POSSIBILITIES TO IMPROVE THE *FESTUCA VALESIACA* L. PERMANENT GRASSLANDS FROM NE OF ROMANIA

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Abstract

Permanent grasslands are an important source of green fodder and fiber needed for animal nutrition. The experiment held on a meadow of Festuca valesiaca L. in the region of Moldavia, aims to improve soil nutrient regime by means of organic and mineral fertilization, that could change the floristic composition in favour to the valuable species. Pasture fertilization with 20-30 t ha^{-1} manure and N_{50+50} P_{72} caused production increases of 34-70%. Regarding floral structure, the predominant species are grasses (60-70%), followed by legumes (8-27% and forbes ranging 11-23%).

Key words: permanent grasslands, manure, yield, floristic composition

INTRODUCTION

Permanent grasslands scattered across the globe with an area of 3.4 billion hectares (23% of the land) and in Romania with 4.9 million ha (30% of agricultural land) is an important source of forage necessary to ensure animal nutrition [7]. Improving soil nutrient regime by organic fertilization causes changes in floristic composition and the ratio of valuable species [1], [3]. If we could harness the nutrient rich fodder produced on permanent grassland across the globe, then animal products would be sufficient and at very low prices [2], [4]. Permanent pastures are widespread in our country in all areas, with a complex role and functions, regulating many aspects of economics, environment and social [6], [7]. Grasslands, in addition to feed source, improves soil fertility, recover degraded land, and help preventing soil erosion, maintain and develop biodiversity, protect soil by reducing pollution, constitute habitat and food source to wild animals, held an aesthetic and recreational function [4], [7]. Permanent grasslands of Central Moldavian Plateau are located mostly on low productive land, with low yields and poor floristic composition [4], [5]. Increasing fodder production is the main objective of farmers owning pastures, where improving soil nutrient regime has a determinant role [1], [6].

The purpose of this experiment is to increase production and improve the floristic composition of permanent grasslands.

MATERIAL AND METHODS

This experiment, set on a meadow of *Festuca valesiaca* L. of the forest steppe of Moldavia is situated on a slightly sloping ground, with NE orientation, chernozem soil type, weak leachate, loam-clay texture, humus content of 4.2 to 4.8% medium supplied with mobile phosphorus (30-37 ppm) and very well supplied with mobile potassium (235-320 ppm), pH 6.5 to 6.9 in 0-20 cm soil layer.

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 floristic composition. We used the following fertilization rates: V_1 - unfertilized control, V_2 - 10 t ha^{-1} cattle manure annually + P_{36} N_{50}, V_3 - 10 t ha^{-1} cattle manure annually + N_{50+50} P_{72}; V_4 - 20 t ha^{-1} cattle manure applied

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at 2 years + N_{50} P_{36}, V_5 - 20 t ha^{-1} cattle manure applied at 3 years + N_{50+50} P_{72}, V_6 - 30 t ha^{-1} cattle manure applied at 3 years + N_{50} P_{36}, V_7 - 30 t ha^{-1} cattle manure applied at 3 years + N_{50+50} P_{72}, V_8 - 40 t ha^{-1} cattle manure applied at 3 years + N_{50} P_{36}, V_9 - 40 t ha^{-1} cattle manure applied at 3 years + N_{50+50} P_{72}.

Cattle manure was applied in the fall annually 10 t ha^{-1}, at 2 years (20 t ha^{-1}) and at 3 years (30-40 t ha^{-1}), 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 %, P_2O_5-0.212 % and K_2O-0.695 %. Sampling was done in earing-flowering of dominant grasses, the results were interpreted statistically by analysis of variance and limit differences using the program SPSS (Statistical Package for the Social Sciences).

RESULTS AND DISCUSSIONS

The organic and mineral fertilization on permanent pastures with low productivity had a positive effect on increasing yield and improving floristic composition. Production level was differentiated according to the doses used and their combination. In table 1 are presented yields in 2011.

The pasture fertilization with 10 t ha^{-1} manure in combination with N_{50} P_{36} has registered a high production (4.76 t ha^{-1}), representing an increase of 46% compared with control plot.

The additional application of a dose of N_{50}, after the first cut, has not increased production, since nitrogen can't be used by plants during drought period. Production increase in this case was only 33%.

The fertilization with 20 t ha^{-1} of manure and $N_{50}P_{36}$, generated a production growth of only 1%, and the association with N_{50+50} P_{72}, increased production at 34%. At the application of 30 t ha^{-1} manure along with two doses of mineral fertilizers, production increases were 37-70% and at the fertilization with 40 t ha^{-1} with two doses of mineral fertilizers production increases were 44-55%. Note that production increases at application of 30-40 t ha^{-1} manure were mainly caused by the organic fertilizer used, mineral fertilizers having little influence, because of precipitation shortages so that nitrogen and phosphorus did not enter the plant nutrient cycle.

