Grassland and Society

Proceedings of the 15th General Meeting of the European Grassland Federation, June 6 – 9, 1994

L. 't Mannetje
J. Frame
Editors in chief

Cattle weight changes and botanical composition of an unfertilized grass sward under continuous grazing
J.H. Neuteboom, L.'t Mannetje, E.A. Lantinga and K. Wind

Wageningen Pers
Wageningen 1994

Cattle weight changes and botanical composition of an unfertilized grass sward under continuous grazing

J.H. Neuteboom[1], L.'t Mannetje[1], E.A. Lantinga[2] and K. Wind[1]

[1] *Department of Agronomy, Agricultural University Wageningen, The Netherlands*
[2] *Department of Theoretical Production Ecology, Agricultural University Wageningen, The Netherlands*

Summary

An extensification experiment was carried out on grassland on a moderately fertile, relatively moist sandy soil under continuous grazing at three fixed stocking rates (2.3, 3.6 and 4.9 animals ha^{-1}) without fertilization. The grass sward mainly consisted of *Lolium perenne, Holcus lanatus, Agrostis capillaris, Alopecurus pratensis* and *Poa trivialis*. Maximum gains $animal^{-1}$ in spring averaged 1.4 kg day^{-1} and the maximum gains ha^{-1} varied between 300 and 320 kg liveweight. Inclusive of a preceding period of 13 years, during which time an annual N fertilization of 50 kg ha^{-1} was applied, floristic diversity had hardly increased.

Keywords: extensification, continuous grazing, nature conservation.

Introduction

For the management of grasslands for nature conservation grazing is preferred over mowing because it is cheaper. Grazing rights can be leased to farmers who can use the grassland for growing young cattle. Especially grazing at low stocking rates can lead to a strong patch wise variation in grass height which favours conditions for a diverse botanical composition.

Data of a continuous grazing experiment with steers in a grassland on sandy soil without fertilization are discussed. The objective was to study the effects of different grazing pressures on botanical composition and animal growth.

This paper reports only results for the years 1986 to 1989 inclusive.

Material and methods

The grassland, located on a moderately fertile sandy soil of good moisture conditions and measuring 6.6 ha, had been grazed and mown for silage for many years until 1973 at a fertilizer rate of about 200 kg N ha^{-1}. During the first period of extensive management (1973-1985) 50 kg N ha^{-1} was applied, but no P or K. Continuous grazing took place with 5 steers ha^{-1} before the end of July, and 3.5 steers ha^{-1} during the remainder of the grazing season. Since 1986 no fertilization was applied and the area was divided into three equally sized paddocks of 2.2 ha are grazed at fixed stocking rates (SR) of 2.3, 3.6 and 4.9 steers ha^{-1}, respectively.

Grazing started each year in April with animals of 385 kg mean liveweight and was continued till October. The animals were weighed periodically. Between 1973 and 1985 the grass sward had developed a more or less stable botanical composition existing of (dry weight proportions) 23% *Lolium perenne*, 25% *Holcus lanatus*, 15% *Agrostis capillaris*, 10% *Alopecurus pratensis* and 8% *Poa trivialis*. There were only a few dicotyledonous species in the remaining 19%.

Results and discussion

The average cumulative liveweight gains (LWG) per animal are presented for two contrasting years, 1986 and 1988 (Figures 1a and 1b). The initial average daily gains (ADG) after the start of grazing were 1.4 kg day^{-1} for all stocking rates, indicating adequate quality and quantity of feed for such a high growth rate. This means that high proportions of *Holcus lanatus* and *Agrostis capillaris*, which are generally considered to be of low quality, are not necessarily a problem from the viewpoint of herbage quality for animal growth in spring. This agrees with results from a continuous grazing experiment of Hagger and Elliot (1978). At a fertilizer N level of 160 kg/ha they could not detect a significant effect of botanical composition on livestock output between *Lolium perenne* swards with widely different total cover percentages (varying from 40 to more than 80%) of lower quality grasses (*Holcus lanatus, Agrostis stolonifera, Festuca rubra* and *Poa* spp.). However, except at the lowest stocking rate in 1986, growth rates declined, to even negative values at the highest stocking rate after mid August. This can partly be explained from a shortage of grass on offer, but another reason may have been large patches of senescent low quality grass after July.

The same reasons may explain why the maximum LWG ha^{-1} measured in all four years was between 300 and 320 kg. In all years, except 1986 when all three SR showed similar maximum values, albeit at different times of the year (Figure 1c), highest LWG ha^{-1} were recorded at the highest SR (Figure 1d). However, from an economic viewpoint it is the LWG at the end of the grazing season which counts, because in all years except 1987 the maximum LWG decreased again after the maximum had been reached.

