Passage kinetics of forage and concentrate fibre in the rumen

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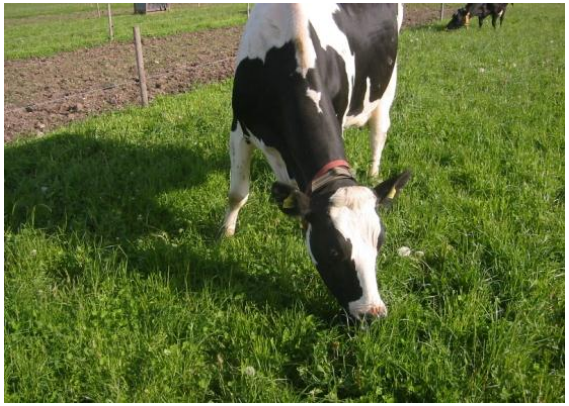
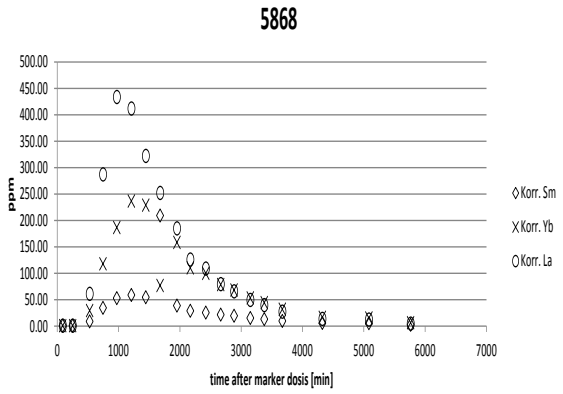




Aims

How do

- forage type
- forage:concentrate (F:C) ratio

affect fibre retention time in the rumen?

Limiting factor for fibre passage?

Background

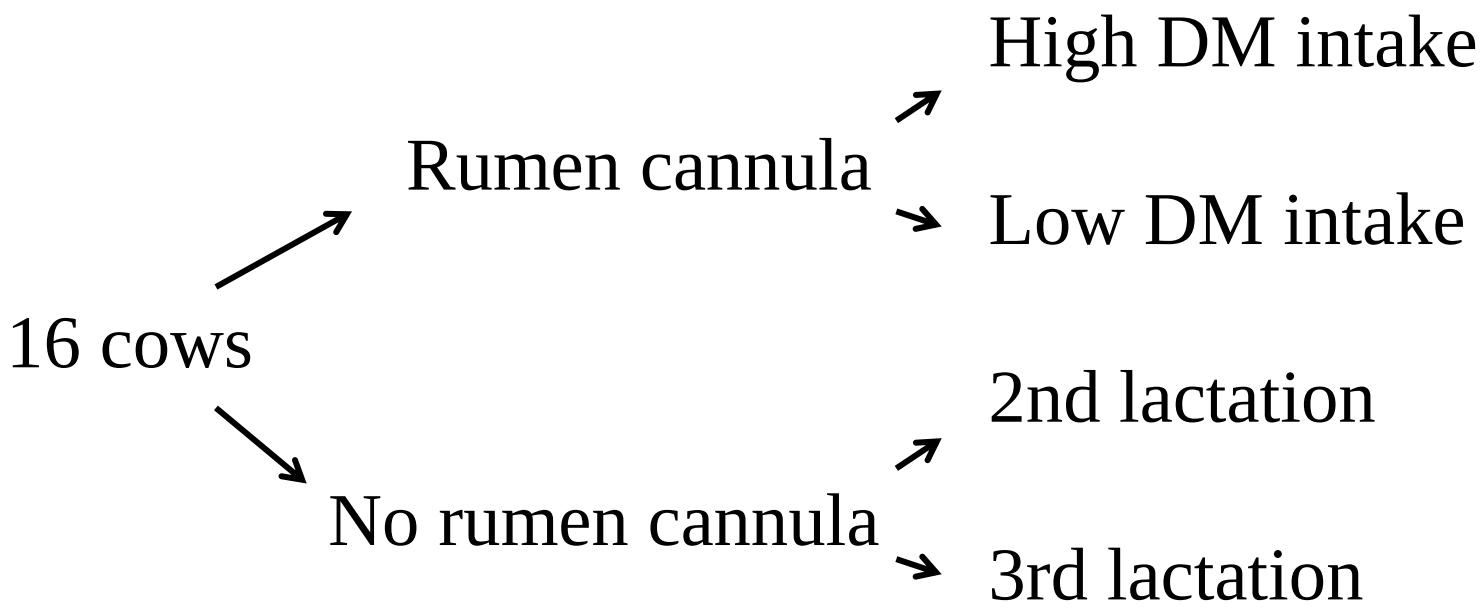
- Fibre: major energy source in ruminant feeds
- Fibre digestibility: competitive digestion and passage
  - Rumen mean retention time (MRT) ⇧:
    - digestibility ⇧
    - feed intake ⇩
- Feed evaluation

