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STRATEGIES OF USING ORGANIC FERTILIZERS ON THE PERMANENT GRASSLANDS FROM NORTH-EASTERN ROMANIA

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ABSTRACT - *From the viewpoint of the total natural grassland area, Romania is found on the fifth place in Europe, after France, Great Britain, Spain and Germany. In the present strategy of using organic fertilizers on permanent grasslands, there are economic and ecological concerns, which main aims are resource saving and environment protection, and less important ones, yield increases. The experiment has investigated the influence of organic fertilizers, applied each year or every 2-3 years, at rates of 10-40 Mg ha^{-1}, in a Festuca valesiaca grassland, situated at the height of 107 m, at Ezăreni-Iasi County, and at rates of 10-30 Mg ha^{-1}, in an Agrostis capillaris+Festuca rubra grassland, situated at the height of 707 m at Pojorîta-Suceava County, on yield and flower composition.*

Key words: grasslands, manure, strategies, fertilization, production

REZUMAT – Strategii privind folosirea fertilizatorilor organici pe pajiştile permanente din nord-estul României. *Din punct de vedere al suprafeţei ocupate cu pajişti naturale, România se situează în Europa pe locul al 5-lea, după Franţa, Marea Britanie, Spania şi Germania. În strategia actuală, de folosire a fertilizatorilor organici pe pajiştile permanente, există preocupări de natură economică şi ecologică, care urmăresc, în principal, economisirea resurselor şi protecţia mediului şi mai puţin creşterea producţiei. În această experienţă s-a urmărit influenţa fertilizării cu îngrăşăminte organice, aplicate anual sau la intervale de 2-3 ani, în doze de 10-40 t/ha, pe o pajişte de Festuca valesiaca, situată la altitudinea de 107 m , la Ezăreni, jud. Iaşi, şi în doze de 10-30 t/ha pe o pajişte de Agrostis capillaris + Festuca rubra, situată la altitudinea de 707 m, la Pojorîta-Suceava, asupra producţiei şi structurii floristice.*

Cuvinte cheie : pajişte, gunoi, strategii, fertilizare, producţie

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INTRODUCTION

Even if the permanent grasslands from north-eastern Romania are situated at a rate of 70% on fields affected by erosion, which highly diminishes their productive potential, the most important reduction in their productivity is caused by unfavourable climatic conditions and bad management (Samuil et al., 2007). Increasing the grassland productive potential may be done by different rates and types of organic fertilizers (Cardasol, 1994; Ryser et al., 2001). The investigations carried out until today have shown the positive effects of manure on grasslands and, if applied reasonably, it may replace all the chemical fertilizers (Vîntu et al., 2007; Jangros et al., 2003).

MATERIALS AND METHODS

In this paper, we present the results obtained in the trials set up at two different sites: Ezăreni – Iasi County, in the forest steppe, on a *Festuca valesiaca* L grassland, and Pojorîta – Suceava County, on *Agrostis capillaris* + *Festuca rubra* grassland, from the boreal floor. Both sites show a weak botanical composition. The trial from Ezăreni – Iasi was set up at the height of 107 m, on 18-20% slope, and the one from Pojorîta – Suceava, at the height of 707 m, on 20% slope. The climatic conditions were characterized by mean temperatures of 9.5^0C and total rainfall amounts of 552.4 mm at Ezăreni – Iasi, and by mean temperatures of 6.3 ^{0}C and total rainfall amounts of 675 mm at Pojorîta - Suceava. We mention that the year 2007 was very dry at Ezăreni – Iasi, and the climatic conditions were unfavourable to the good development of vegetation on grasslands.

The experimental factors at Ezăreni - Iasi: V_1–Unfertilized control; V_2-10 Mg ha^{-1} sheep manure applied every year; V_3-20 Mg ha^{-1} sheep manure applied every 2 years; V_4-30 Mg ha^{-1} sheep manure applied every 3 years; V_5-40 Mg ha^{-1} sheep manure applied every 3 years; V_6-10 Mg ha^{-1} cattle manure; V_7-20 Mg ha^{-1} cattle manure applied every 2 years; V_8-30 Mg ha^{-1} cattle manure applied every 3 years; V_9-40 Mg ha^{-1} cattle manure applied every 3 years.

