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

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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

**Batch fermentation in vitro**
- Sampling at a vegetative stage
- Freeze-drying

- Forages alone
  - 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)

**Measurements**
- At 3.5 h (soluble fraction) and 24 h (whole plant)
  - In vitro true dry matter digestibility (IVTDMD)
  - Total gas production
  - NH₃ in the fermentation medium
At 3.5h of incubation

**RESULTS**

IVTDMD

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

CTs decrease the gas production per unit of DM degraded

PEG effect: $P < 0.001$
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

PEG effect : $P < 0.01$

Gas production (mmol)

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
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