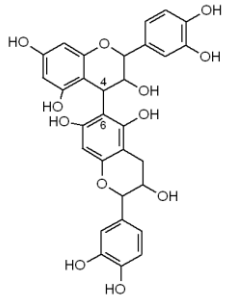
The condensed tannins in sainfoin cause digestive synergy on *in vitro* rumen fermentation of cocksfoot

Niderkorn V. , Le Morvan A. and Baumont R.

INRA Clermont-Ferrand-Theix centre






23rd General Meeting of the European Grassland Federation 2010 , Germany, Kiel
August 29th - September 2nd

DIET
AGRICULTURE
ENVIRONMENT

Introduction

- **Forage from multi-species or permanent grasslands** **can contain secondary metabolites potentially bioactive on rumen digestive processes**
  Ex: condensed tannins, saponins, polyphenol oxidase

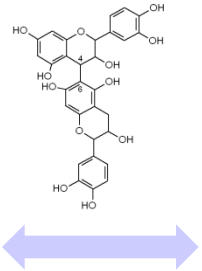
- **Digestive interactions between grasses and legumes** **when the digestive profile of a combination of forages differs from the balanced average values of its components** (Niderkorn and Baumont, 2009)

Could synergistic effects be useful for reconciling animal production and its environmental footprint ?

Decreasing N losses and methane emissions without affecting nutrient use by animals

Objective of the study

- To describe the digestive synergy between cocksfoot and sainfoin on rumen fermentation parameters
- To clarify the role of condensed tannins from sainfoin in these interactions



Sainfoin

Perennial forage legume, palatable, non bloating, anthelmintic properties, melliferous flowers

Condensed tannins (CTs)

- **Proanthocyanidins located in plant vacuoles**
- **Form stable complexes with protein reducing the degradation of dietary protein in the rumen** (Waghorn , 2008) **and decreasing N losses in urine** (Aufrère et al., 2008)

Experimental design

Cocksfoot

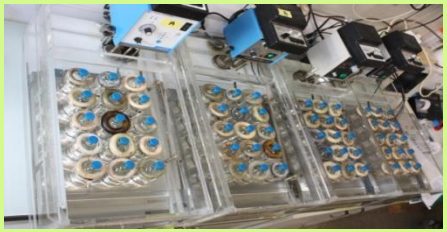
(g/kg DM) NDF=542 ; CP=144

Sainfoin

(g/kg DM) NDF=346 ; CP=157

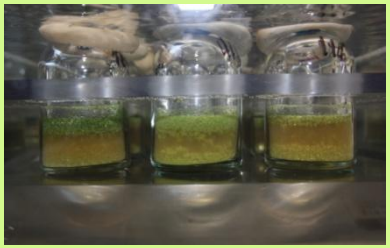
Protein binding activity CTs = 15.2 g eq-tannic acid/kg DM

- *Sampling at a vegetative stage*
- *Freeze-drying*



BATCH FERMENTATION *in vitro*

- **Forages alone**
- **Mixtures cocksfoot/sainfoin** (25:75, 50:50, 75:25)



❖ Incubation in buffered rumen juice from sheep

❖ Anaerobic conditions at 39ºC, in triplicate

In presence or absence of polyethylene glycol (PEG, binding/inactivation of CTs)