The experimental factors at Pojorîta – Suceava: V_1-Unfertilized control; V_2-10 Mg ha^{-1} cattle manure applied every year; V_3-20 Mg ha^{-1} cattle manure applied every 2 years; V_4-30 Mg ha^{-1} manure applied every 3 years; V_5-20 Mg ha^{-1} cattle manure applied in the first year+10 Mg ha^{-1} cattle manure applied in the second year+0 Mg ha^{-1} manure applied in the third year; V_6-20 Mg ha^{-1} cattle manure applied in the first year+0 Mg ha^{-1} manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year; V_7-20 Mg ha^{-1} cattle manure applied in the first year+10 Mg ha^{-1} cattle manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year; V_8-10 Mg ha^{-1} cattle manure applied in the first year+20 Mg ha^{-1} cattle manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year.

Harvesting was done at the phase of ear formation in the dominant grasses, and yield was expressed in dry matter (DM). The changes that took place in the structure of canopy were determined by the gravimetrical method, used to observe the evolution of grassland vegetation, completed by the planimetrical method.

RESULTS AND DISCUSSION

Analysing the production data concerning the *Festuca valesiaca* grassland from Ezăreni, we have noticed that in 2006, they were comprised between 1.56 Mg ha^{-1} DM at the control and 2.71 Mg ha^{-1} DM at the fertilization with 40 Mg cattle manure, applied every 3 years (*Table 1*). The highest yields were found in case of 40 Mg ha^{-1} manure fertilization, applied every 3 years. The yields were of 2.57 Mg ha^{-1} DM when applying sheep manure and 2.71 Mg ha^{-1} DM when applying cattle manure. In 2007, the vegetation from permanent grasslands was highly affected by the long-term draught that dominated the experimental area from Ezăreni, since September 2006 until August 2007, so that the productivity of these agro-ecosystems was greatly diminished, the effect of fertilization on production becoming negligible. During 2006-2007, the mean yields were comprised between 1.09 Mg ha^{-1} DM at the control and 1.96 Mg ha^{-1} DM at the fertilization with 40 Mg ha^{-1} cattle manure, every 3 years.

Table 1 - Influence of organic fertilization on DM yield (Mg ha^{-1}), Ezăreni, Iasi

Fertilization variant	2006	2007	Mean
V_1 - Unfertilized control	1.56	0.61	1.09
V_2 - 10 Mg ha^{-1} sheep manure applied every year	2.16	0.91	1.54*
V_3 - 20 Mg ha^{-1} sheep manure applied every 2 years	2.35	1.02	1.69**
V_4 - 30 Mg ha^{-1} sheep manure applied every 3 years	2.12	1.01	1.57**
V_5 - 40 Mg ha^{-1} sheep manure applied every 3 years	2.57	1.12	1.85***
V_6 - 10 Mg ha^{-1} cattle manure	2.28	1.13	1.71**
V_7 - 20 Mg ha^{-1} cattle manure applied every 2 years	2.50	1.09	1.80***
V_8 - 30 Mg ha^{-1} cattle manure applied every 3 years	2.69	1.04	1.87***
V_9 - 40 Mg ha^{-1} cattle manure applied every 3 years	2.71	1.21	1.96***
Mean	2.33	1.02	1.68
**=P≤0.05; **=P≤0.01; ***=P≤0.001; I = insignificant*			

In the trial conducted on the *Agrostis capillaris+Festuca rubra* grassland from Pojorîta in 2006, the yields were comprised between 2.95 Mg ha^{-1} DM at the control and 4.17 Mg ha^{-1} DM at 30 Mg ha^{-1} manure fertilization, applied every 3 years (*Table 2*). In 2007, the yields were higher than in 2006, being comprised between 4.34 Mg ha^{-1} at the control and 5.51 Mg ha^{-1} at the fertilization with 30 Mg ha^{-1} manure, applied every 3 years. During 2006-2007, the mean yields have been influenced by climate, type, and level of organic fertilization, being comprised between 3.65 Mg ha^{-1} at the control and 4.84 Mg ha^{-1} at the fertilization with 30 Mg ha^{-1} manure, applied every 3 years.

