Abstract number 5331

The prevalence of propanol fermentation in corn silage

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Objectives

1. Investigate the prevalence of propanol fermentation in corn silage at Danish dairy farms.
2. Monitor the seasonal pattern of propanol concentrations in corn silage.

Material and method

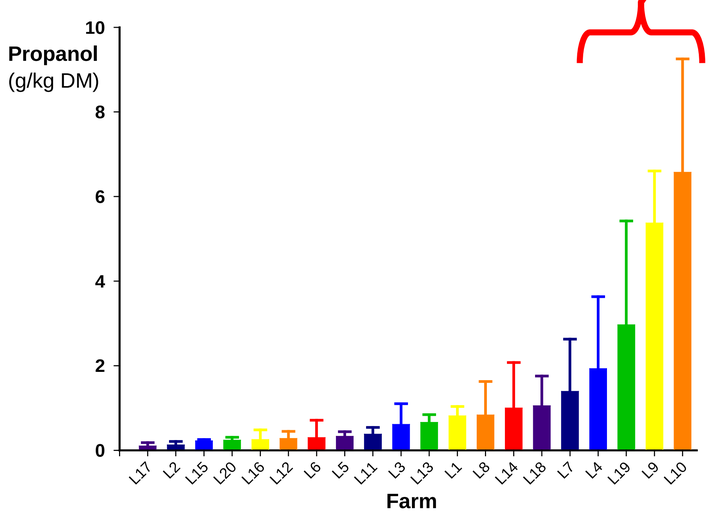
Corn silage from twenty dairy farms were sampled 5 times from January to September 2007.

Samples were obtained by drilling vertical cores one meter behind the bunker face.

Definition: Propanol fermentation = propanol content in silage at ≥5 g/kg DM in at least one sample during the sampling period.

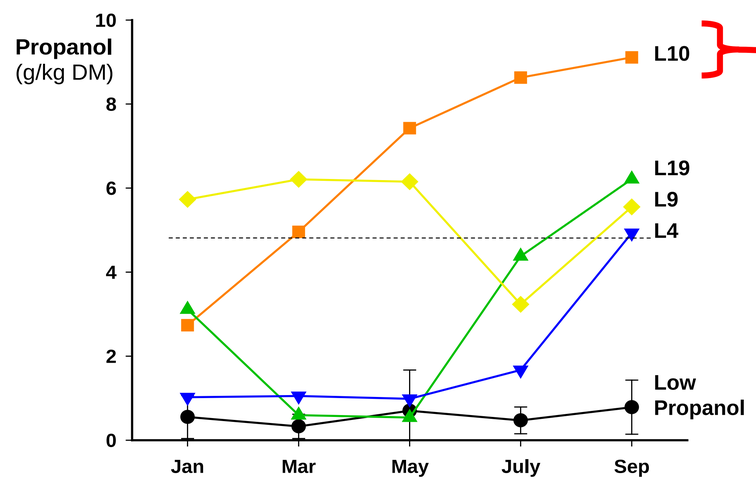
Farm means

Overall farm means from the sampling period



Seasonal variation

The four propanol silages are shown individually, the remaining 16 farms are shown as a mean ± SE (●)