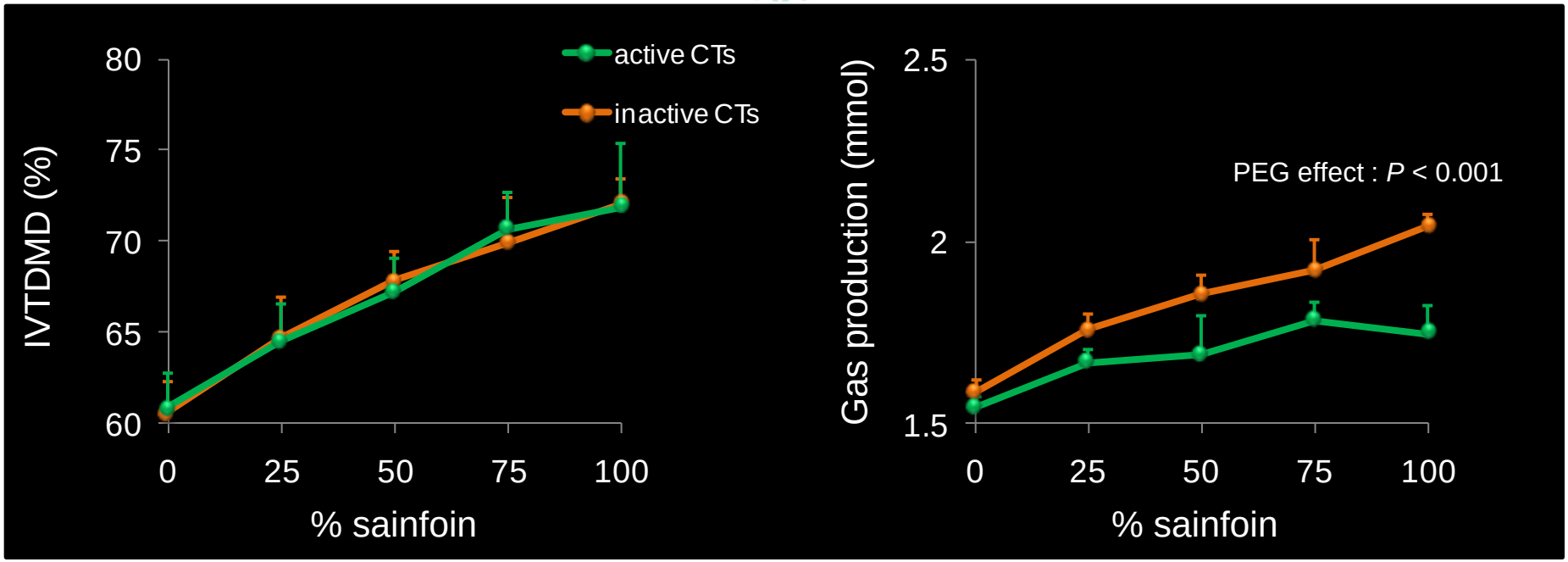
Role of CTs

MEASUREMENTS at 3.5 h (soluble fraction) and 24 h (whole plant)

- *In vitro* true dry matter digestibility (IVTDMD)
- Total gas production
- NH_3 in the fermentation medium

