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## Postprandial Kinetics of Dissolved Hydrogen in the Rumen of Cows Fed Nitrate and/or Linseed Oil

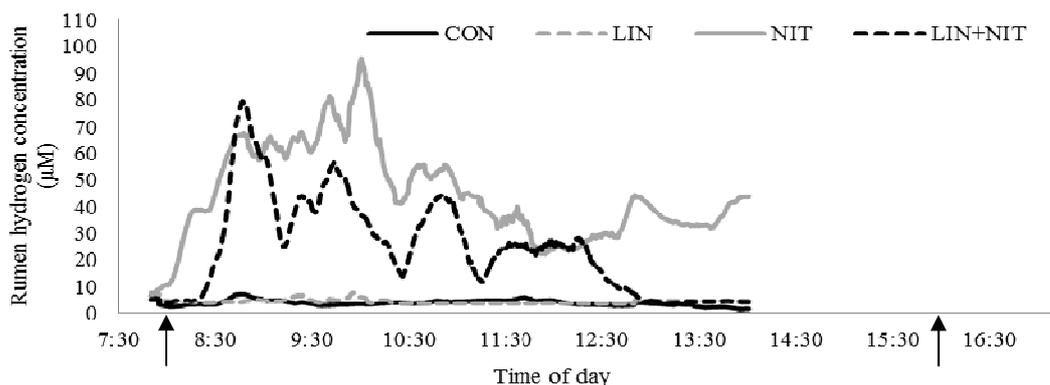
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Linseed oil and nitrate fed alone or in association significantly reduced methane (CH<sub>4</sub>) emissions from cows (Guyader *et al* 2014, this conference). To have a better insight of the mechanisms involved in CH<sub>4</sub> mitigation by these additives, we focused on the hydrogen (H<sub>2</sub>) pool, a key element regulating methanogenesis in the rumen. We hypothesized that linseed oil and nitrate differently affect the rumen H<sub>2</sub> pool. Linseed oil may decrease H<sub>2</sub> production via a toxic effect on protozoa, and nitrate may use H<sub>2</sub> at the expense of methanogens.

Four cows were randomly assigned to 4 dietary treatments in a 4 x 4 Latin square design: 1) control diet (CON), 2) control diet with 4% linseed oil (LIN), 3) control diet with 3% calcium nitrate (NIT), and 4) control diet with 4% linseed oil and 3% calcium nitrate (LIN+NIT) (for more details see Guyader *et al* 2014, this conference). The kinetics of dissolved H<sub>2</sub> concentrations in rumen fluid were measured using a H<sub>2</sub> sensor (H<sub>2</sub>-500, Unisense, Denmark). The sensor was introduced through the rumen cannula and placed at the bottom of the ventral sac before the morning feeding and data were continuously collected up to 6 hours postfeeding. Data were analyzed in repeated time using the MIXED procedure of SAS (SAS, 2009) with a model including period, diet, hour and diet x hour interaction as fixed effects, and cow as random effect.



**Figure 1. Postfeeding pattern of rumen dissolved H<sub>2</sub> concentrations from dry cows fed nitrate and/or linseed oil. Black arrows indicate time of feeding**

With CON and LIN, the pool of dissolved H<sub>2</sub> in the rumen remained low and stable after feeding ( $P>0.05$ , Figure 1), showing that the equilibrium between production and use of H<sub>2</sub> was unaffected. Then, it is a lower H<sub>2</sub> production and consequently a concomitant lower H<sub>2</sub> availability for methanogens which may explain the CH<sub>4</sub> mitigation effect of linseed oil. In contrast, compared to CON, NIT induced a postprandial rise of rumen H<sub>2</sub> concentration ( $P<0.05$ ), confirming that nitrate decreased CH<sub>4</sub> not only because it is a H<sub>2</sub> sink but also through its inhibitory action on methanogens. This effect is alleviated by associating nitrate with linseed oil as shown by the lower build-up of H<sub>2</sub> concentration with LIN+NIT. By studying for the first time the dynamic of rumen dissolved H<sub>2</sub> concentrations, we confirmed our hypothesis that linseed oil and nitrate have different modes of action on the rumen H<sub>2</sub> pool, and that the mechanisms of CH<sub>4</sub> mitigation by those compounds involve different pathways.

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Guyader J., Eugene M., Doreau M., Rochette Y., Morgavi D.P. and Martin C. (2014). Proc. Aust. Soc. Anim. Prod.

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