ENVIRONMENTAL CONSEQUENCES OF SUSTAINABILITY ON GRASSLAND

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Introduction

Grass is the most cost-effective fodder of ruminants. Grassland is a natural plant community; with the selection of grass species, the systemathical management of established grasslands also became possible. Grassland management means the systemathical use of the yield raised from grassland plants.

Grassland management always aimed to increase the quality and quantitiy of the yield. The yield, the composition of species, the ratio of valuable and valueless fodder plants can all be influenced and controlled by grassland management methods. /Magyar et. al.2005/

No cultivation, or starting the cultivation of grasslands that were deteriorating as a result of nutrient shortage can be an improvement in itself. Restoring the nutrient supply improves the quality and quantity of yield for all agricultural plants as well. /Nagy 2006./

With the evolution of science and technology, yield can also be increased by the systematically use of agrotechnical methods. The use of 1 kg active N ingredient can result in 100 kg/hectare of extra yield on the grassland. /Barcsák et al. Tarnawa et. al. 2006, Husti 2006,/

Nitrogen shortage reduces grass coverage, determining the quality of fodder and the carrying capacity of the territory. In grasslands of high diversity, numerous species remain ungrazed, therefore they appear as weeds in the yield. /Kádár et.al.2005, Kádár 2005 a, b,/

Methods aiming to increase the yield of grassland can be systematized into management systems. Intensive management systems enabled the planned increase of yields.

Since the EU Accession of Hungary, subsidized sustainable rural development programs forbid the use of yield increasing substances, and allow only the natural utilization of grassland yields.

In this essay, we examine the effects of sustainable extensive grassland management systems and intensive technologies to the carrying capacity of improved grasslands. / Szarka et. al. 2006.

Table 1. Change of coverage of grassland plants

No.	Name of plant	Treatments											
		∅				N_1 (150kgNha^{-1})				N_2 (300 kgNha^{-1})			
		Years of research (coverage %)											
		Y1	Y2	Y3.	Y4	Y1	Y2	Y3.	Y4	Y1	Y2	Y3.	Y4
1.	Festuca rupicola	2	15	9	2	3	15	9	1	6	15	3	3
2.	Festuca rubra	2	3	3	4	6	6	6	6	6	3	3	3
3.	Poa pratensis	3	3	6	9	9	12	18	24	12	15	21	21
4.	Arrhenatherum elat.	12	2	2	2	18	12	9	2	15	6	3	2
5.	Festuca pratensis	1	3	3	8	6	9	15	24	6	12	21	22
6.	Dactylis glomerata	1	3	2	2	3	3	3	3	3	3	6	6
7.	Festuca arundinacea	-	-	1	2	-	1	1	1	-	6	3	3
8.	Alopecurum pratensis	2	2	1	2	12	9	9	9	12	12	15	15
9.	Agropyron repen	3	2	2	2	3	3	2	2	3	3	3	6
	Grass Total %	**26**	**33**	**30**	**30**	**60**	**70**	**72**	**72**	**63**	**75**	**78**	**80**
10.	Lotus corniculatus	1	-	-	-	-	-	-	-	-	-	-	
11.	Trifolium pratense	-	1	1	1	-	-	-	1	-	-	-	-
	Leguminous total %	**1**	**1**	**1**	**1**	-	-	-	**1**	-	-	-	-
12.	Helitrotrichon pubesc	1	-	-	-	1	-	-	-	2	-	-	-
13.	Anthoxanthum odor.	2	1	6	6	1	3	6	1	1	-	1	-
14.	Briza media	3	2	3	3	2	-	3	2	2	-	1	1
15.	Bromus arvensis	6	3	6	2	3	-	-	-	3	-	-	-
16.	Calamagrostis epig.	9	6	3	2	6	3	3	3	6	6	6	6
17.	Galum glacum	18	9	9	9	6	6	6	6	6	6	6	3
18.	Dianthus pontederae	1	-	-	1	-	-	-	-	-	-	-	-
19.	Achillea millefojum	2	1	1	6	2	2	-	1	2	1	-	1
20	Thymus glabrescens	1	1	2	1	1	-	-	1	-	-	-	-
21.	Fragraia viridis	3	6	1	9	2	2	1	2	2	1	-	1
22.	Trifolium campestre	1	-	1	1	-	-	-	-	-	-	-	-
23.	Ranunculus acris	2	1	1	1	1	1	1	-	1	-	-	-
24.	Plantago major	1	1	1	1	1	1	-	1	1	-	-	-
25.	Rumex acetosa	1	-	-	-	1	-	-	-	-	-	-	-
26.	Crepis biennis	1	1	1	1	1	1	-	1	1	1	-	-
27.	Filipendula vulgaris	1	2	2	-	1	1	1	-	1	-	1	-
28.	Centaurea sadleriana	1	6	1	2	1	1	-	1	1	1	-	-
29.	Rosa canina	1	1	1	1	1	1	-	-	-	1	-	-
30.	Colchicum automnale	3	3	3	3	2	-	-	3	2	-	2	2
31.	Ajuga chamaepitys	1	-	1	-	1	-	1	-	1	-	-	-
32.	Lathyris tuberosus	2	1	1	1	1	1	1	1	1	-	-	-
33.	Viola odorata	1	1	1	1	1	1	-	-	1	1	-	-
34.	Stellaria nemorum	1	-	1	-	-	-	1	-	-	-	1	-
35.	Seseli osseum	-	1	-	-	-	1	-	-	-	-	-	-
36.	Senecio vulgarius	-	2	-	-	-	1	-	-	-	-	-	-
37.	Agrimona eupatoria	-	2	1	1	-	1	-	2	-	1	-	1
38.	Veronica arvensis	-	1	-	-	-	-	-	-	-	-	-	-
39.	Plantago lanceolata	-	-	1	-	-	-	1	1	-	-	-	-
40.	Carex silvatica	-	-	3	2	-	-	-	-	-	-	-	-
41.	Hypericum perfor	-	-	1	-	-	-	-	-	-	-	-	-
42.	Campanula medium	-	-	1	2	-	-	1	-	-	-	-	-
43.	Chrysanthemum leucanthem	-	-	1	-	-	-	-	-	-	-	-	-
44.	Salvia nemorosa	-	-	2	-	-	-	-	-	-	-	-	
45.	Apera spica-venti	-	-	-	3	-	-	-	2	-	-	-	1
46.	Vicia cracca	-	-	-	1	-	-	-	-	-	-	-	-
47.	Cerastium fontanum	-	-	-	1	-	-	-	-	-	-	-	1
	Other plants total %	**63**	**52**	**56**	**60**	**36**	**27**	**26**	**26**	**34**	**19**	**18**	**17**

