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A new *in vitro* ensiling technique for silage research

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Background

- Variation in fermentation quality and aerobic stability is still large
- Variation in field flora?
- Variation in chemical composition?
- How to test these hypotheses?

Background



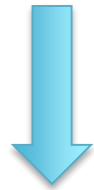
Background



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Treatments:
Chem. & mic.
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Aim:

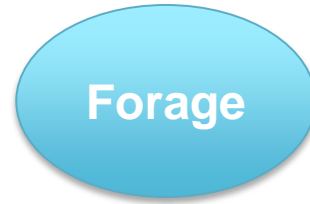
- To enable separating the confounded effects of pre-ensiled chemical or microbial composition

Aim:

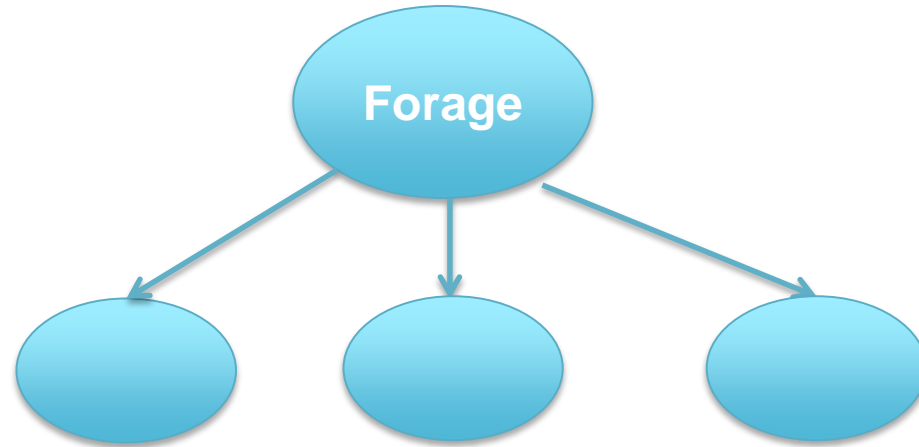
- To enable separating the confounded effects of pre-ensiled chemical or microbial composition

This work has already been accepted for publication in the “Grass and Forage Science”

