CONTRIBUTIONS TO PERMANENT GRASSLANDS' IMPROVEMENT IN THE NEMORAL AREA OF SUHARD MASSIF

M. STRATON[1]

[1] D.A.D.R. Suceava

The permanent grassland from the mountain area, with a special economical and ecological importance, has multiple purposes, represents a habitat and a nourishment source for animals, assures the biodiversity for many plant species, protects the soil against erosion, ennobles and enhances the beauty of the environment. Experimenting in the nemoral area of the Suhard Massif, during 2007-2009, was made in order to improve the productive potential of the grasslands, by fertilization. The applications were made with cattle manure (10-20 t/ha), complex fertilizers (22-22-0) 100-200 kg/ha alone and together manure + complex fertilizers. After fertilization we registered production increases of 50-96% compared to the control; the biggest productions were obtained for the fertilization with manure 20 t/ha annually + 10 t/ha every two years (3.4 t/ha d.s.) and with manure 20 t/ha annually + 100 kg/ha complex fertilizer (3.3 t/ha d.s.). Fertilization contributed to the improvement of the vegetal carpet's floristic structure, the participation of the valuable graminee species increasing along with the fertilization with mineral compounds and combined manure and mineral compounds.

***Key words**: grassland, mountain, fertilization, exploitation, improvement*

Mountain area permanent grasslands represent an important source of succulent and fiber full fodder for the animals in the area (3). The increase of this grasslands' productive potential requires some improving works consisting in fertilization, over seeding and rational use (1, 2).

This paper emphasizes the influence of organic and mineral fertilization on the dry substance production, on the floristic structure and the quality of the fodde for mountain grassland of *Festuca rubra + Agrostis capillaris*.

MATERIAL AND METHOD

The experiment, set according to the subdivided lots method, is single itemed, organized in Suhard Massif, at 820 m altitude, with the following fertilization variants:

v_1 – control;
v_2 – cattle manure 10 t/ha annually;
v_3 – cattle manure 20 t/ha annually;
v_4 – cattle manure 10 t/ha annually + 10 t/ha every second year;
v_5 – cattle manure 10 t/ha annually + 20 t/ha every second year;
v_6 – cattle manure 20 t/ha annually + 10 t/ha every second year;

v_7 – cattle manure 20 t/ha annually + 20 t/ha every second year;
v_8 – complex fertilizer (22-22-0) 100 kg/ha annually;
v_9 – complex fertilizer (22-22-0) 200 kg/ha annually;
v_{10} – cattle manure 10 t/ha + complex fertilizer 100 kg/ha annually;
v_{11} – cattle manure 10 t/ha + complex fertilizer 200 kg/ha annually;
v_{12} – cattle manure 20 t/ha + complex fertilizer 100 kg/ha annually;
v_{13} – cattle manure 20 t/ha + complex fertilizer 200 kg/ha annually;

The production was expressed in dry substance and the statistic calculus of the production results was made according to the variance analysis; the floristic structure of the vegetal carpet was determined by sample collection from each fertilization variant and the fodder's quality indicators were determined with chemical analyses, expressing in percentages the protein, cellulose, ash and fat contents.

RESULTS AND DISCUSSIONS

The average production for the studied grassland was influenced by the applied fertilizers' type and quantity (table 1, figure 1). The obtained productions were of 1.7 t/ha d.s. for the control and between 2.6 – 3.5 t/ha d.s. as effect of fertilization. For the variants with cattle manure fertilization, the production increases were of 53 – 124%, the biggest results being registered for the variants with 20 t/ha annually + 10 - 20 t/ha every second year (3.4 – 3.8 t/ha d.s.). The fertilization made only with complex fertilizers lead to production increases of 94 – 100% (3.3 – 3.4 t/ha d.s.), and the combined fertilization, manure and mineral fertilizers, offered production increases of 82 – 106% (3.1 – 3.5 t/ha d.s.).

The fertilization also influenced the floristic structure of the grassland (table 2). If in 2007 the graminee species had a percentage of 45 – 74%, the leguminous species of 1 – 13% and the diverse species of 23 – 51%, after three years of fertilizer applications we registered some changes.

Thus, the graminee species' participation raised with 3 – 7% for the variants fertilized with cattle manure 10 - 20 t/ha annually an with 10 t/ha annually + 10 - 20 t/ha every second year, increased with 1 – 3% for the variants fertilized with mineral compounds and decreased with 2 – 7% for the combined fertilization.

