Growing Grass for Greener Grazers: Herbage Management for Improved N Utilisation of Grazing Cows

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Growing grass for greener grazers :herbage management for improved N utilisation of grazing cows

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Key words : herbage quality , high-sugar cultivar , *Lolium perenne* , N application rate , regrowth period

Introduction Grazing is accompanied by localised deposition of nitrogen (N) in urine and dung patches , which can contribute to losses of N to water and air . The N utilisation of cows can be manipulated through diet composition . In Ireland , this diet consists mainly of grazed grass . Therefore , the main way to manipulate the diet is through grassland management . Previous studies have investigated the impact of single herbage management tools on herbage composition and sometimes cow N efficiency . In this paper , we aim to identify grassland management systems to optimise the N efficiency of grazing bovines .

Materials and methods In order to study the direct impact of herbage management on bovine N efficiency we linked the Cornell Net Carbohydrate and Protein System model to a herbage intake quality model (Hoekstra et al . , submitted) . Plot experiments provided input data for the model ; field experiments at farmlet scale with contrasting herbage management regimes were used to evaluate the model . The herbage management tools evaluated were : fertiliser N application rate , length of the regrowth period and diploid high sugar grass cultivar (cv Aberdart) . All calculations were performed for three seasons : early , mid and late season .

Results and discussion Results from the model and field experiments showed that the crude protein (CP) concentration of the herbage ingested during grazing is the main factor for improving bovine N efficiency , with the optimum CP concentration lying between 13-15% DM (Figure 1) . At CP levels above 15% , the supply of N was in excess of the energy supply and could not be utilised by the animal , whereas at CP levels below 13% , the supply of N limits milk production , resulting in lower N use efficiency . Fertiliser N application rate in interaction with length of the regrowth period were shown to be effective tools for manipulating the CP concentration of herbage ingested during grazing (Figure 2a) , with rotation length having a more pronounced effect at high levels of fertiliser N application . The modelled efficiency of N utilisation for milk production as affected by N application rate (14-56 kg N ha^{-1} $rotation^{-1}$) and length of regrowth period (3 to 7 weeks) ranged from 23 to 37% during early and mid season and from 21 to 26% during late season (Figure 2b) .

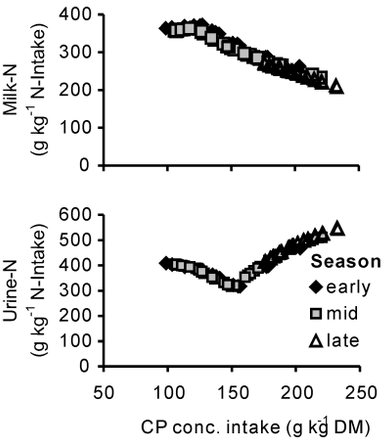

Figure 1 *Modelled relation between the CP concentration in the intake and a) Milk-N and b) Urine-N (g kg^{-1} N-Intake) during early , mid and late season .*

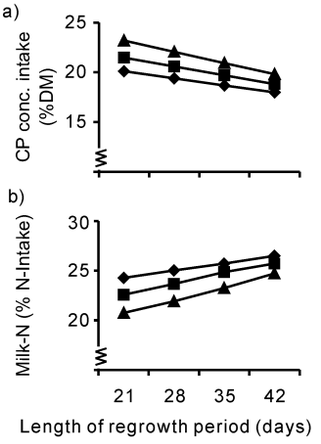

Figure 2 *Modelled effect of N application rate (◆ 14 , ■ 36 and ▲ 56 kg N ha^{-1} $rotation^{-1}$) and length of regrowth period on a) the CP concentration of the intake , and b) the milk N efficiency during late season .*

The high-sugar grass cultivar did significantly increase the water soluble carbohydrate (WSC) concentration in the ingested herbage . However , this did not affect cow N efficiency , as the increase in WSC was at the expense of neutral detergent fibre rather than CP (data not shown) .

Conclusions The CP concentration of ingested herbage is the main factor for improving the N efficiency of grazing bovines and this can be effectively manipulated through fertiliser N application rate in interaction with the length of the regrowth period . Diploid high-sugar cultivars do not appear to be effective for improving the bovine N utilisation . It is recommended that the model will be extended to include a herbage yield and an intake component . This will allow the model to be used to design herbage management systems to optimise N utilisation on a yearly basis .

Reference

Hoekstra , N .J . , Lantinga , E .A . , Schulte , R .P .O . & Struik , P .C . (submitted) . Predicting the nitrogen utilisation of grazing dairy cows : model description and validation . *Agricultural Systems* .