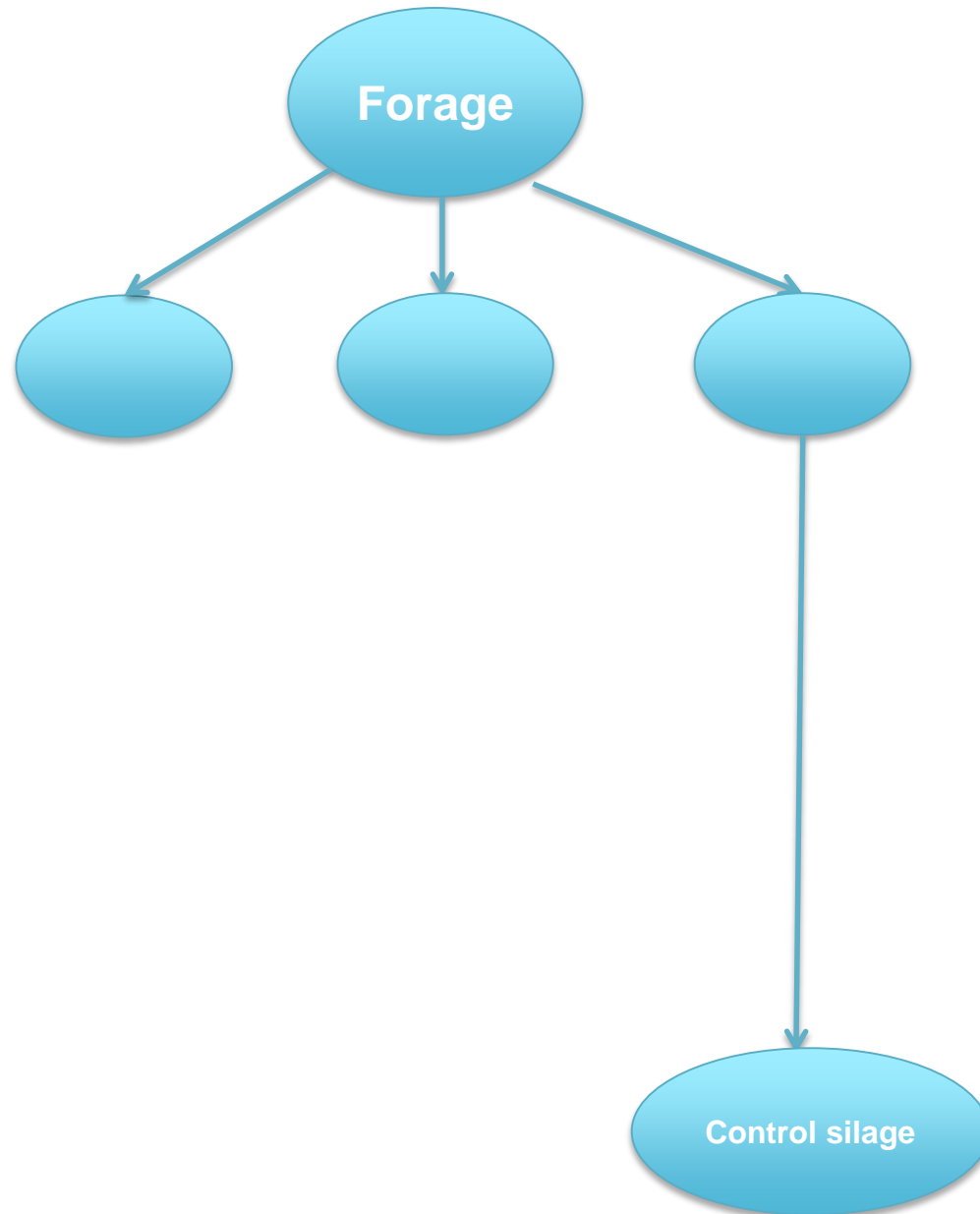
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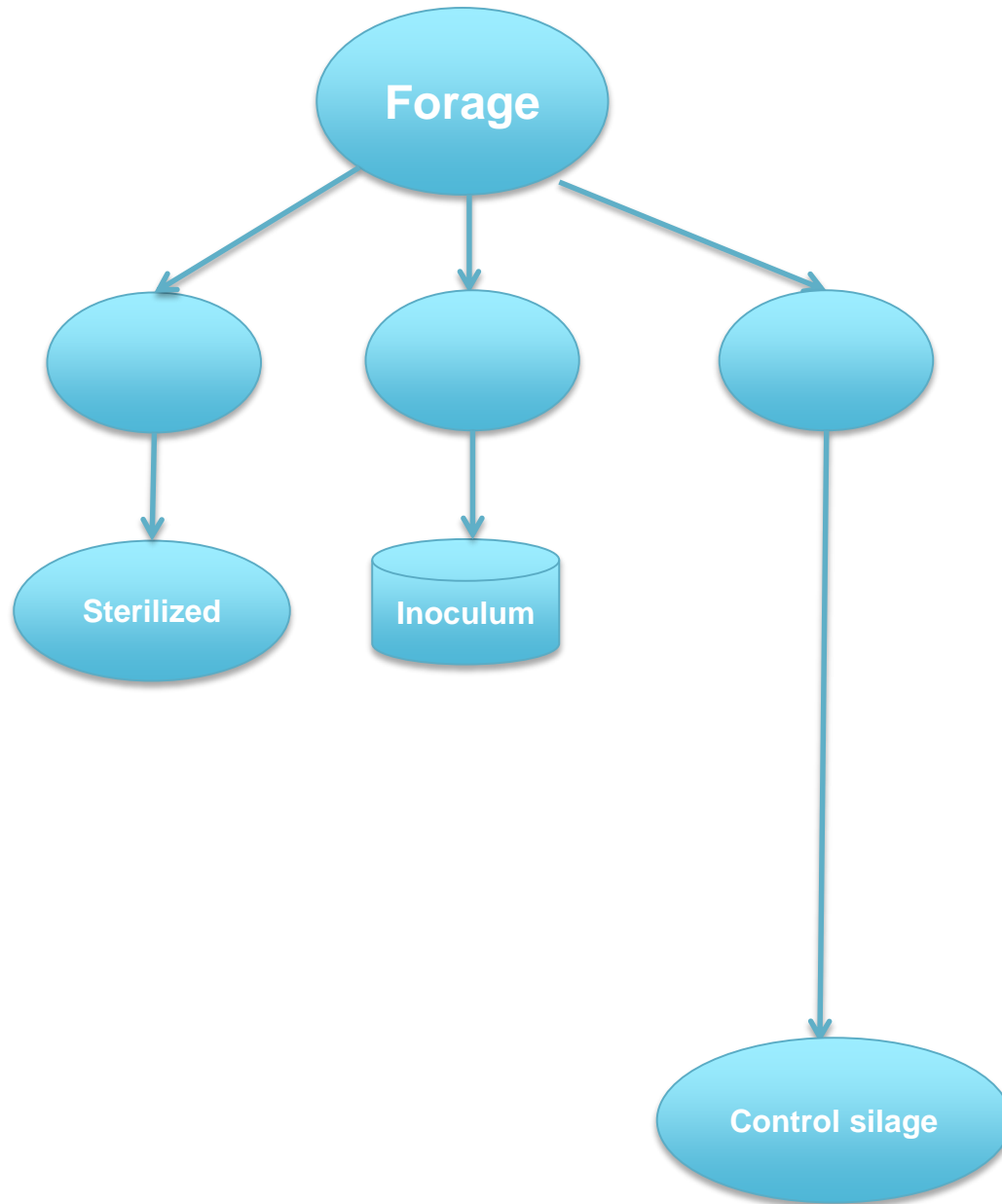