Table 1 The influence of organic and mineral fertilization rates on dry matter (DM) yield in 2011

Fertilization variant	Production		Difference t ha^{-1}	Significance
	DM t ha^{-1}	%		
Unfertilized plot (control plot)	3.26	100	-	
10 t ha^{-1} manure every year + N_{50} P_{36}	4.76	146	1.49	*
10 t ha^{-1} manure every year + N_{50+50} P_{72}	4.34	133	1.08	
20 t ha^{-1} manure every 2 years + N_{50} P_{36}	3.29	101	0.03	
20 t ha^{-1} manure every 2 years + N_{50+50} P_{72}	4.38	134	1.12	
30 t ha^{-1} manure every 3 years + N_{50} P_{36};	4.48	137	1.22	
30 t ha^{-1} manure every 3 years + N_{50+50} P_{72}	5.53	170	2.27	**
40 t ha^{-1} manure every 3 years + N_{50} P_{36}	4.69	144	1.43	*
40 t ha^{-1} manure every 3 years + N_{50+50} P_{72}	5.05	155	1.79	*
LSD 5% = 1.37 t/ha; LSD 1% = 1.88 t/ha; LSD 0,1% = 2.59 t/ha				

Table 2 shows the floristic composition and structure of the *Festuca valesiaca* L. meadow. Floristic structure was slightly modified as a result of fertilization. It was found that the largest percentage in floral structure was held by Poaceae (51-80%), so that the largest value was recorded at the variant fertilized with 20 t ha^{-1} manure combined with N_{50} P_{36} (75%) and at fertilization with 30 t ha^{-1} manure combined with N_{50+50} P_{72} (80%).

Other botanical families are represented by a relatively small percentage (11-23%) showing the good pastoral value from this point of view. The percentage of Fabaceae species was 8-27%, higher in variants V_9 (24%), V_5 (26%) and V_8 (27%) and lower in V_7 (8%) and V_3, V_4 (11%).

Table 2 Influence of organic and mineral fertilization on floristic composition

Species	Ground cover (%)								
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9
Agropyron repens	1	-	1	+	5	-	3	+	10
Arrhenatherum elatius	16	26	38	46	11	6	5	15	-
Bromus inermis	-	1	-	-	-	-	-	-	+
Dactylis glomerata	21	16	15	15	20	27	31	15	3
Festuca pratensis	-	-	1	+	+	4	1	+	-
Festuca valesiaca	16	12	15	8	10	11	10	10	25
Poa pratensis	21	14	-	7	5	26	30	20	22
Koeleria macrantha	-	-	-	-	-	-	-	-	+
Poaceae	**75**	**69**	**70**	**76**	**51**	**74**	**80**	**60**	**60**
Lathyrus touberosus	1	-	-	-	-	-	-	-	-
Lotus corniculatus	1	-	1	1	3	+	+	-	-
Medicago falcata	1	3	5	5	4	3	+	3	8
Medicago lupulina	-	1	-	-	-	-	-	-	-
Trifolium pratense	5	12	4	4	15	10	7	23	15
Trifolium repens	2	-	-	-	-	-	-	-	-
Trifolium montanum	-	-	-	-	1	2	-	-	+
Vicia sativa	1	1	1	1	3	+	1	1	1
Fabaceae	**11**	**17**	**11**	**11**	**26**	**15**	**8**	**27**	**24**
Ajuga genevensis	+	-	-	+	-	-	-	-	-
Agrimonia euptoria	+	+	-	-	-	-	+	+	+
Achillea millefolium	1	3	-	1	-	4	6	2	2
Alium rotundum	+	+	+	-	+	-	+	-	-
Cardaria draba	-	-	-	-	-	-	-	-	1
Carex hirta	+	+	1	-	+	-	-	-	-
Convolvulus arvensis	+	+	-	+	1	+	+	2	-
Centaurea jacea	8	10	14	9	10	5	6	5	5
Cerastium pumilum	+	+	-	2	-	+	-	-	-
Chaerophyllum bulbosa	+	+	-	-	-	-	-	-	-
Cichorium intybus	-	-	-	+	+	-	+	+	+
Daucus carota	+	+	-	-	-	+	+	-	-
Dianthus caryophyllus	-	-	-	+	-	-	+	+	+
Eryngium campestre	-	-	-	-	-	-	-	-	1
Euphorbia agraria	-	-	-	-	5	-	-	-	-
Fragaria viridis	+	+	+	+	1	+	+	+	5
Filipendula vulgaris	+	+	+	1	+	+	+	+	+
Galium verum	+	-	1	1	3	2	+	3	+
Glechoma hederacea	+	+	-	-	-	-	-	-	-
Hieracium bauhinii	-	-	-	-	-	-	-	-	+
Myosotis micrantna	-	-	1	-	-	-	-	-	-
Potentilla argentea	-	-	+	-	1	+	+	+	+
Potentilla recta	+	+	+	-	-	+	-	-	+
Ranunculus polynanthemos	2	1	1	+	2	+	+	1	-
Rumex crispus	+	-	-	-	-	-	-	-	-
Salvia nemorosa	-	-	1	-	-	-	-	-	-
Taraxacum officinale	+	+	-	-	-	-	-	-	+
Tragopogon pratensis	+	-	-	-	+	+	-	-	-
Veronica arvensis	+	-	-	-	-	-	-	-	-
Veronica chamaedrys	+	+	-	-	-	-	-	-	-
Other botanical families	**11**	**14**	**19**	**13**	**23**	**11**	**12**	**13**	**14**
Ground cover (%)	**97**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**97**
Gapes (%)	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
Total (%)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Number of species	**32**	**25**	**20**	**21**	**23**	**22**	**23**	**20**	**24**
New species	**-**	**2**	**4**	**3**	**5**	**3**	**4**	**4**	**9**
Lost species	**-**	**9**	**16**	**14**	**14**	**13**	**13**	**16**	**17**