RESULTS

- **At 3.5h of incubation**



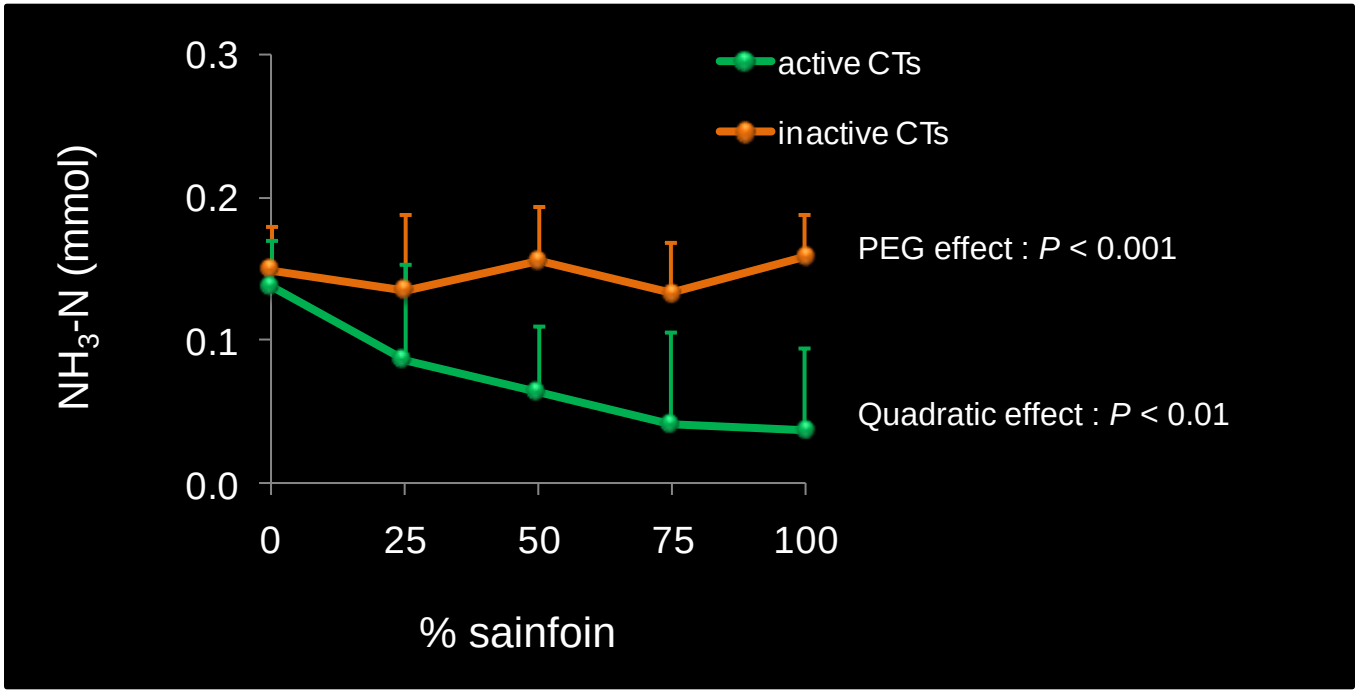
IVTDMD

- **Linear increase when % sainfoin increases**
- **No effect of CTs**

CTs decrease the gas production per unit of DM degraded

RESULTS

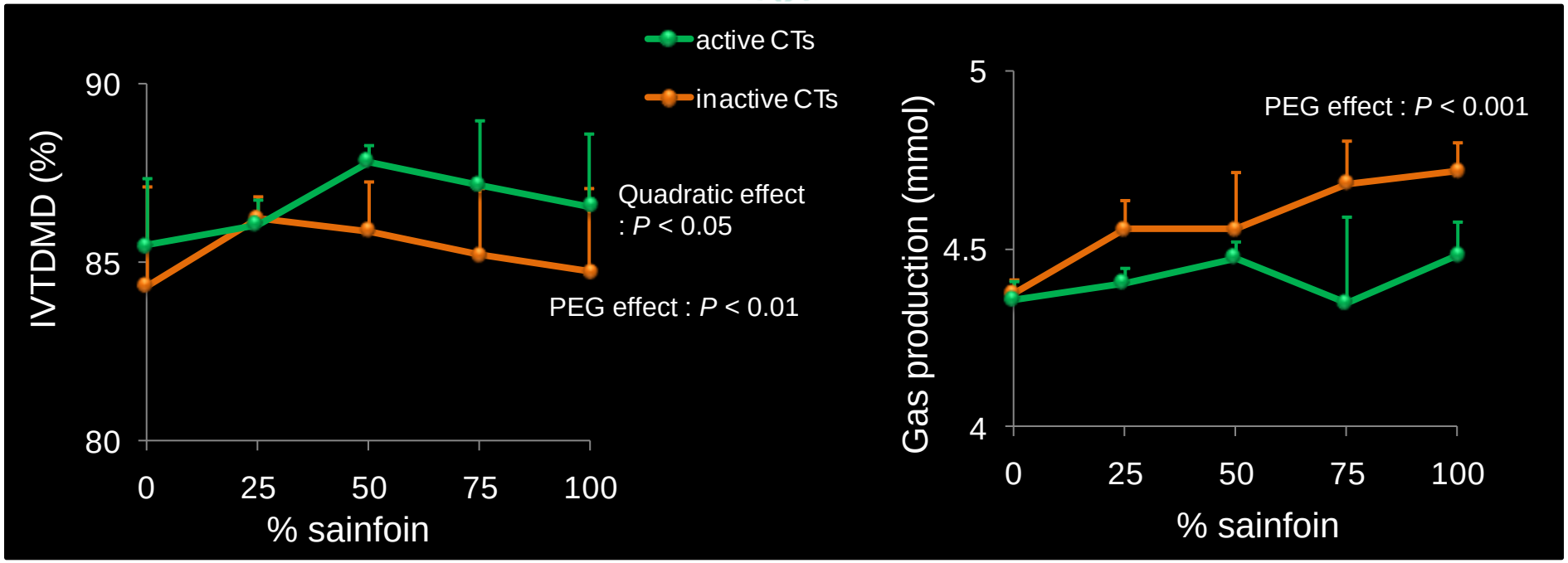
- **At 3.5h of incubation**



- **Lesser degradation of cocksfoot proteins in mixtures containing sainfoin**
- **CTs in sainfoin also bind cocksfoot proteins**