Hypotheses

- Total mean retention time (TMRT):
  maize silage > grass silage fibre
- TMRT of forage > concentrate fibre
- Forage : concentrate ratio ⬇:
  - MRT⬇

Material and Methods

Continuous block design:

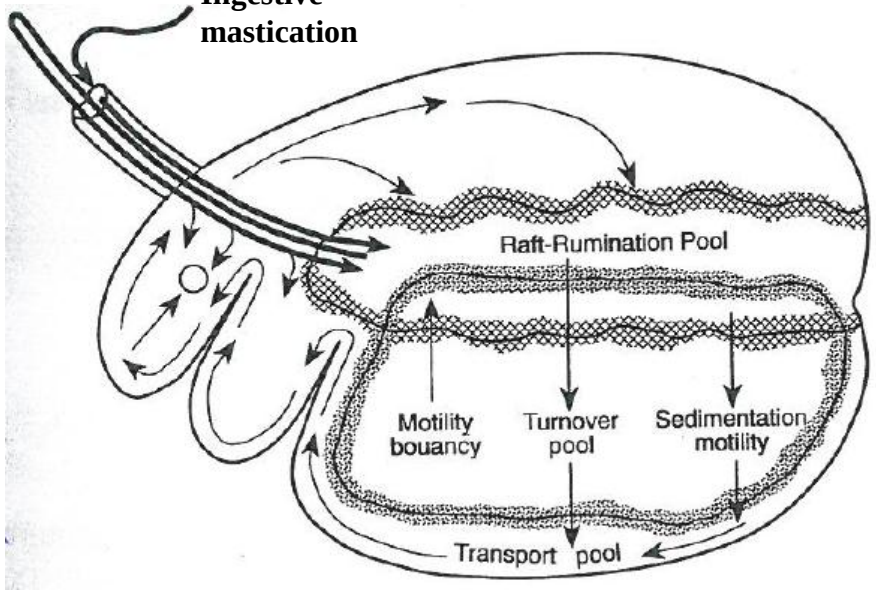


Material and Methods

Feeding (3 x daily, 95% DM intake):

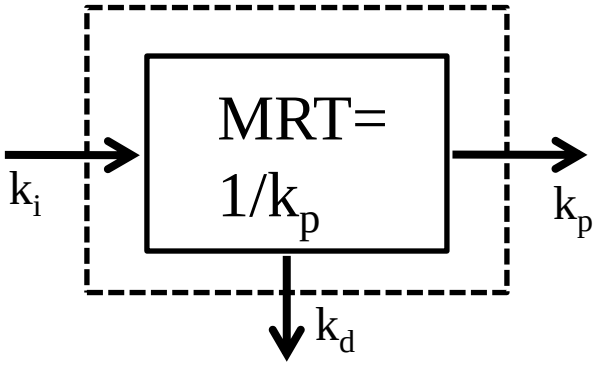
Forage type	Maize silage		Grass silage	
Forage:concentrate ratio	50:50	75:25	50:50	75:25
fibre marker fed as single pulse dose				
Yb	Maize	Maize	Grass	Grass
La	Conc	Conc	Conc	Conc

Material and Methods

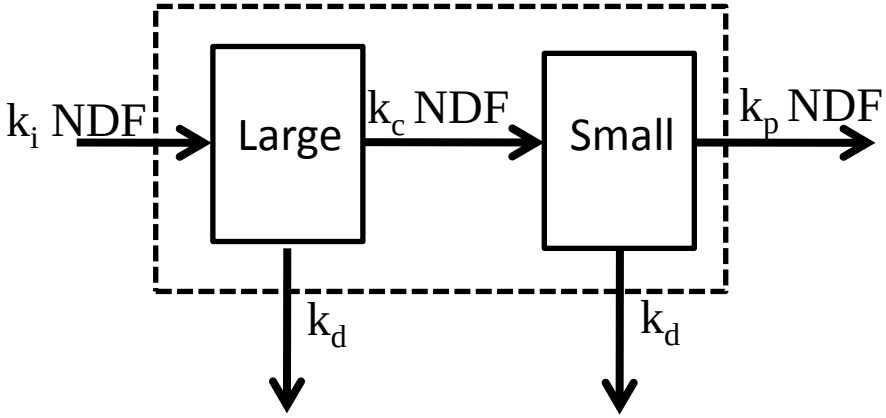


(Ellis et al., 1994)