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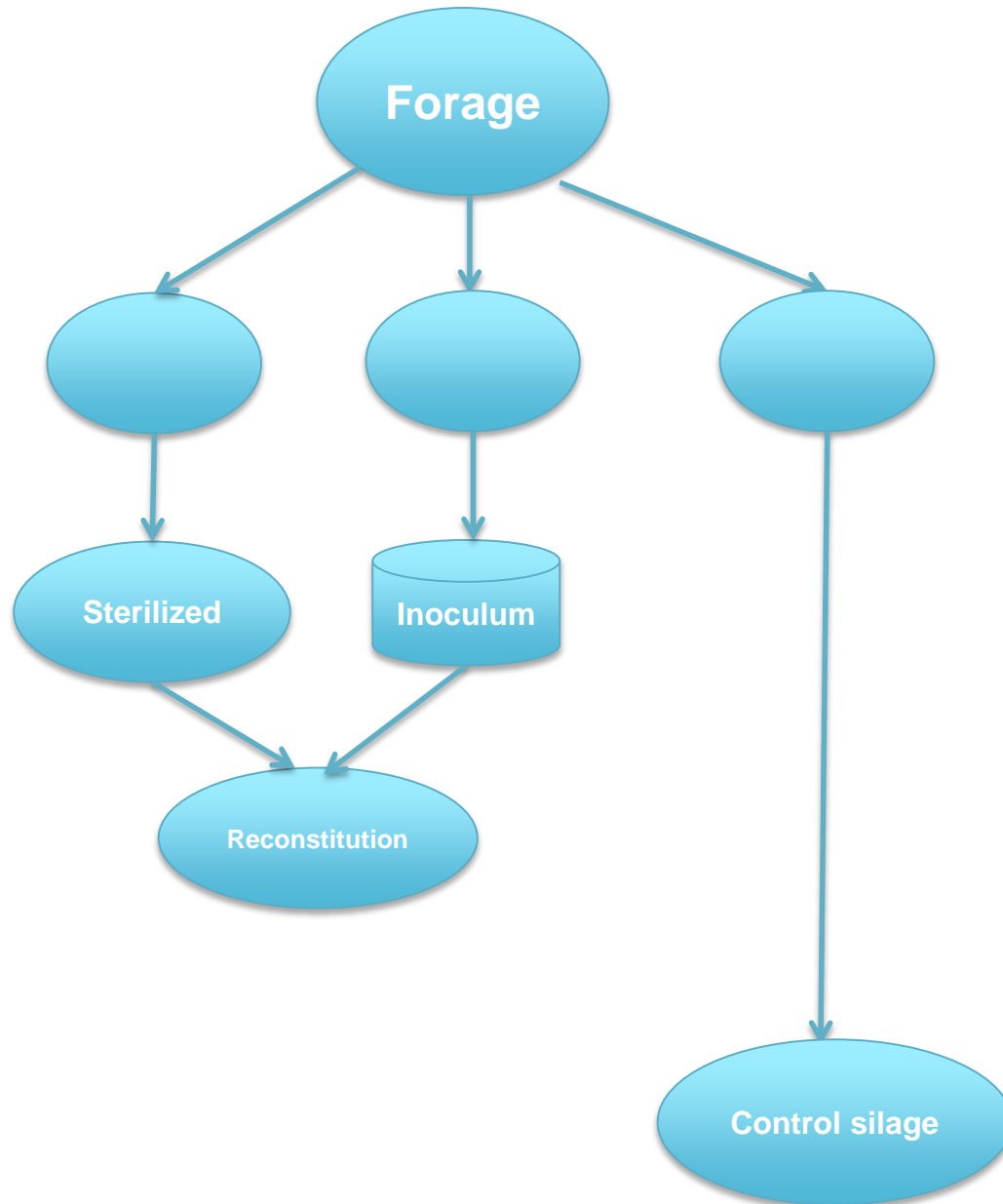
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