Effects of grassland management on herbage lipid composition and consequences for fatty acids in milk

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Introduction Herbage provides bulk feed and is the basis for ruminant nutrition. Herbage lipids, especially C18:3, are a major source of beneficial fatty acids (FA) in milk. These desired FA are unsaturated FA such as CLA (conjugated linoleic acid), especially the isomer rumenic acid, and also vaccenic acid, both trans omega-7 FA (Ellen & Elgersma, 2004). As information on lipids in forages is scarce, effects were studied of N application level and regrowth period on the lipid concentration and FA composition of perennial ryegrass (*Lolium perenne* L.), the most important forage in temperate climate zones. A linear relation had previously been found between C18:3 intake of cows stall-fed with fresh grass and the amount of omega-7 FA in milk (Elgersma *et al*., 2003).

Materials and methods N was applied at 100, 45 and 0 kg/ha, and swards were cut after various regrowth periods (20, 27 and 32 days after N application), resulting in six treatments abbreviated as 100N-20d, etc. Treatments were designed as randomised blocks with three replicates. For lipid analyses, herbage was frozen immediately after cutting and concentrations of individual FA were determined by gas chromatography. Canopy characteristics and herbage quality were also analysed.

Results The N applications and different harvest dates resulted in canopies with contrasting dry matter (DM) yields. The leaf blade proportion of DM declined from 0.70 to 0.55 to 0.45 in the various harvests, due to booting as time progressed. Five FA (C16:0, C16:1, C18:1, C18:2 and C18:3), representing 0.98 of total FA, were studied in detail. The mean concentration of FA in fresh grass was 15.5 g/kg DM and on average 0.68 of the FA consisted of C18:3. Regrowth period did not significantly affect the total FA concentration, but relatively less C18:3 and C16:1 and more C16:0, C18:0 and C18:2 were found after a longer period of regrowth. N application resulted in higher concentrations of total FA. There was a tendency for a relative increase in C18:3 and a decrease in C18:2 with higher N application. A strong positive overall linear relation was found between the concentrations of total FA and C18:3 and the protein content in the fresh herbage (Figure 1). This confirms findings of Boufaïed *et al*. (2003) with timothy.
The linear relation was due to both the increase in protein and C18:3 concentrations with N application and the declines in concentrations with longer regrowth period.

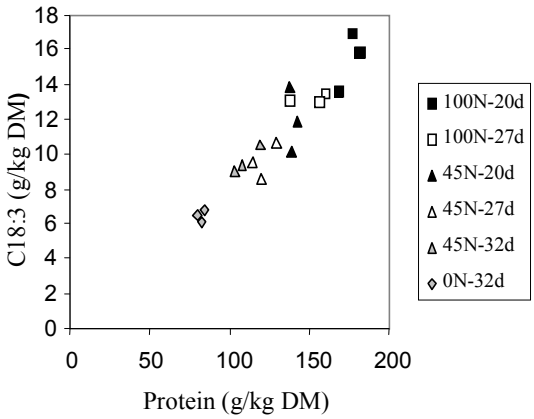

Figure 1 Relation between protein content and C18:3 concentration of perennial ryegrass

Conclusions These studies demonstrate opportunities to change the FA concentration and composition of FA in herbage through management strategies, which could favour an improved milk FA composition.

References

Boufaïed, H., P.Y. Chouinard, G.F. Tremblay, H.V. Petit, R. Michaud & G.Bélanger (2003). Fatty acids in forages. I. Factors affecting concentrations. *Canadian Journal of Animal Science,* 83, 501-511.

Elgersma, A., G. Ellen, P.R. Dekker, H. van der Horst, H. Boer & S. Tamminga (2003). Effects of perennial ryegrass (*Lolium perenne* L.) cultivars with different linoleic acids contents on milk fatty acid composition. *Aspects of Applied Biology*, 70, 107-114.

Ellen, G. & A. Elgersma (2004). Letter to the Editor: Plea for using the term n-7 fatty acids in place of C18:2 *cis*-9, *trans*-11, and C18:1 *trans*-11 or their trivial names rumenic acid and vaccenic acid rather than the generic term conjugated linoleic acids. *Journal of Dairy Science*, 87, 1131.