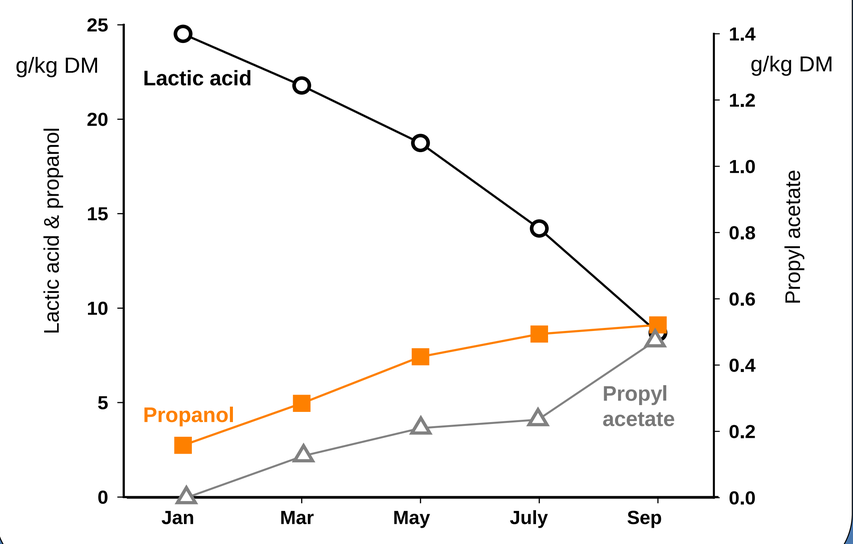


Propanol correlated with:

Propyl acetate (r = 0.88)
Acetic acid (r = 0.86)
2-Butanol (r = 0.81)
Propanal (r = 0.60)
Ammonia (r = 0.49)
Propionic acid (r = 0.46)
L-lactic acid (r = -0.38)

Farm L10

Examples of the propanol correlations at farm level



Propanol concentrations ranged from not detectable to 9.1 g/kg DM.

4 out of 20 farms were designated as having propanol fermented corn silage.

Large variation in fermentation pattern between propanol silages.

First detection of high propanol concentrations in propanol silages were not limited to a specific period in the sampling season.

Propanol concentrations were highest in September.

Apart from the high concentrations of propanol, the observed seasonal changes in fermentation variables were in general small.

Data (means by time, n=20)

	Sample time						*P*		
	Jan	Mar	May	July	Sep	SEM	Time	Min	Max
DM, %	34.5	35.6	35.3	36.6	36.2	0.6	<0.01	31.3	43.4
pH	3.82	3.80	3.83	3.83	3.83	0.02	0.33	3.63	4.14
Centre temp., C	13.28	15.43	15.44	18.79	17.33	0.81	<0.01	8.70	26.90
(g/kg DM)									
Ethanol	15.0	13.1	13.1	12.1	14.6	1.4	0.02	4.9	43.2
Propanol	1.1	0.9	1.3	1.3	2.0	0.5	0.04	0.0	9.1
2-Butanol	0.02	0.02	0.05	0.08	0.09	0.02	0.09	0.00	0.61
Propanal	0.015	0.013	0.013	0.021	0.018	0.003	0.17	0.000	0.064
Ethyl acetate	0.34	0.43	0.44	0.42	0.44	0.02	<0.01	0.27	0.59
Propyl acetate	*0.01*	0.03	0.05	0.05	0.08	0.02	<0.01	0.00	0.47
Propylene glycol	4.3	*2.5*	*2.9*	*2.8*	6.9	1.6	0.21	0.1	59.5
D-Glucose	1.11	1.22	1.50	1.73	1.86	0.30	0.34	0.15	6.15
L-Lactate	30.5	29.3	28.6	27.4	27.9	1.2	0.21	8.7	38.6
NH_3	1.02	1.02	1.07	1.12	1.23	0.05	<0.01	0.53	1.58
Acetic acid	13.2	11.8	12.8	12.5	14.6	1.1	0.02	6.8	29.3
Propionic acid	0.23	*0.10*	0.14	0.18	0.21	0.06	0.12	0.03	1.63
Butyric acid	*0.02*	0.04	0.06	0.08	0.06	0.02	0.05	0.00	0.47

Conclusions

- Propanol fermentation was observed to have a relatively high prevalence (20 %).
- Propanol concentration increased during the season in the four propanol silages, but fermentation pattern of propanol were diverse.
- The fermentation profile of propanol silages resembled that of hetero-fermented silages.
- No predictors of propanol fermentation were found.

Perspective

Reports from the dairy industry indicate great concerns about the impact of propanol fermentation products on dairy cows. Better understanding of the influence of this fermentation profile on silage palatability and dairy cow metabolism is required.

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