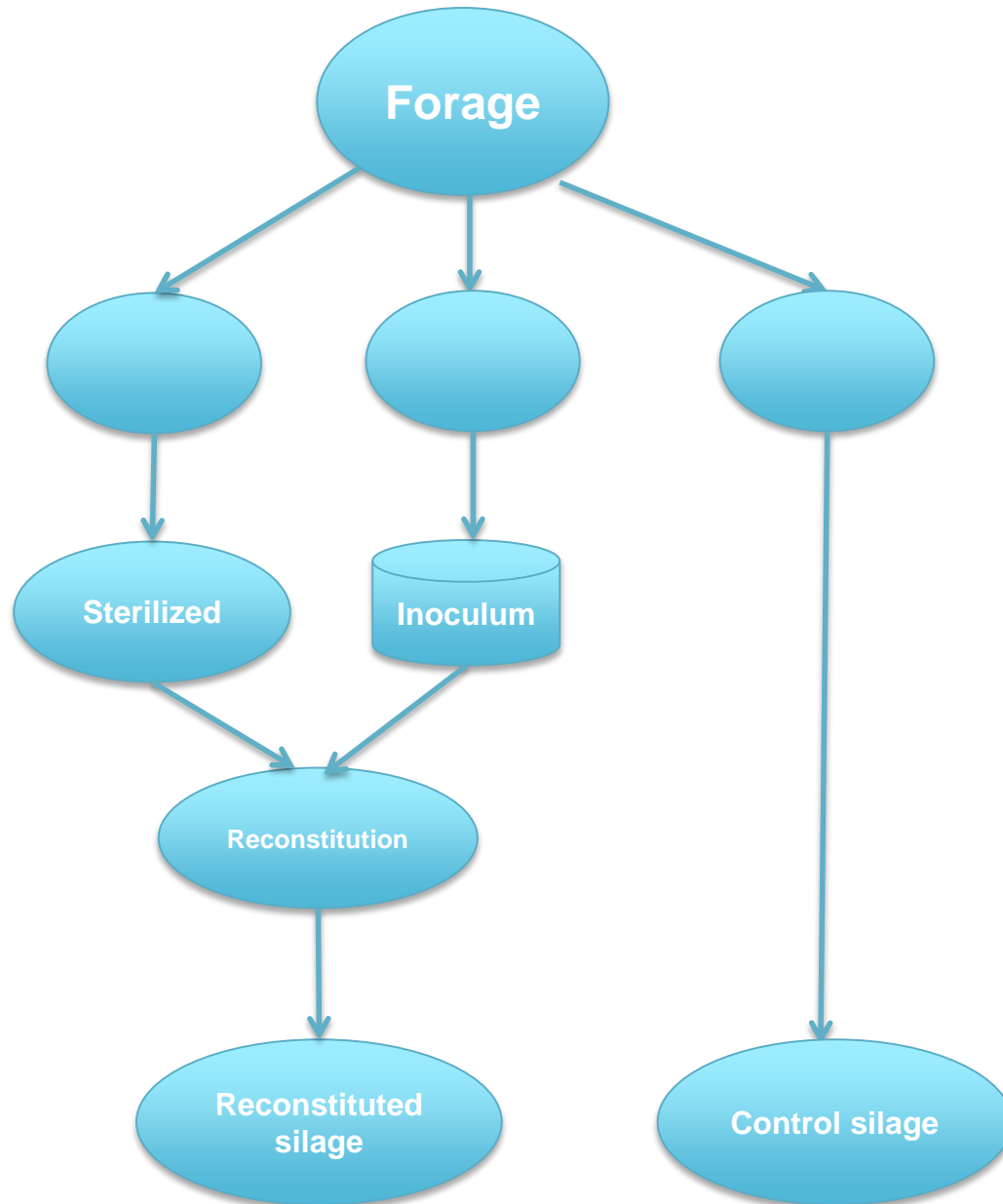
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Design



