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Effect of live yeast on dairy cows under practical conditions

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Mode of action of Live yeasts in ruminants

Yeast characteristics

- Yeasts well known for high respiratory rate (200 to 300 mmol/min per g; Barford and Hall, 1979, Newbold et al., 1996)
- Production of metabolites, e.g. malate, which improves the activity of lactate using bacteria (Nisbet and Martin, 1991)

Benefits of live yeast on rumen bacteria

- Increased viable bacterial numbers one of the most consistently effects (Wiedmeier et al., 1987; Harrison et al., 1988; Kumar et al., 1997).
- Higher number of cellulotic bacterial (Martin and Nisbet, 1992; Wallace and Newbold, 1993; Kumar et al., 1997)
- Production of dicarboxylic acids stimulate lactic acid utilizing bacteria (Nisbet and Martin, 1990, 1991, 1993; Martin and Nisbet, 1992)

Practical Feeding trial – Trial set up (1)

Purpose: Investigation of the effect of a daily dosage of $50x10^9$ cfu live yeast per animal per day on milk production parameters of dairy cows under practical farm conditions.

- Trial location: Practical dairy farm in Germany with a herd of total 1200 dairy cows in free stall barn. Animals are kept in barn all year.
- Trial groups: At the same time 400 animals (German Holstein) from high yielding group involved in the trial, divided into 2 groups of 200 animals each (+Yeast, -Yeast), each group separate feeding band
- Duration: 7 months (01.April-31.October), start on average in lact.wk. 4 (varied from lact.wk. 2 to 6, according to fill up procedure)
- At start groups balanced according milk yield, days of lactation and number of lactation (38.5 kg milk/h/d, 81 lact.days, 1.4 lact.nr.)
- Once a month trial groups filled up with fresh animals (about 50 per group) which assigned at random to one of the treatment groups. Accordingly oldest (in terms of lact.days) removed from the trial.

Trial set up (2)

- Feed: Animals were fed a total mixed ration, which was already used in practice on the farm (see table), TMR was mixed in a computer processed mixed wagon and fed directly to the feeding band.

Feed stuff	Feed Intake (kg/head/day)	Nutrient	Ration content (g/kg DM)
Maize silage	24.00	Crude protein	166
Grass silage	8.00	RNB[1]	± 0
Brewer's grain	4.00	Crude fiber	161
Rapeseed meal	1.00	Structured Crude fiber[2]	2705
Soybean meal	2.00	Starch	231
Concentrated feed	7.00	Resistant starch[2]	1037
Fat (Ca soap)	0.25	Energy MJ NEL	7,2
Mineral feed	0.20		
kg DM/head/day (total)	22.9		
kg DM/head/day (from roughage)	12.6		

[1]= Ruminal Nitrogen Balance
[2] = in g per head per day

Trial set up (3)

- Yeast supplementation: once per day via separate premix (Wheat bran 93.7% + Yeast 6. 7%), dosage75g/h/d (= 15kg per day in treatment group), to provide mistakes no placebo given to control group
- Live yeast concentrate (*Saccharomyces cerevisiae,* MUCL 39885, EU-No. E 1710 + 4b 1710 (gut flora stabilizer), brand name: Biosprint®
  - light-brown product with natural coating and minimum concentration of $10*10^9$ CFU/g
  - Registration for dairy cows, beef cattle, piglets, sows
- Expected CFU levels regularly analyzed and confirmed

Trial set up (4)

- Data collection: daily feed intake per treatment group, weekly individual milk yield, 2 times per month individual milk composition (fat, protein, glucose, somatic cell count, urea)
- Statistics: „proc mixed" from SAS (mixed model with special modeling of lactation curve; beside treatment groups further cofactors lact.nr., trial day)

Number of available animals and observations (entry of milk quantities in staple)

Lactation	Number of animals	Number of observations
1	544	5780
2	227	2337
>2	214	2150

Number of available observations per lactation and day of lactation (day of lactation min=6 max=159)

Lactation	Days in lactation	Number of observations
1	≤ 50	982
	51 - ≤100	2592
	> 100	2206
2	≤ 50	472
	51 - ≤100	1132
	> 100	733
>2	≤ 50	436
	51 - ≤100	1011
	> 100	703

Results (1): Feed intake

Feed stuff	Feed intake (kg DM per animal and day)* Control	Yeast
Maize silage	8.22	8.25
Grass silage	2.16	2.18
Brewer's grain	0.90	0.89
Rapeseed meal	1.21	1.21
Soybean meal	1.80	1.80
Concentrated feed	5.93	5.92
Fat (Ca soap)	0.24	0.24
Mineral feed	0.19	0.19
Biosprint premix	-	0.075
kg DM / head / day	20.650	20.755

* Feed intake calculated from average daily feed quantity per feeding group and number of animals.