The participation of the leguminous species decreased with 1 – 3% for the variants fertilized with cattle manure and increased with 1 – 6% for the variants treated with complex fertilizers and those treated with combined organic and mineral fertilizers. Related to the graminee and leguminous species' ratio, we also registered changes in the diverse species' participation.

Table 1

The influence of fertilization on production for the mountain grassland of *Festuca rubra* + *Agrostis capillaris* (2007 – 2009)

No crt	Fertilization	Production		Differences (t/ha d.s.)	Significance
		t/ha ds	%		
1	control	1.7	100	-	
2	manure 10 t/ha annually	2.6	153	0.9	xx
3	manure 20 t/ha annually	3.2	188	1.5	xxx
4	manure 10 t/ha annually + 10 t/ha every 2nd year	3.2	188	1.5	xxx
5	manure 10 t/ha annually + 20 t/ha every 2nd year	3.1	182	1.4	xxx
6	manure 20 t/ha annually + 10 t/ha every 2nd year	3.4	200	1.7	xxx
7	manure 20 t/ha annually + 20 t/ha every 2nd year	3.8	224	2.1	xxx
8	complex fertilizer 100 kg/ha annually	3.3	194	1.6	xxx
9	complex fertilizer 200 kg/ha annually	3.4	200	1.7	xxx
10	manure 10 t/ha + complex fertilizer 100 kg/ha annually	3.1	182	1.4	xxx
11	manure 10 t/ha + complex fertilizer 200 kg/ha annually	3.2	188	1.5	xxx
12	manure 20 t/ha + complex fertilizer 100 kg/ha annually	3.3	194	1.6	xxx
13	manure 20 t/ha + complex fertilizer 200 kg/ha annually	3.5	206	1.8	xxx

LSD 5% = 0.5 t/ha;
LSD 1% = 0.7 t/ha;
LSD 0.1% = 1.0 t/ha.

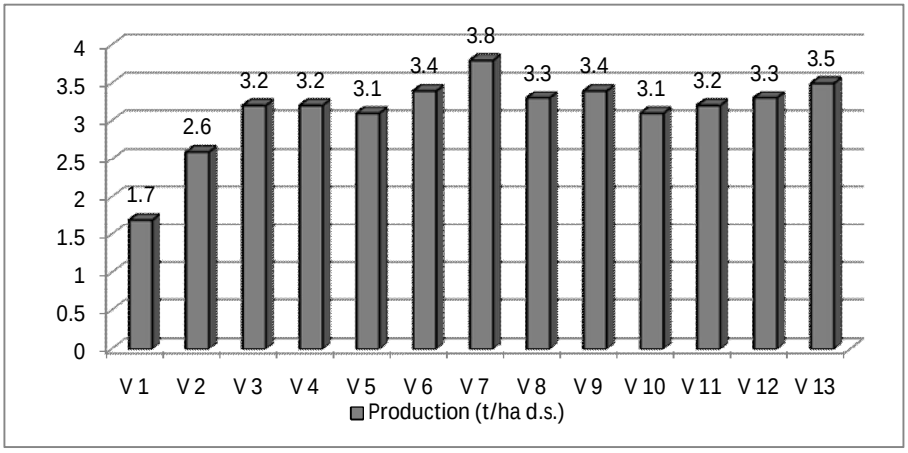

Figure 1 **The influence of fertilization variant on production (t/ha d.s.)**

Table 2

The influence of fertilization on the floristic structure for the *Festuca rubra* + *Agrostis capillaris* grassland (%)

No crt	Fertilization	Graminee species		Leguminous species		Diverse species	
		2007	2009	2007	2009	2007	2009
1	control	64	60	1	2	35	38
2	manure 10 t/ha annually	48	52	4	3	48	45
3	manure 20 t/ha annually	57	58	9	8	40	34
4	manure 10 t/ha annually + 10 t/ha every 2nd year	45	50	4	4	51	45
5	manure 10 t/ha annually + 20 t/ha every 2nd year	55	58	5	4	40	38
6	manure 20 t/ha annually + 10 t/ha every 2nd year	64	60	13	10	23	30
7	manure 20 t/ha annually + 20 t/ha every 2nd year	60	62	7	6	33	32
8	complex fertilizer 100 kg/ha annually	70	71	5	9	25	20
9	complex fertilizer 200 kg/ha annually	66	69	6	11	28	20
10	manure 10 t/ha + complex fertilizer 100 kg/ha annually	61	58	10	12	29	30
11	manure 10 t/ha + complex fertilizer 200 kg/ha annually	72	65	8	9	20	26
12	manure 20 t/ha + complex fertilizer 100 kg/ha annually	74	72	2	8	24	20
13	manure 20 t/ha + complex fertilizer 200 kg/ha annually	72	69	6	9	22	22

Fertilization also influenced the chemical composition of the obtained fodder (*table 3*). For the variants fertilized with cattle manure, the protein content was 9.2 – 11.9%, the cellulose content was 21.3 – 22.4%, the ash content was 9.0 – 10.4% and the fat content was 1.9 – 2.4%.

