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Amazing Grazing: effect of cutting height and defoliation frequency on grass production and feeding value

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Abstract

In the Netherlands, different grazing systems are practised with the extremes of continuous grazing and strip grazing. To get more insight into the effect of these different stocking systems on grass production and feeding value under different post grazing residuals, a mowing experiment was conducted. In total, six treatments were compared; three defoliation frequencies (cut every two, three and four weeks) and two different stubble heights (3 and 5 cm). The total grass production of the system with a low stubble height and a high defoliation frequency was four to five tonnes dry matter (DM) ha⁻¹ lower than the other systems as a result of a higher mowing frequency. The feeding value of the grass, measured as protein content and digestible organic matter (OM) percentage was significantly higher at a higher defoliation frequency but the difference could not compensate for the loss of DM production.

Keywords: Amazing Grazing, defoliation frequency, stubble height, grass production, digestible OM, perennial ryegrass

Introduction

In the Netherlands, there are a number of grazing systems practised with the extremes of continuous and strip grazing and intermediate systems like rotational grazing and compartment continuous grazing. The reasons farmers choose different systems include grass production and milk production, stability in feeding value and production, labour requirement, farm lay-out, automated milking systems and personal preference (Van den Pol-van Dasselaar *et al.*, 2016). In these different grazing systems the defoliation frequencies can vary from daily to four weeks. These systems commonly have high post grazing residuals (> 6 cm), while in New Zealand systems post grazing residuals are generally lower (3.5 cm; Lee *et al.*, 2008). In order to measure the effect of lower and higher post grazing residuals under different defoliation frequencies, a mowing experiment was conducted.

Materials and methods

A cutting experiment with four replicates was set up in spring 2015 on a permanent grassland with 80% perennial ryegrass (*Lolium perenne* L.) and 20% rough meadow grass (*Poa trivialis* L.). The experiment was conducted on the Dairy Campus experimental farm in Friesland (the Netherlands) on a marine clay soil. It contained two factors: factor one was a fixed defoliation frequency: two, three and four week defoliation (Table 1) and factor two was stubble height; 3 and 5 cm. All treatments received the same amount of N artificial fertiliser ha⁻¹ divided over six applications (80 kg N (23 - 3), 60 kg N (21 - 5 and 19 - 6), 55 kg N (15 - 7), 50 kg N (12 - 8) and 40 kg N (9 - 9), in total 345 kg N ha⁻¹). The swards were mown with a lawn mower (Etesia) because the standard mower could not harvest at a stubble height of 3 cm. A strip, 7 × 0.8 m was mown. All grass was collected, weighed and sampled (about 1 kg fresh material) for dry matter (DM) content and feeding value (crude protein, crude fibre content and digestible organic matter). The cumulative DM and N-yield from the individual harvests were calculated. At the start and the end of the experiment, the percentage of the surface covered with plants (sward density) was visually estimated. Data were analysed with the ANOVA test (Genstat 18th) with the replicates as random block factor.

Table 1. Defoliation schedule.

Week	0	1	2	3	4	5	6	7	8	9	10	11	12
2 Weeks	X		X		X		X		X		X		X
3 Weeks	X			X			X			X			X
4 Weeks	X				X				X				X

Results and discussion

The cumulative annual DM yield was significantly affected by defoliation frequency and stubble height (both $P < 0.001$, LSD = 687 resp. 561), and the interaction between both factors ($P = 0.022$, LSD = 971). The results are shown in Figure 1.