The relationship Y= a -bX between LWG $animal^{-1}$ (Y) and SR (X) followed the model of Jones and Sandland (1974). The mean maximum LWG ha^{-1} $year^{-1}$ was 280

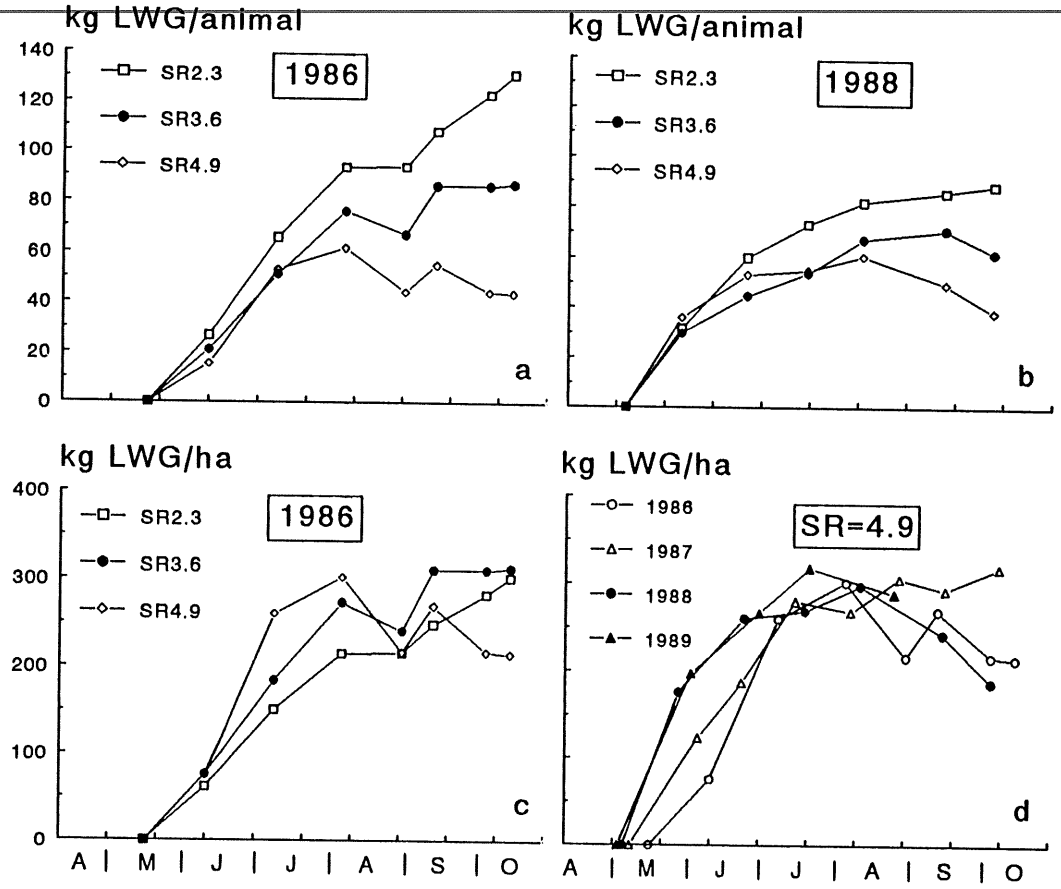

Figure 1. Mean LWG animal^{-1} at three SR in 1986 (a) and 1988 (b); LWG ha^{-1} for all three SR in 1986 (c) and LWG ha^{-1} for the highest SR in 1986, 1987, 1988 and 1989 (d).

kg, which was obtained at a SR of 3.8 animals ha^{-1}, the regression coefficient (b) was 20 kg and the theoretical LWG animal^{-1} at zero SR was 150 kg.

During the first period of extensification from (1973-1985), floristic diversity had hardly increased, while dicotyledonous species had in fact steadily decreased. Despite the complete absence of fertilization from 1986 onwards, there was no increase in species diversity. In 1990 only two dicotyledonous species had presence frequency percentages (F%) in 100 0.25 dm cores higher than 5% (*Cardamine pratense* (9% in early spring) and *Ranunculus acer* (6%)), and a further 6 species had a F% higher than 1%. Nevertheless, a total of 38 species had been recorded on the field borders and along ditches. Therefore, the reason for the monotonous vegetation is probably the very dense grass sward under the given relatively moist soil conditions, which prevents establishment of invading species. The results are totally different from another extensification experiment under continuous grazing on a poor dry sand soil (Wind *et*

al., 1993). In that experiment a relatively species rich vegetation with several dicotyledonous species had developed after 15-20 years.

Apart from the few changes in botanical composition from the viewpoint of floristic value, the present extensification experiment suggests that without fertilization, with continuous grazing and fixed SR not the botanical composition but the combination of the low productivity of the vegetation and the patchwise low herbage quality due to selective grazing and ageing is the primary limiting factor for animal production.

References

Hagger, R.J. & J.G. Elliot, 1978. The effect of dalapon and stocking rate on the species composition and animal productivity of a sown sward. *Journal of the British Grassland Society*, **33**, 23-33.

Jones, R.J. & R.L Sandland, 1974. The relation between animal gain and stocking rate. Derivation of the relation from the results of grazing trials. *Journal of Agricultural Science, Cambridge*, 83: 335-342.

Wind, K., J.H. Neuteboom & L. 't Mannetje, 1993. Effect of extensification on dry-matter yield and botanical composition of grassland on dry sand soil. In: *Grassland management and nature conservation. Occasional symposium of the British Grassland Society.* No. 29, pp ..-.. .