Table 2 - Influence of organic fertilization on DM yield (Mg ha^{-1}), Pojorîta, Suceava

Fertilization variant	2006	2007	Mean
V_1 - Unfertilized control	2.95	4.34	3.65
V_2 - 10 Mg ha^{-1} cattle manure applied every year	3.50	5.05	4.28**
V_3 - 20 Mg ha^{-1} cattle manure applied every 2 years	3.90	4.90	4.40**
V_4 - 30 Mg ha^{-1} cattle manure applied every 3 years	4.17	5.51	4.84***
V_5 - 20 Mg ha^{-1} cattle manure applied in the first year+10 Mg ha^{-1} cattle manure applied in the second year+0 Mg ha^{-1} manure applied in the third year	3.86	4.87	4.37**
V_6 - 20 Mg ha^{-1} cattle manure applied in the first year+0 Mg ha^{-1} manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year	3.78	5.25	4.52**
V_7 - 20 Mg ha^{-1} cattle manure applied in the first year+10 Mg ha^{-1} cattle manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year	4.03	4.81	4.42**
V_8 - 10 Mg ha^{-1} cattle manure applied in the first year+20 Mg ha^{-1} cattle manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year	3.63	5.12	4.38**
Mean	3.72	4.98	4.36**
*=P≤0.05; **=P≤0.01; ***=P≤0.001; I= insignificant			

Table 3 - Influence of the organic fertilization on the canopy structure (%), Ezăreni, Iasi

Fertilization variant	Grasses	Legumes	Others
V_1 - Unfertilized control	69	10	21
V_2 - 10 Mg ha^{-1} sheep manure applied every year	76	13	11
V_3 - 20 Mg ha^{-1} sheep manure applied every 2 years	59	16	25
V_4 - 30 Mg ha^{-1} sheep manure applied every 3 years	70	11	19
V_5 - 40 Mg ha^{-1} sheep manure applied every 3 years	67	15	18
V_6 - 10 Mg ha^{-1} cattle manure applied every year	62	11	27
V_7 - 20 Mg ha^{-1} cattle manure applied every 2 years	68	16	16
V_8 - 30 Mg ha^{-1} cattle manure applied every 3 years	71	12	17
V_9 - 40 Mg ha^{-1} cattle manure applied every 3 years	69	11	20
Mean	68	13	19

The analysis of canopy has shown that the mean values of the presence rate were of 68% in grasses, 13% in legumes and 19% in other species (the trial from Ezăreni) (*Table 3*) and 39% in grasses, 32% in legumes and 29% in other species (the trial from Pojorîta) (*Table 4*).

At Ezăreni – Iasi, a total number of 40 species was registered, of which six species from grass family, 10 species from *fabaceae* and 24 species from others, while at Pojorîta – Suceava, the total number of species was of 45, of which 12 grasses, 9 legumes and 24 species from others. The species with the highest

presence rate from Ezăreni – Iasi were *Festuca valesiaca (39%), Trifolium pratense (7%), Plantago media (3%), Achillea setacea (4%),* and from Pojorîta – Suceava, *Agrostis capillaris (14%), Festuca rubra (7%), Trisetum flavescens (6%), Trifolium repens (16%), Trifolium pratense (8%)* and *Taraxacum officinale (5%).*

Table 4 - Influence of the organic fertilization on the canopy structure (%), Pojorîta, Suceava

Fertilization variant	Grasses	Legumes	Others
V_1 - Unfertilized control	44	25	31
V_2 - 10 Mg ha^{-1} cattle manure applied every year	38	33	29
V_3 - 20 Mg ha^{-1} cattle manure applied every 2 years	43	30	27
V_4 - 30 Mg ha^{-1} cattle manure applied every 3 years	37	33	30
V_5 - 20 Mg ha^{-1} cattle manure applied in the first year+10 Mg ha^{-1} cattle manure applied in the second year+0 Mg ha^{-1} manure applied in the third year	36	36	28
V_6 - 20 Mg ha^{-1} cattle manure applied in the first year+0 Mg ha^{-1} manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year	42	30	28
V_7 - 20 Mg ha^{-1} cattle manure applied in the first year+10 Mg ha^{-1} cattle manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year	36	33	31
V_8 - 10 Mg ha^{-1} cattle manure applied in the first year+20 Mg ha^{-1} cattle manure applied in the second year+10 Mg ha^{-1} cattle manure applied in the third year	33	37	30
Mean	39	32	29

CONCLUSIONS

The yields obtained were influenced at both experiencing sites by climatic conditions, type and level of organic fertilization.

Our results have shown the positive effects of organic fertilizers on canopy structure, biodiversity and productivity in the studied permanent grasslands.

The highest biodiversity was found in the grassland from Pojorîta, covered with 45 species of *Agrostis capillaris + Festuca rubra,* compared to the 40 species found in the grassland from Ezăreni, covered with *Festuca valesiaca*.

In both trials, we noticed that the highest number of species (24 species) was represented by other species, demonstrating that the management of organic fertilizers did not affect the biodiversity of these grassland types.

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