

Ensiled whole sugar beets and their influence on preference and feed intake by goats

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- Sugar beets (*Beta vulgaris ssp. vulgaris*)

- Temperate climate zones
- High yields per hectare
- High sugar content

Sugar production

Ruminant feeding

Biogas

Conservation is needed

- Ensiling characteristics of sugar beets

- Low dry matter (DM) content
- Low buffering capacity, high sugar concentration
- Formation of ethanol



Comparing two different methods of conserving sugar beets

Evaluating the effect of ensiled beets on DM intake and preference when used as diet ingredient for goats

- Ensiling of whole sugar beets
 - Untreated control (**CON, control beet silage**)
 - **Treated beet silage (TBS)** with an additive (6 L/t) containing 85% of a formic and propionic acid mixture
- 120l-barrels with a perforated second bottom and one-way valve for exit of gases
- 6 months of anaerobic storage
- Chopping of ensiled beets with a meat cutter
- Preparation and vacuum-packing of experimental diets for 2 preference trials



Ingredients of basal diet (DM 439 g/kg)	% of diet (DM basis)
Maize silage	48
Grass silage	35
Straw	5
Soybean meal	12
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+ Beet silage	varying
Control beet silage (CON)	0; 6.25; 12.5; 18.75; 25
or Treated beet silage (TBS)	0; 5; 10; 15; 20



All diet components	<ul style="list-style-type: none">• Proximate constituents and fibre fractions• 24 h <i>in vitro</i> gas production
All silages	<ul style="list-style-type: none">• Fermentation products and pH• DM correction for volatile compounds (Weißbach and Strubelt, 2008)
Beet silages	<ul style="list-style-type: none">• Glucose, fructose and sucrose, mannitol and glycerol, formic and citric acids• Microbial testing

2 Preference trials (Burns et al. 1997)

- 10 Saanen type wethers
 - German Improved White Goat breed
 - Body weight 93 ± 10.9 kg
- 10 days of adaptation each
- 10 days of experimental period each
- In each trial, all possible combinations of diets (n=10)
- DM intake after 30 min and after 3 h



Statistical analysis of preference trial

- Analysis of variance
- Waller-Duncan k-ratio t-test for minimum significant difference (MSD)
- Level of significance at $p < 0.05$

Chemical composition of untreated (CON) and treated (TBS) sugar beet silages (g/kg DM)

