Prunella vulgaris L., Gymnadenia conopsea* L., *Colchicum autumnale* L., *Centaurea pseudophrygia* C A Mey *etc.*

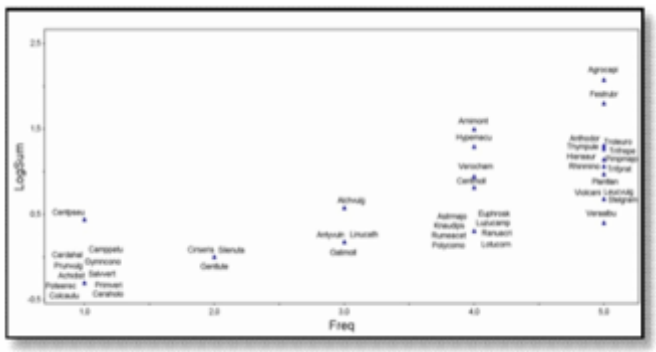

Figure 2. Phytocoenosis control dominant frequency curve type *Agrostis capillaris* L.- *Festuca rubra* L. in 2012

Comparing floristic composition of the control to observe the floristic composition of other variants that influence species change their low technological inputs, like previous years, dominance and frequency.

Thus, some species if the control had great coverage such as *Rhinanthus minor* L. species greatly reduce their coverage (fig. 3), followed by *Arnica montana* L.

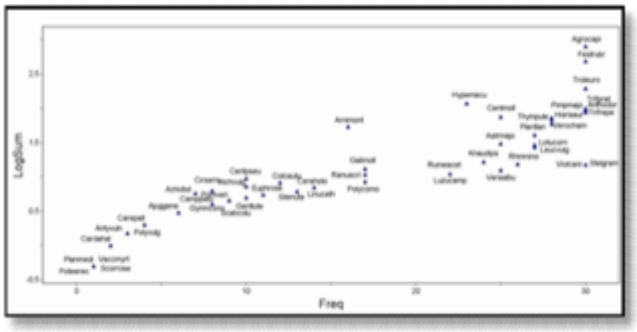

Figure 3. Curve-dominant frequency phytocoenosis treatments without control in 2012

In the fourth experimental year, as we have seen from the above data inputs reduced beginning to make its presence felt. Therefore, in 2012 we have seven species showing statistical significance. Analysis of variance experiences across media dominance of species abundance showed a significant effect of treatment on the species. Applying an annual mulching in combination with fertilization with 10 t/ha manure every three years significantly increased abundance of species *Agrostis capillaris* L. (table 4).

Table 4. Response of the species *Agrostis capillaris* L. to the applied treatments

LSD	*Agrostis capillaris* L.						
Var	V1	V2	V3	V4	V5	V6	V7
ADM	23.5	17.0	25.5	31.5	25.5	35.5	23.5
V1 23.5		0.124 ns.	0.630 ns.	0.061 ns.	0.630 ns.	0.007 **	1.000 ns.
V2 17.0			0.047 *	0.0014 **	0.047 *	p < 0.001 ***	0.124 ns.
V3 25.5				0.155 ns.	1.000 ns.	0.021 *	0.630 ns.
V4 31.5					0.155 ns.	0.338 ns.	0.061 ns.
V5 25.5						0.021 *	0.630 ns.
V6 35.5							0.007 °°
V7 23.5							

p < 0.05 * ° p < 0.01 ** °° p < 0.001 * °°° ns – not significant**
V1 - control, V2 - mulching/year, V3 - mulching/year + 5 t/ha manure, applied annually, V4 - mulching /year 5 t/ ha manure, applied once to 2 years, V5 - mulching/year + 10 t/ha manure, applied once to 2 years, V6 - mulching/ year + 10 t/ha manure, applied once to 3 years, V7 - abandoned meadow.

At the same time, any amount of manure applied either annually or every two or three years (V4, V5, V6) combined with mulching growth bring significant ($p < 0.001$, $p < 0.01$ $p < 0.05$) compared with alternative mulch. Application amount of 10 t/ha manure every three years (V6) compared with the same quantity, but applied every two years (V5) resulted in a significant increase in the abundance of this species ($p < 0.05$). Abandonment negatively influenced ($p < 0.01$) coverage of this species compared with V6 only once a year mulching + 10 t/ha manure every three years.

4. Conclusions

Meadows of *Festuca rubra* L. - *Agrostis capillaris* L. from Poienile Ursului phytocoenosis is a very stable, which is in equilibrium *climax* as reacts to different technological low inputs.

After 4 years of application of organic fertilizers, species *Agrostis capillaris* L. has an average increase of abundance dominance grassy carpet in variants fertilized with 5 and 10 t/ha manure compared to variant mulched once/year.

Application of organic inputs even if in different doses and at different time intervals were made co-dominant species *Festuca rubra* L. to increase its abundance in all variants compared to the control and mulching option and without organic inputs.

Regarding species *Antyllis vulneraria* L., mulching and mulching combined with organic fertilization or abandonment, have an adverse effect on the abundance of this species compared to the control.

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