Rumen 1 pool model (Waldo, 1972)



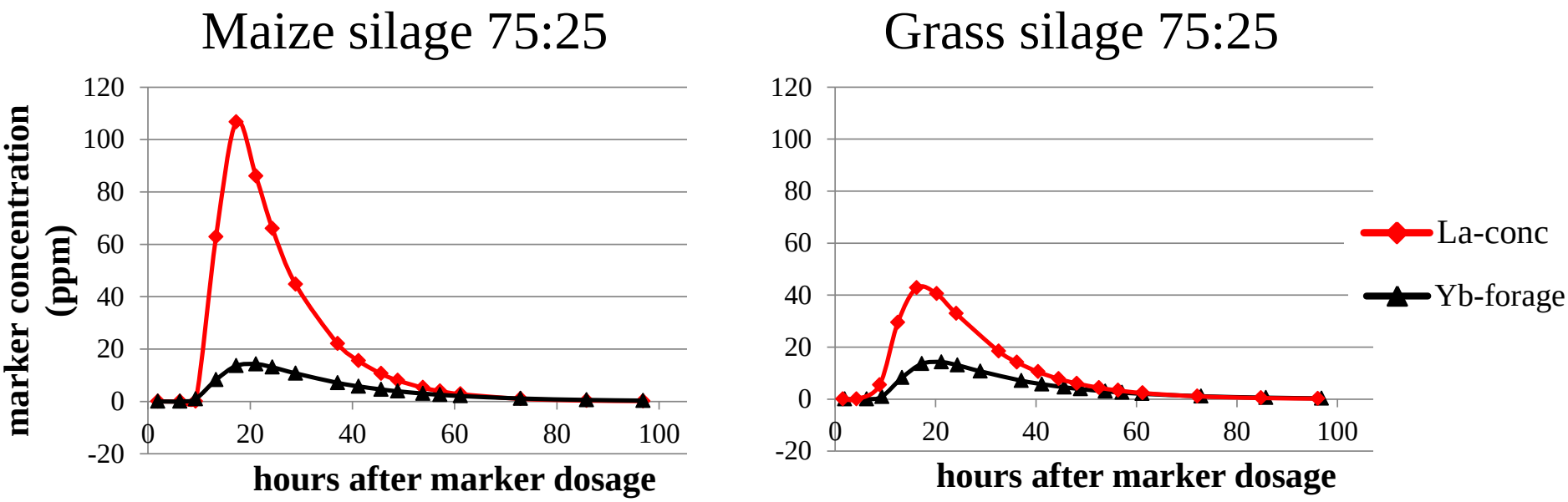
Rumen 2 pool model (mod. Allen & Mertens, 1988)



MRT= mean retention time; k_i= rate of intake, k_d= rate of digestion, k_c= rate of comminution, k_p= rate of passage

Marker excretion profile (feces)

- G4G1 model fits best



Yb-forage fibre

	Maize silage		Grass silage		SEM
F:C ratio	50:50	75:25	50:50	75:25	(n = 16)
MRT (large), h	7.12	7.74	8.78	11.8	1.01
MRT (small), h	21.8	23.8	19.2	19.7	3.9
TMRT, h	34.8	38.6	32.1	36.6	3.9

$P_F = 0.02$

F = forage, C = concentrate, TMRT = total mean retention time, P_F = P-value of forage

MRT (large): grass silage > maize silage fibre

Forage type influences hydration, comminution, particle reduction

MRT (small) > MRT (large)

Small particles limit fibre passage out of rumen

La-concentrate fibre

	Maize silage		Grass silage		SEM
F:C ratio	50:50	75:25	50:50	75:25	(n = 16)
MRT (large), h	10.7	12.6	6.26	8.93	1.5
MRT (small), h	18.5	18.4	22.8	25.8	2.8
TMRT, h	34.4	36.9	34.1	40.5	3.3

F = forage, C = concentrate, MRT = mean retention time, TMRT = total mean retention time

TMRT: forage fibre > concentrate fibre ($P < 0.001$)
Smaller particles & higher specific gravity: TMRT ⇩

Conclusions

- Total mean retention time (TMRT): maize silage > grass silage fibre

✓ TMRT of forage > concentrate fibre

- Forage : concentrate ratio ⇩:
  - MRT⇩

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