

GRADED MANAGEMENT INTENSITY OF GRASSLAND SYSTEMS FOR ENHANCING BIODIVERSITY ON A SPECIES AND LANDSCAPE SCALE

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ABSTRACT

The objective of our research is to maintain and enhance wildlife resources, landscape diversity and economic competitiveness of grassland-ruminant systems. This may be accomplished by a diversified, graded management intensity of pastures and meadows (Dietl, 1990), resulting in a network of intensively and extensively used grassland and other semi-natural habitats. Botanical diversity is thus increased on both a habitat and landscape level. In intensively farmed regions it may be necessary to re-establish species-rich grassland types and adjust management intensity to the site conditions and species' requirements.

KEYWORDS

Grassland, flora, biodiversity, landscape, extensification, management intensity

INTRODUCTION

The enormous increases in agricultural production over the past 50 years have been associated with an equally drastic loss of plant and animal species and of diverse, extensive grassland habitats. Specialization and concentration of production on a farm and regional level, with uniform, mechanized, intensive management on a large scale, have reduced sensitive habitats and fragile organisms. Efficient, high natural value farming systems are required to change this trend. Our research aims to develop sustainable grassland - ruminant systems that fulfill ecological, economical and social functions.

METHODS

We assess floristic composition of grassland types by the method of Daget and Poissonet (1969) and calculate the Shannon-index (Shannon and Weavers, 1963) as a measure of diversity at the field plot level. The Mann Whitney U-test is applied to species numbers and the Shannon indices to test for significance ($p=0.05$). We observe long-term botanical stability and forage quality of the different grassland types as a function of the natural conditions, the fertilization intensities (Table 1) and the type and frequency of utilization. We study the development of habitat and species diversity, in both relatively uniform and diverse grassland areas, and relate it to structural and management changes. It is also planned to include economic and other ecological criteria (nutrient fluxes).

RESULTS AND DISCUSSION

In species-rich grasslands the botanical composition is greatly influenced by management intensity. Fertilization of an alpine pasture during 40 years has markedly reduced diversity as measured by the number of species (Fig. 1) and their distribution (Shannon index, Fig. 2). Extensification of previously intensively managed meadows with a limited number of species may or may not reverse this process (results are not given here). The success depends on the seed potential present in the region and on the soil's fertility. Multi-species grass-clover seed mixtures, supplemented with adapted wild flower seeds may be necessary to re-establish species-rich grassland habitats.

Extensively managed grassland has not only a lower yield potential, but also a lower forage quality. In high producing dairy herds (cows with >6000 kg milk per lactation and a live weight of 600 kg) only about 15% of the annual forage requirement may be low quality hay, to be fed when the cows are dry or have a low production (Jans,

1992). During lactation high quality forage is essential; otherwise excessive amounts of feed concentrate are required to satisfy the cows' nutrient requirements. This results in nutrient surpluses on the grassland and high costs for supplemental feedstuffs.

We are finding that a graded management intensity of meadows and pastures enhances biodiversity both on the farm and landscape level. It also makes it possible to feed dairy cows according to the changing requirements throughout the lactation cycle.

REFERENCES

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Figure 1
Effects of 40 years of fertilization of an alpine pasture on the number of species.

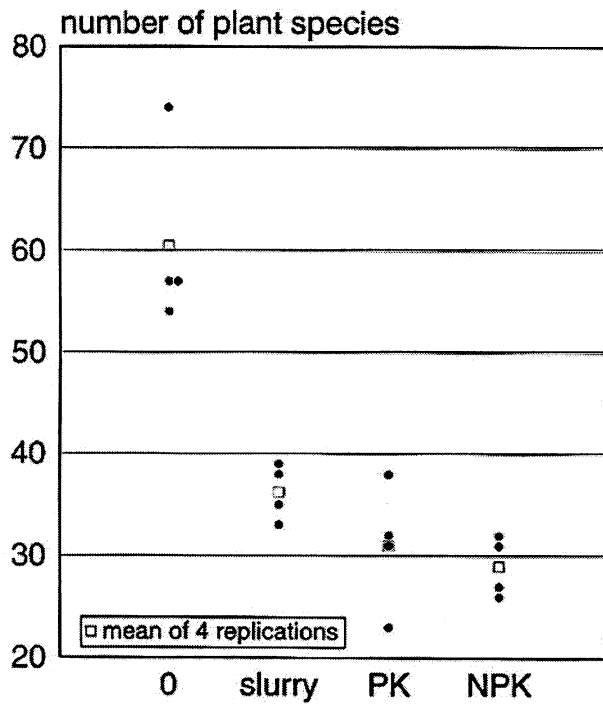


Figure 2
Influence of 40 years of fertilization of an alpine pasture on plant distribution (diversity).

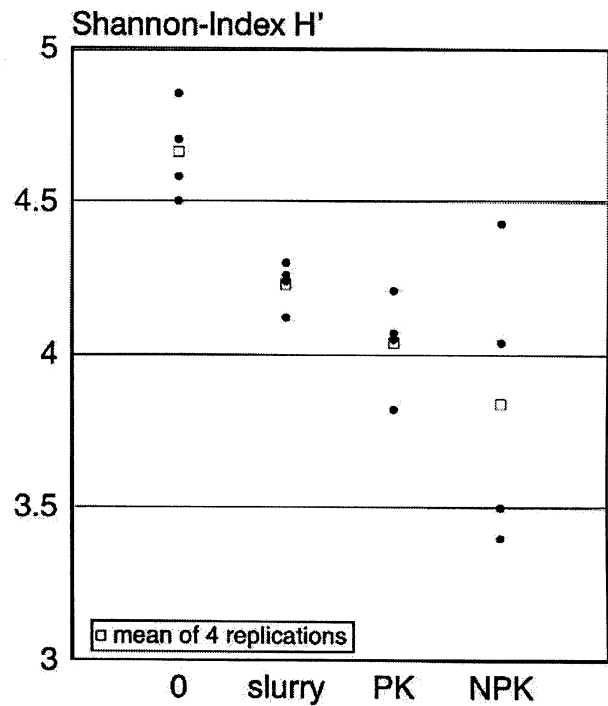


Table 1
Fertilization treatments on an Alpine pasture from 1956 to 1995 at Zweisimmen, near Bern: 1'340 m altitude, 1200 mm annual precipitation

Treatments	Nutrients applied in kg / ha and year		
	P ₂ O ₅	K ₂ O	N
0	0	—	—
Slurry*	35	160	80**
PK	90	180	—
NPK	90	180	83

*50 m³ ; **readily available N