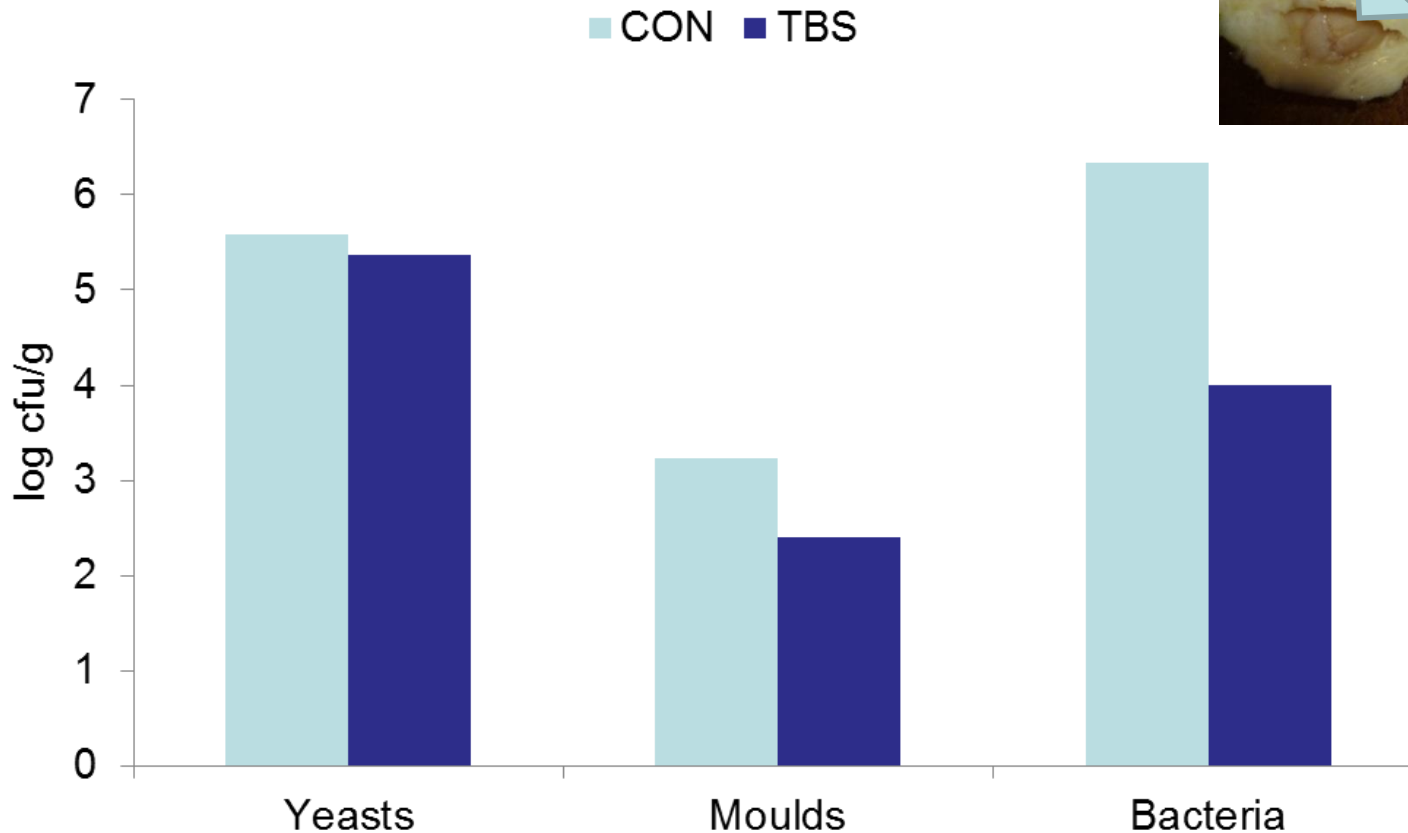
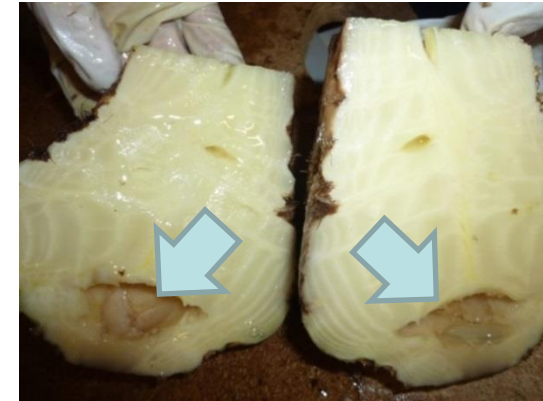
	DM (g/kg)	Crude protein	NDFom	pH	Lactic Acid	Acetic Acid	Ethanol	Sugar	ME MJ/kg DM
CON	213	56	199	3.5	42	35	209	203	14.1
TBS	271	39	122	3.9	6	4	38	700	14.0

NDFom = Neutral detergent fibre expressed exclusive residual ash
 ME = Metabolizable energy