RESULTS

- **At 24h of incubation**



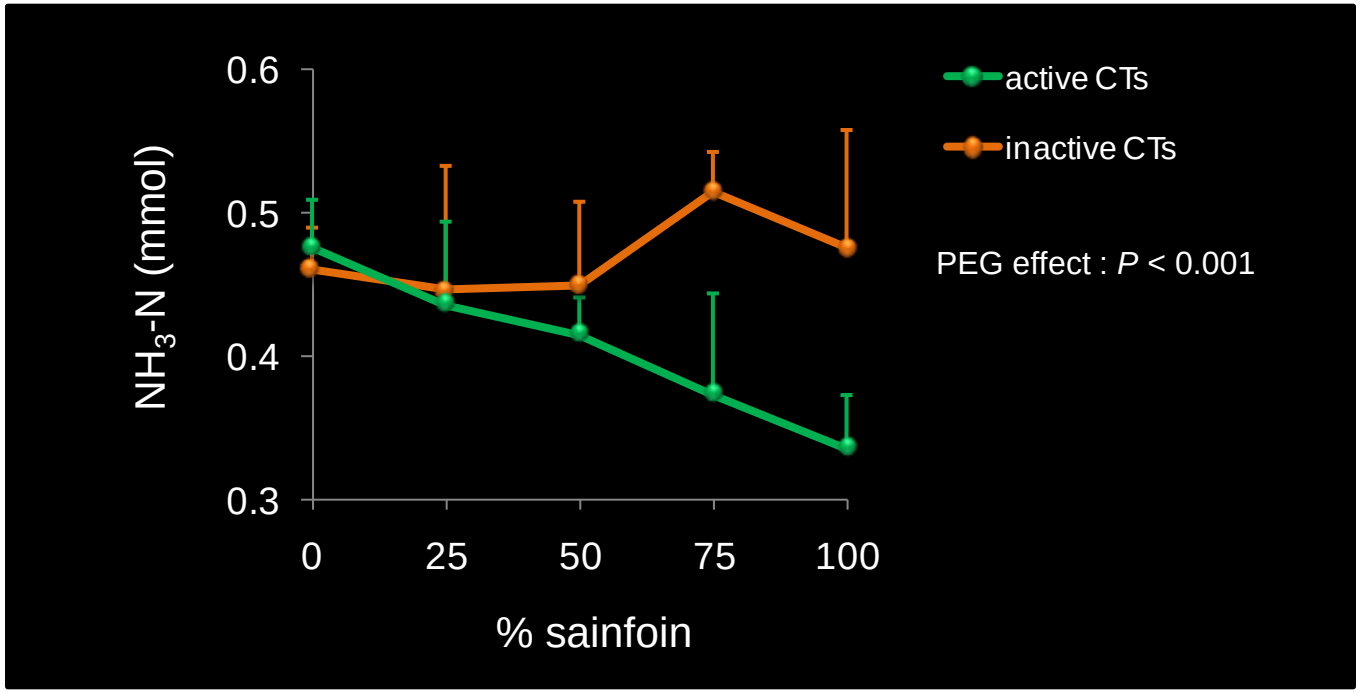
IVTDMD

- **Synergistic action on substrate degradation (optimal: 50:50)**
- **with a beneficial effect of CTs**

- **CTs decrease the gas production**
- **More DM degraded and less gas produced → high microbial biomass production** (Blummel *et al*., 1997)

RESULTS

- **At 24h of incubation**



CTs are active on the protein degradation throughout the fermentation process

Conclusion

When mixing cocksfoot and sainfoin, CTs produce:

- a synergistic action on the DM digestibility *in vitro*
- a decrease of the gas losses while maintaining the nutritive value

→ Better utilization of plant substrates by the rumen ecosystem likely due to a high microbial biomass production

- a decrease of the protein degradation of the whole mixture

→ Due to the role of CTs, introducing sainfoin in an association of forage species could interact favourably on N metabolism in the rumen

Synergy relevant in terms of nutritive value and environmental footprint

Optimal: 50-75% of sainfoin

Thank you for your attention