A lower defoliation frequency led to a significantly higher annual DM yield. In the three and four week defoliation frequency, stubble height influenced the annual DM yield positively. Despite the longer growing period, there was no significant difference in crude fibre content of the grass. The crude protein content was significantly lower ($P < 0.001$, LSD = 8) on the four week treatment. There was no significant effect of stubble height on the crude protein or crude fibre content. The digestible OM percentage was significantly higher ($P = 0.015$, LSD = 1.35) at a higher stubble height (80.5 at 3 cm stubble vs 82.3 at 5 cm stubble) but also significantly higher ($P = 0.004$, LSD = 1.65) for the two week defoliation treatment (83.2% at two weeks vs 80.4% at four weeks). There was no interaction for the effect of defoliation frequency and the stubble height on the feeding value parameters measured. Analysing the total N-yield, the treatments with the highest cumulative DM yield also had the highest N yield despite the lower crude protein content. The sward was visibly denser at the end of the season at the two weeks defoliation frequency. No difference in root numbers was observed. From experience, farmers often mention that higher stubble leads to a quicker regrowth. In this experiment, the treatments with a 3 cm stubble height and a defoliation frequency of three and four weeks had a higher DM yield than those with a 5 cm stubble height. This is similar to Davis (1977) who found that stubble density had a greater effect than stubble height. In this mowing experiment a two week defoliation schedule resulted in a 2 t DM ha⁻¹ reduction compared with a three week defoliation schedule and about 5 t DM ha⁻¹ reduction compared with a four

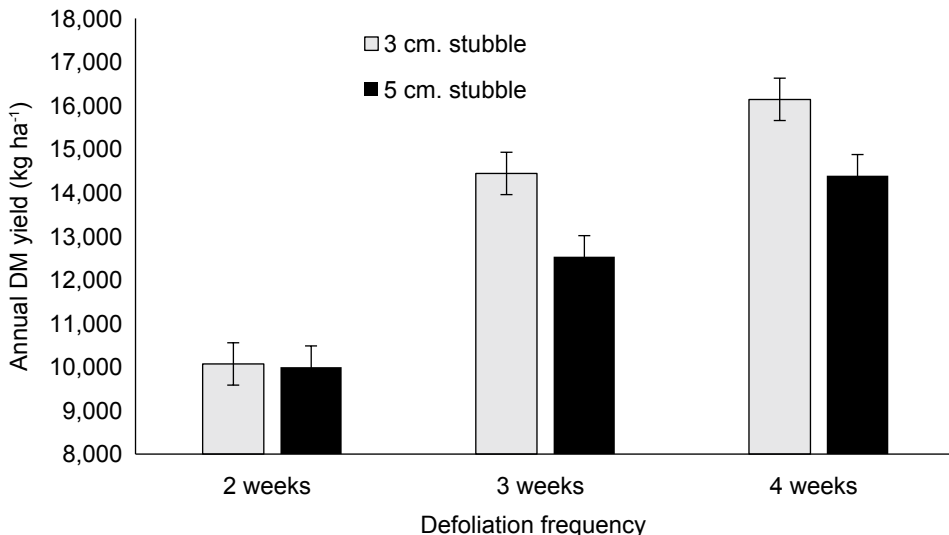


Figure 1. Cumulative annual DM yield at three defoliation frequencies and two stubble heights.

week mowing schedule. A higher defoliation frequency was also found at continuous grazing systems and this can be an indication for a lower gross yield production, also reported in the grazing experiment of the project Amazing Grazing (Holshof *et al.*, 2018). Due to the continuous grazing, a very dense sward will develop (also measured in the Amazing Grazing experiment) which could possibly compensate the lower vertical growth in this system. The cutting experiment was only one year duration and there was already a denser sward after the first season, however, one season was too short to measure this positive effect. Real time grazing may give a denser sward than just cutting. The higher protein content with the two week defoliation management could not compensate for the loss of DM yield, but the digestible OM percentage was slightly higher at a two week defoliation and a longer stubble. The short stubble could contain more dead leaf material due to the lawn mower used which allowed some pieces of very short material remain in the sward after mowing. In the next mowing, old material was picked up and affected the digestible OM.

Conclusion

A higher defoliation frequency will lead to a significantly lower total DM yield, with a higher protein content and a higher digestible OM. The higher protein level could not compensate for the lower DM yield, so the total N yield was also lower. Shorter stubble height led to a higher DM yield in combination with three or four weeks defoliation but resulted in a slightly lower digestible OM.

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