



In vitro fermentation and methane production kinetics of grass and sainfoin using rumen inoculum from dairy cows receiving diets differing in quality



Wilbert Pellikaan, Sander Abrahamse, Steven Borgjink, Dick Bongers, Saskia van Laar and Wouter Hendriks

¹ Animal Nutrition Group, Wageningen University, P.O. Box 338, Wageningen, The Netherlands

MESSAGE

- In vitro* measured methane production kinetics differs from the total gas production kinetics
- Microbiota of cows receiving a high digestible diet tends to be more active than of cows receiving a low digestible diet
- Tannins tend to affect fermentation kinetics, decrease fermentation end-products and reduce proteolytic fermentation.

Objective

- Assess the effect of sainfoin (*Onobrychis viciifolia*, cv. Cotswold common) addition to rye grass (*Lolium perenne* L) on total gas, methane production kinetics and fermentation end-products using the *in vitro* cumulative gas production technique

Materials & Methods

in vivo part

Animals	Diets	Inocula	Substrates	& Treatments
<ul style="list-style-type: none"> 3 lactation HF cows BW: 612 ± 33 kg DIM: 172 ± 45 d 3 non-lactation HF cows BW: 747 ± 14 kg 	<ul style="list-style-type: none"> Diet of higher digestibility (HIGH) <ul style="list-style-type: none"> grass silage, maize, wheat, soy/rapeseed concentrates (4-5 kg) DMI: 25.5 ± 0.6 kg Diet of lower digestibility (LOW) <ul style="list-style-type: none"> Low quality grass silage from unfertilized pasture DMI: 9.2 ± 1.8 kg 		<ul style="list-style-type: none"> Grass100 - Sainfoin 0 Grass 70 - Sainfoin 30 Grass 30 - Sainfoin 70 Grass 0 - Sainfoin100 	<ul style="list-style-type: none"> PEG added (+) or not (-)

in vitro part

Incubation	Measurements & Analyses
<ul style="list-style-type: none"> 72h 3 replicate bottles 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>cumulative gas production</p> <p>Pressure Transducer System (Theodorou <i>et al.</i>, 1994)</p> </div> <ul style="list-style-type: none"> Gas production (GP) measured at time points 0, 4, 8, 12, 15, 18, 21, 24, 28, 31, 35, 41, 50, 60, 72h CH₄ analysed by GC (Fisons HRGC Mega 2, CE Instruments, Milan, Italy) fitted with an Alltech Ecolucap Column (EC-1000, 30m × 0.53mm) A monophasic model was fitted to the GP & CH₄ data points (Groot <i>et al.</i>, 1996). Fermentation fluids analysed for VFA & NH₃ at 72h

RESULTS

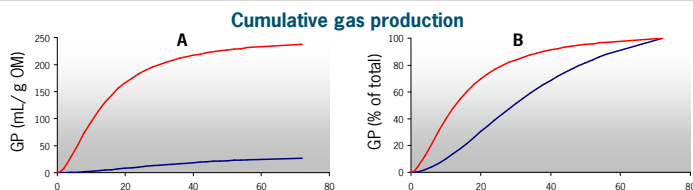


Fig. 1. Cumulative gas (GP, —) and methane (CH₄, —) production from sainfoin following incubation with rumen fluid of cows receiving a high digestible diet (HIGH). The absolute values are shown in (A), and (B) presents the gas production profiles as a percentage of GP (—) or CH₄ (—) produced at 72h.

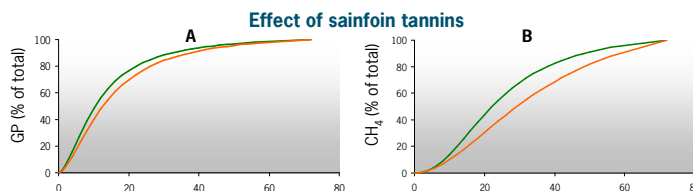


Fig. 2. Cumulative gas (A) and CH₄ (B) production as a percentage of GP or CH₄ produced at 72h from sainfoin in absence (-) or presence (+) of PEG4000.

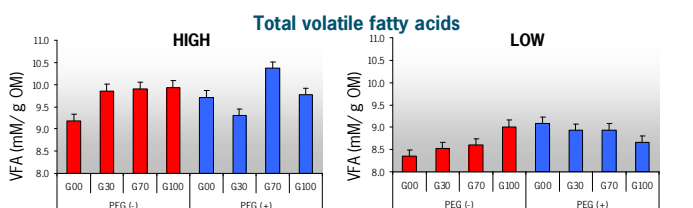


Fig. x. Total VFA concentration for sainfoin (G00), grass (G100) and combinations (G30, G70) after incubation with rumen fluid from cows receiving high digestible (HIGH) or low digestible (LOW) diets in absence (-) or presence (+) of PEG4000.

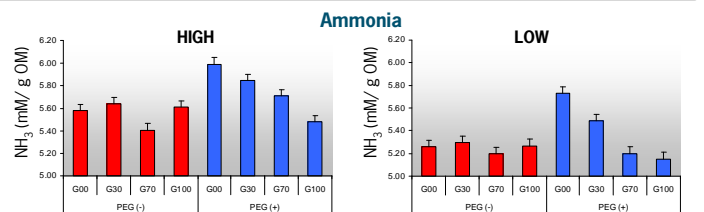


Fig. 3. Ammonia concentration for sainfoin (G00), grass (G100) and combinations (G30, G70) after incubation with rumen fluid from cows receiving high digestible (HIGH) or low digestible (LOW) diets in absence (-) or presence (+) of PEG4000.

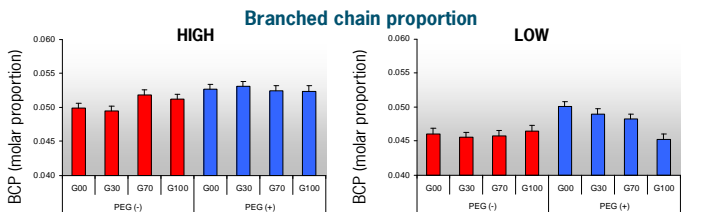


Fig. 4. Proportion of branched chain fatty acids (BCP) for sainfoin (G00), grass (G100) and combinations (G30, G70) after incubation with rumen fluid from cows receiving high digestible (HIGH) or low digestible (LOW) diets in absence (-) or presence (+) of PEG4000.

Conclusions

- Fermentation kinetics of methane differ considerably from total gas production
- Sainfoin tannins tend to reduce fermentation kinetics, decrease the amount of fermentation end-products formed and reduce proteolytic fermentation
- Diet type affected the microbial activity of the rumen inoculum, but results were ambiguous

Further information

✉: wilbert.pelikaan@wur.nl
mila.domenis@wur.nl

🌐: <http://www.anu.wur.nl/UK>
<http://healthyhay.vt.tuwien.ac.at/>

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