Material and methods

The experiment has been set on deteriorating grassland. Species with good nutritive value were still found in the plant stock, but their ratio was insignificant. The diversity of the grassland was appr. 50.

Our main objective was to investigate the opportunities of improving deteriorating grassland. The object of renovation was to increase the yield and carrying capacity of run-down permanent pastures by cultivation.
Every spring, fertilizers were applied on the plots at a rate of 150 and 300, 50 and 100,100 and 200 kg ha^{-1} N, P_2O_5, and K_2O respectively, and two harvests were taken. All plots were cut and the weight of fresh herbage was recorded.
The changes in the plant stock of experimental plots were established in the first growth. The covering rate of the species occurring in the experiments was determined by means of plant sociological sampling.
From the changes of plant stock, the diversity and the change of ratio of grass species was calculated – in both sustainable extensive and intensive grassland management systems. Carrying capacity was calculated based on the yield.

Results and discussions
The number of species /1 table/ changed as a result of cultivation. On the control plot, species tolerating cultivation proliferated, while others disappeared. The coverage and ratio of Poa pratensis and Festuca pratensis in the grassland increased.
There was a change in the ratio of grass species compared to each other. As a result of cultivation, the ratio of weed plants decreased, but they did not totally disappear from the grassland. The feeding value of the grassland did not increase due to the presence of weeds, because the coverage of grass species hardly increased.

Table 2. The carrying capacity of the grassland

N rate kg h^{-1}	Herbage DM t/ha	Carrying capacity Head/ha
Ø	1,8	0,66
N_1 (150kgNha^{-1})	5,3	1,90
N_2(300 kgNha^{-1})	7,8	2,88

As a result of artificial fertilizers, the number of species in the grassland decreased. Although the diversity decreased, the feeding value of improved grassland increased. The grass coverage on the control plot increased from 30% to 72% as a result of 150kg ha^{-1} nitrogen, and as a result of 300kg N it reached an 80% coverage. However, some of the dicotyledons disappeared from the grassland.
Fresh and DM herbage yield increased as the nutrient supply improved, /2.table/ and the increase of yield improved the carrying capacity of the grassland. The increase in the ratio of grass species improved the quality of the yield. The sustainable, environment friendly extensive method did not improve the carrying capacity of the grassland.

Conclusions
The use of extensive grassland management methods did not improve the composition of species in deteriorating grasslands, but changed the ratio of species compared to each other. As an unfavourable effect, it did not increase the yield or the carrying capacity of the grassland. As a favourable effect, the diversity of the grassland did not deteriorate.

As a result of artificial fertilizers, the ratio of grass species changed. On the positive side, the yield and carrying capacity of the grassland improved, while the decreasing diversity is a negative effect.

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