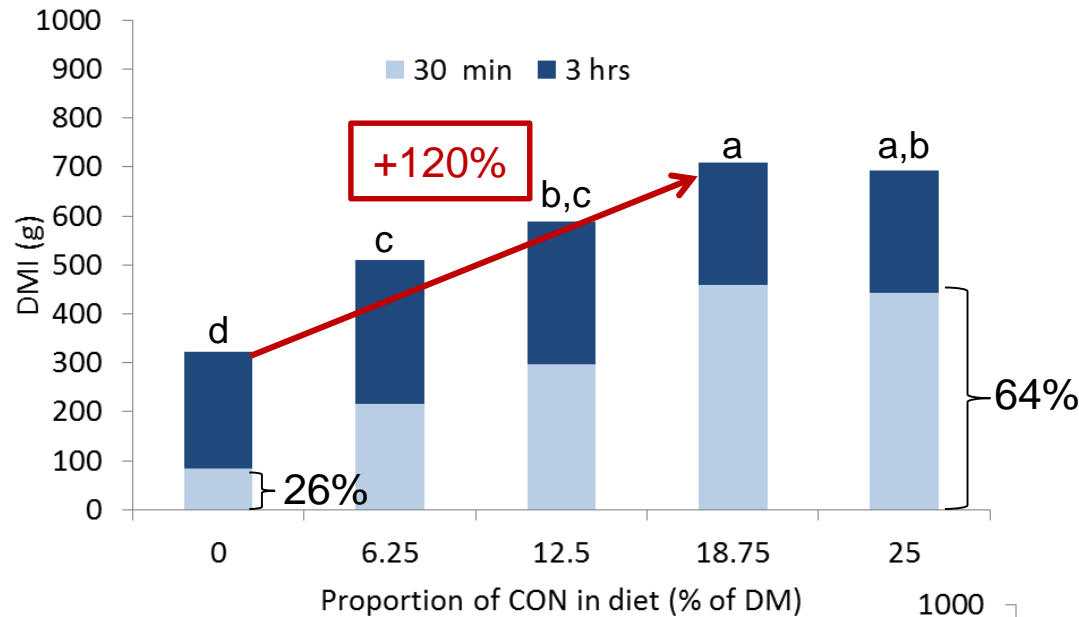


	Glucose	Sucrose	Fructose	Glycerol	Mannitol
CON	87	35	82	22	163
TBS	127	440	133	4	16

Microbial counts (colony forming units (cfu)) in control beet silage (CON) and treated beet silage (TBS)

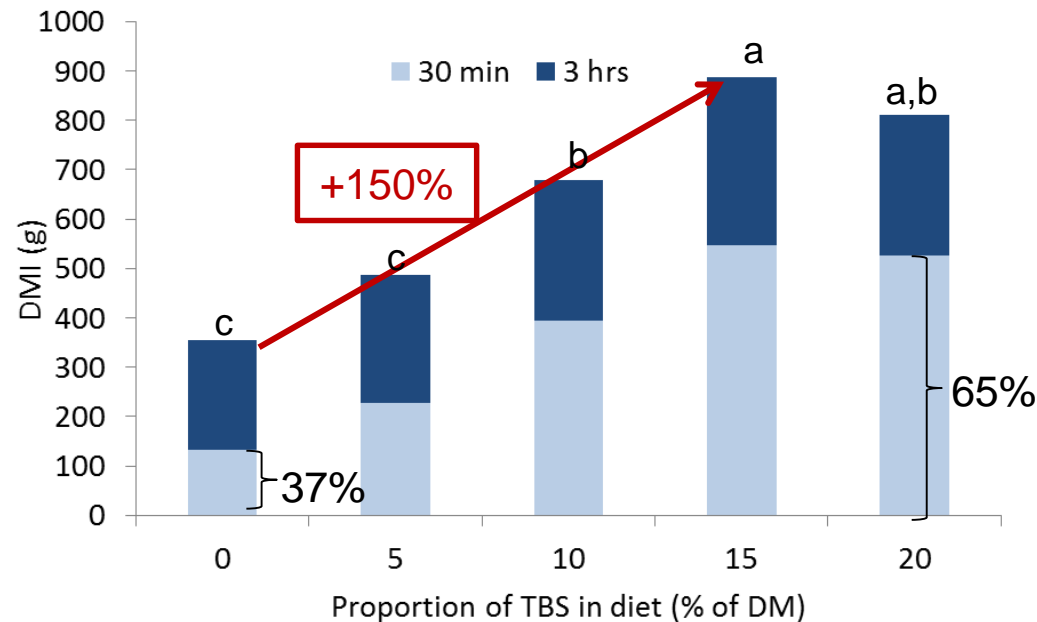


Results – Dry matter intake (n=40)

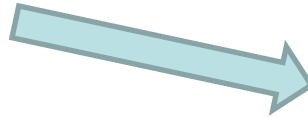


Initial feed intake determined the difference in total DM intake
 → Increased motivation to eat by sensory stimulus?

Promising diet component for high yielding ruminants to enhance intake



- High sensory quality, good microbial status and low pH in both types of ensiled whole beets
- Chemical additive impaired extensive conversion of sugar to ethanol
- No negative influence of ethanol on intake **but high DM losses during ensiling and feed-out**



Anaerobic conversion of sugar into ethanol by yeasts → **50% DM losses** (McGechan 1990)

e.g., ethanol in maize silages: **80% of initial ethanol** emitted after 12 h of air exposure (Hafner et al. 2010)

→ **Use of chemical additive recommended!**

- Positive influence of both CON and TBS on preference and DM intake
- **Ensiled beets as highly palatable, energy-rich diet component**



Thank you!