STRESS EFFECTS OF EXTENSIVE AND INTENSIVE NUTRIENT SUPPLY ON GRASSLAND COENOSYS

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Abstract: Fertilization is a yield-increasing procedure, but its effects on botanical composition have also been proven by several experiments. In case of fertilizing, the major yield increasing nutrient is nitrogen, but phosphorus and potassium are also having a profound influence. Effects of extensive (without nutrient supply), medium (150 $kgha^{-1}$) and large dose (300 $kgha^{-1}$) intensive fertilizers on the botanical combination of meadows are compared in this study. As a summary it can be concluded, that the level of nutrient supply modifies grassland composition. Stress caused by the lack of nutrients will not only result in a decrease in the number of species, but also in the disappearance of valuable grass species from the area. In case of nutrient supplies, first-rate grassland components are going to remain on the area, but the numbers of other species are going to decrease in direct proportion due to the effects of the stress caused by the increasing dose of fertilizers.

Keywords: extensive grassland management, intensive grassland management, nutrient supply, coenosys of grasslands

Introduction

Fertilization is a yield-increasing procedure, but its effects on botanical composition have also been proven by several experiments. According to Szemán (2007a), the number of grass species increases when nitrogen fertilizers are applied, but fertilization with the same amount of nitrogen each year stabilizes the composition of species. Applying a minimum of 100-150 $kgha^{-1}$ N causes a considerable change in the number of species (Magyar et al. 2005, Tasi 2008). According to Bánszki (1991), nitrogen fertilizers promote the propagation of *Dactylis glomerata* L. and *Bromus inermis* Leyss., as these species prefer nitrogen. It has also been observed that leguminous species disappear from grasslands after large doses of nitrogen (100 $kgha^{-1}$) are applied (Bánszki 1991, Szemán 2007a).

Potassium and phosphorous provide favourable conditions for the spreading and survival of leguminous species (Szemán, 2007a; Vinczeffy ed., 1993; Barcsák, 2004).

Both the lack of fertilizing as well as overdosing may cause stress in the plant community (Penksza et al. 2008). The degree of stress depends on the type of utilization and the aim of grassland management. The lack of nutrients, for instance, can not be considered a stress factor in case the aim of the management is sustaining a natural habitat (Szemán 2007b; Tasi 2007, Harcsa et al. 2008), and the decrease in the number of species caused by applying fertilizers in large doses can not be considered a stress effect on lawns either (Kulin et al. 2008).

As a summary, we can conclude that the level of nutrient supply can modify the proportions of different grassland components in the grassland composition (Tasi, 2007; Kulin et al. 2008; Füleky, 2008). According to Bánszki (1991) in case of major changes in the nutrient level, the type of grasslands can also undergo transformation.

In my article, I compare the effects of extensive (without nutrient supply), and intensive (150 $kgha^{-1}$ and 300 $kgha^{-1}$ fertilizers) grassland management methods on the botanical composition of natural meadows.

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Materials and methods

In the recent study, analysis of the effects of nutrient supply on natural grasslands in Kosd, a hilly area, and in Mátra, a mountainous area, in Hungary have been carried out in five years. Three kinds of treatments were applied at both sites on small plots: a 150 $kgha^{-1}$ (N_1) (with 50 $kgha^{-1}$ P_2O_5 and 100 $kgha^{-1}$ KCl) fertilizer and a 300 $kgha^{-1}$ (N_2) (with 100 $kgha^{-1}$ P_2O_5 and 200 $kgha^{-1}$ KCl) fertilizer were applied each year, while the third plot was left untreated as the control area (Ø)(0 $kgha^{-1}$ N). The size of plots was 4x5 m, in randomised block design. The botanical survey was carried out through Balázs's dominancy analysis (1949) at both sites on all plots four replications. The results presented in this article refer to the changes in cover rates and species' composition comparing the initial (zero) year to the final year of the experiment.

Results and discussion

In the experiment in Kosd (1. table), throughout the five years of the experiment, a continuous degradation was experienced on the control plot. Succession processes could be identified on the natural grassland. The area got weedy because of the stress caused by the lack of nutrient supplies and treatment. The coverage and diversity of grass species showed a decreasing tendency.