For the variants fertilized with complex mineral compounds, these contents were: protein - 9.6 – 10.3%, cellulose - 21.5 – 22.0%, ash – 9.8 – 10.5% and fat - 2.1 – 2.6%; the combined fertilization lead to the increase of the protein content up to 10.1 – 12.4%, to the decrease of the cellulose content down to 21.0 – 22.2%, of the ash content down to 8.9 – 9.6% and of the fat content down to 1.9 – 2.3%.

Table 3.

The influence of fertilization on the chemical composition for the *Festuca rubra* + *Agrostis capillaris* grassland (g/100 g d.s.)

No crt	Fertilization	Raw protein	Raw cellulose	Raw ash	Raw fat	N-free extract.subst.
1	control	8.9	23.1	9.2	2.1	56.7
2	manure 10 t/ha annually	9.2	22.1	9.0	2.0	57.7
3	manure 20 t/ha annually	9.6	21.9	10.1	1.9	56.5
4	manure 10 t/ha annually + 10 t/ha every 2nd year	9.4	22.4	10.2	2.3	55.7
5	manure 10 t/ha annually + 20 t/ha every 2nd year	10.5	22.1	9.6	2.2	55.6
6	manure 20 t/ha annually + 10 t/ha every 2nd year	11.4	21.6	9.9	2.6	44.5
7	manure 20 t/ha annually + 20 t/ha every 2nd year	11.9	21.3	10.4	2.4	54.0
8	complex fertilizer 100 kg/ha annually	9.6	22.0	10.5	2.1	55.8
9	complex fertilizer 200 kg/ha annually	10.3	21.5	9.8	2.6	55.8
10	manure 10 t/ha + complex fertilizer 100 kg/ha annually	10.1	22.2	8.9	2.0	56.8
11	manure 10 t/ha + complex fertilizer 200 kg/ha annually	12.0	21.3	9.1	1.9	55.7
12	manure 20 t/ha + complex fertilizer 100 kg/ha annually	11.9	21.6	9.7	2.1	54.7
13	manure 20 t/ha + complex fertilizer 200 kg/ha annually	12.4	21.0	9.3	2.3	55.0

CONCLUSIONS

1. The fertilization with cattle manure and complex mineral fertilizers (22-22-0) influenced the production yield; the biggest productions were obtained for the variants fertilized with cattle manure 20 t/ha annually + 20 t/ha every second year (3.8 t/ha d.s.) and with cattle manure 20 t/ha annually+complex fertilizers 200 kg/ha/year (3.5 t/ha d.s.).

2. The vegetal carpet's floristic structure for the studied grassland suffered some changes under the influence of fertilization; the participation of the graminee species decreased with 2 – 7%, the one for the leguminous species increased with 1 – 6% in 2009 compared to 2007 for the variants fertilized with cattle manure 10-20 t/ha + complex fertilizer 100-200 kg/ha.

3. Fertilization also influenced the quality of the obtained fodder: the highest protein content and the lowest cellulose content was registered for the fertilization with cattle manure 20 t/ha annually + 20 t/ha every second year (11.8% respectively 21.3%) and for the variants treated with cattle manure 10 t/ha + complex fertilizer 200 kg/ha annually and cattle manure 20 t/ha + complex fertilizer 100 - 200 kg/ha annually (11.9 – 12.4% respectively 9.1 – 9.4%).

BIBLIOGRAPHY

1. Dobromil, M., Grabowski, A., 1991 – *Methods for improvement meadows by sod seeding in Central and Eastern Europe.* Conference held at Graz, Austria.
2. Popovici, D. and coworkers, 1996 – *Pajiştile din Bucovina.* Editura Helios.
3. Vîntu, V., Samuil, C., Iacob, T., Popovici, I., 2007 – *The biodiversity and agronomic value of mountain permanent grasslands from the northeastern part of Romania*, Grasssland Science in Europe, vol. 12.