Design



Materials and methods

- Grass, grass-clover, white clover, maize
- Sterilization
 - Heating dried-ground sample (DM>90%) at 103°C for 15 h
- Inoculum
 - Centrifugation (15500 g for 40 min), sterile filtration, homogenization of the pellet and filters

Materials and methods

- Ensiled for 60-63 d
- Microbial analyses (culture-dependent techniques) on untreated and sterilized forages, silages
- Chemical analyses on untreated and sterilized forages
- Fermentation products of silages
- MIXED procedure, with forage as random factor

Results

Table 1 Microbial counts (\log_{10} cfu g^{-1} fresh matter) of control and sterilized forage samples (Mogodiniyai Kasmaei et al., 2015)

	Treatment			
Variables	Control	Sterilization	SEM	P-value
Enterobacteria	5.83	<0.70	0.25	<0.0001
Lactic acid bacteria	3.83	<0.70	0.48	<0.0001
Yeasts	4.28	<1.70	0.26	<0.0001
Moulds	4.04	<1.70	0.30	<0.0001
Clostridia	3.44	<1.70	0.03	<0.0001

Results

Table 2 Effect of sterilization on chemical composition (Mogodiniyai Kasmaei et al., 2015)

	Treatment			
Variables	Control	Sterilization	SEM	P-value
WSC (g kg ⁻¹ DM)	69	36	8.8	<0.0001
BSN (g kg ⁻¹ total N)	272	213	14.0	<0.0001
ADIN (g kg ⁻¹ total N)	41	63	9.6	<0.01
BC (g lactic acid kg ⁻¹ DM)	61	58	13.0	<0.0001

Results

Table 3 Fermentation quality (g kg⁻¹ dry matter ± SEM) of control and reconstituted silages (Mogodiniyai Kasmaei et al., 2015)

Variables	Treatment		P-value
	Control	Reconstituted	
Lactic acid	59.7 ± 8.0	48.9 ± 7.8	0.04
Acetic acid	17.4 ± 3.4	17.5 ± 3.2	0.97
Butyric acid	0.6 ± 0.2	0.3 ± 0.1	0.27
Propionic acid	1.5 ± 0.4	1.1 ± 0.3	0.39
Ethanol	4.0 ± 0.9	3.2 ± 0.9	0.03
2,3-Butanediol	2.6 ± 0.9	2.0 ± 0.9	0.44
Organic acids plus alcohols	85.9 ± 10.2	73.0 ± 9.9	0.06
Ammonia-N (g kg ⁻¹ total N)	42.8 ± 4.2	26.9 ± 4.0	< 0.001

Results

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Results

Table 4 Microbial counts (\log_{10} cfu g^{-1} fresh matter \pm SEM) of control and reconstituted silages

	Treatment		
Variables	Control	Reconstituted	P-value
Enterobacteria	0.88 ± 0.34	$<0.70 \pm 0.30$	0.27
Lactic acid bacteria	7.88 ± 0.43	7.86 ± 0.43	0.89
Yeasts	2.83 ± 1.12	3.12 ± 1.10	0.58
Moulds	<1.70	<1.70	-
Clostridia	1.98 ± 0.52	$<1.70 \pm 0.45$	0.38

Conclusions

- Sterilization treatment was effective but caused chemical damage
- Differences in fermentation profiles were mainly due to chemical damage
- However, fermentation results were comparable
- The methodology is useful for evaluating relative effects of micro-floras on fermentation quality



Thanks for your attention!!!