As a result of fertilizers, the coverage of grass species increased, the number of species became balanced, but their numbers were less than those in the control area. The coverage of other plant species were also increasing, but to a smaller extent. The number of weed species was smaller, than on the control areas. Applying a larger dosage of fertilizer, the number of plant species decreased considerably.

Table 1. Cover rates and number of species
Kosd, 1998-2002

Botanical composition	Treatments											
	Control				N_1				N_2			
	1.year	2. year	3. year	4. year	1. y	2. y	3. y	4. y	1.y	2. y	3. y	4. y
Cover rates (%)												
Grass species	60	55	34	22	78	68	69	78	81	80	86	90
Legumes	0	0	0	2	0	0	0	0	0	0	0	0
Weeds	22	26	41	38	10	14	18	13	5	6	9	7
Uncovered area	18	19	25	38	12	18	13	9	14	14	5	3
Number of species												
Grass species	4	5	5	3	3	4	5	4	2	4	4	2
Legumes	0	0	0	1	0	0	0	0	0	0	0	0
Other	11	11	13	12	8	10	11	8	3	4	6	2
Total	15	16	18	16	11	14	16	12	5	8	10	4

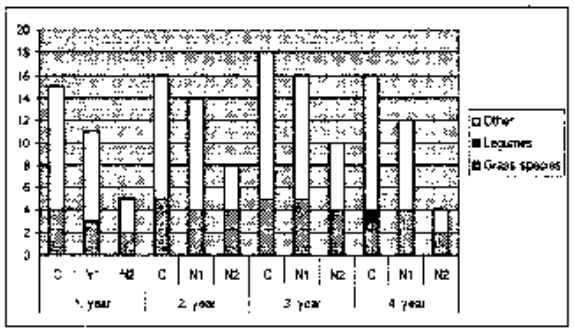

Figure 1. Changes in number of species in Kosd

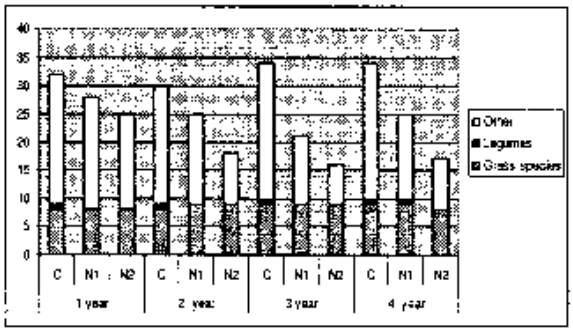

Figure 2. Changes in number of species in Mátra

C- control, N1- 150 kgha^{-1}, N2- 300 kgha^{-1}

Values of Mátra's area (2. table) showed similar results, as the grassland in Kosd. However, at first, in the control areas there was an increase in the cover rates of grass species; decrease only started in the third year of the experiment. The number of grass species in the control area was almost constant. The number and cover rate of leguminous species was also constant. The number and cover rates of weeds fluctuated; they decreased in the second and third years of the experiment, and showed an increasing tendency afterwards. This result was presumably caused by the different climate effects of the different years.

As a result of fertilization, the botanical composition of Mátra's natural grassland went through substantial changes. The coverage of grass species was increasing, while the number of species remained constant. Compared to the Kosd experiment, larger doses of nitrogen did not cause so large a change in the cover of grass species. As a result of nutrient supplies, legumes disappeared from the area. The number of dicotyledonous plant species ("other") and their coverage also showed a major decrease, compared to the results of the control plot.

Table 2. Cover rates and number of species
Mátra, 1998-2002

Cover rates (%)	Treatments											
	Control				N_1				N_2			
	1. year	2. year	3. year	4. year	1. y	2. y	3. y	4. y	1. y	2. y	3.y	4. y
Grass species	26	33	30	28	60	70	72	72	63	75	78	80
Legumes	1	1	1	1	0	0	0	1	0	0	0	0
Weeds	63	52	56	60	36	27	26	26	34	19	18	17
Uncovered area	10	14	13	11	4	3	2	1	3	6	4	3
Number of species												
Grass species	8	8	9	9	8	9	9	9	8	9	9	8
Legumes	1	1	1	1	0	0	0	1	0	0	0	0
Other	23	21	24	24	20	16	12	15	17	9	7	9
Total	32	30	34	34	28	25	21	25	25	18	16	17

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