In the floristic composition were determined 8 species of perennial grasses, 8 Fabaceae species and 30 species from other botanical families. The ground cover of the meadow is very good (97-100%). Figure 1 shows the coverage of main species, the most widespread plants in the three groups. Thus, *Festuca valesiaca* L. has a relatively constant

proportion in all variants (8-25%), *Dactylis glomerata* L. with a high percentage at fertilization variants V_5, V_7 (20-31%) *Arrhenatherum elatius* L. with a high percentage at variants V_3, V_4 (38-46%) and *Poa pratensis* L. at V_6 and V_9 variants (20-30%). Among legumes, a higher proportion had *Medicago falcata* L. at variants V_3, V_4, V_9 (5-8%) and *Trifolium pratense* L. species at variants V_5, V_8, V_9 (15-23%). Among other botanical families *Centaurea jacea* L. had the highest percentage of 5-14% followed by *Achillea millefolium* L. (4-6%) at variants V_6, V_7.

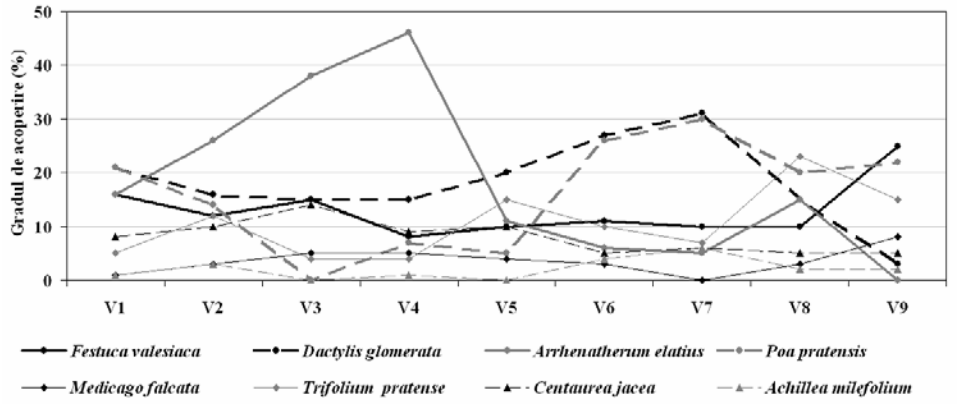

Fig. 1 Influence of organic and mineral fertilization on the main species coverage in the vegetal canopy

CONCLUSIONS

Applying manure with mineral fertilizers influenced positively the structure of the vegetal canopy, especially at doses of 20-30 t ha^{-1} + N_{50+50} P_{72}, where the percentage of valuable species increased, and production increases reached values between 34-70%.

Both Fabaceae and Poaceae had a good response to the application of manure combined with mineral fertilizers. Dominant Poaceae are: *Festuca valesiaca* L. (8-25%), *Dactylis glomerata* L. (15-32), *Arrhenatherum elatius* L. (5-38%) and among Fabaceae, *Trifolium pratense* L. (4-23%) and *Medicago falcata* L. (1-8%).

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