Results (2): milk yield

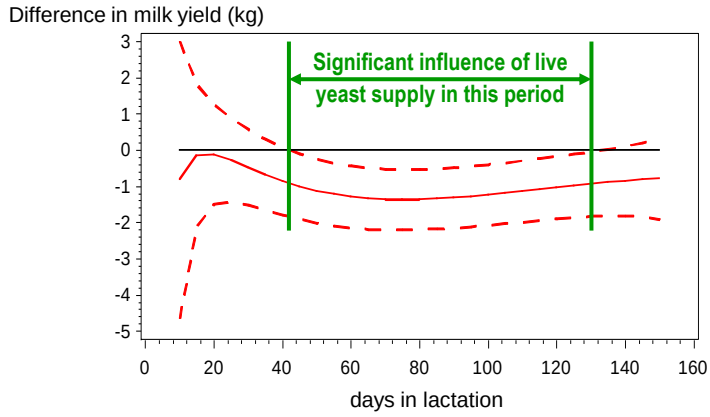
Average Daily Milk Yield (LSMEANS)

	Control (±s)	Yeast (±s)	Difference (B-K)	PR>|t|
Total#	36.88 (0.71)	37.99 (0.71)	+1.10 (0.40)	0.006
1. Lactation#	34.36 (0.73)	34.13 (0.75)	-0.23 (0.49)	0.640
2. Lactation#	38.25 (0.84)	39.33 (0.85)	+1.08 (0.76)	0.160
>2. Lactation#	38.02 (0.86)	40.47 (0.86)	+2.45 (0.78)	0.001
10.-50. day in lactation	34.93 (0.82)	35.49 (0.84)	+0.56 (0.58)	0.340
51.-100. day in lactation	38.00 (0.72)	39.31 (0.73)	+1.31 (0.42)	0.002
101.-150. day in lactation	35.15 (0.73)	36.14 (0.73)	+0.99 (0.44)	0.024
FCM*	33.71 (0.25)	34.51 (0.25)	+0.78 (0.36)	0.026
EFCM*	**34.10 (0.24)**	**34.89 (0.24)**	**+0.79 (0.34)**	0.019

calculated on basis of weekly individual milk yield
* FCM und EFCM calculated on basis of data of the individual milk control (2xmonth)

Results (3): milk yield

Differences in daily milk yield during lactation depending on treatment group
(LSMEANS, Interval limit double sided, P = 0.95)



Continuous line –milk yield mean value difference (Control – Yeast)
Interrupted line – upper and lower interval limit

Results (4): milk fat

(LSMEANS)

	Control (±s)	Yeast (±s)	Difference (B-K)	PR>|t|
Total (in %)	3.36 (0.033)	3.30 (0.033)	-0.062 (0.047)	0.18
1. Lactation	3.20 (0.040)	3.18 (0.041)	-0.016 (0.057)	0.76
2. Lactation	3.46 (0.063)	3.31 (0.063)	-0.150 (0.089)	**0.09**
>2. Lactation	3.42 (0.063)	3.40 (0.065)	-0.017 (0.092)	0.85
Total (in kg/h/d)	**1.241 (0.012)**	**1.266 (0.012)**	**+0.024 (0.017)**	**0.16**

Results (5): milk protein

(LSMEANS)

	Control (±s)	Yeast (±s)	Difference (B-K)	PR>|t|
Total (in %)	3.19 (0.010)	3.16 (0.010)	-0.030 (0.015)	**0.04**
1. Lactation	3.17 (0.013)	3.18 (0.013)	+0.016 (0.018)	0.37
2. Lactation	3.26 (0.020)	3.20 (0.020)	-0.064 (0.028)	**0.03**
>2. Lactation	3.15 (0.022)	3.11 (0.021)	-0.042 (0.029)	0.15
Total (in kg/h/d)	**1.194 (0.008)**	**1.219 (0.008)**	**+0.026 (0.011)**	**0.02**

Results (6): milk parameters

Lactose-, urea content and Somatic cell count

(LSMEANS)

	Control (±s)	Yeast (±s)	Difference (B-K)	PR>|t|
Lactose (in %)	4.79 (0.007)	4.80 (0.007)	+0.005 (0.009)	0.55
Urea (in mg/l)	301.1 (1.93)	303.3 (1.92)	+2.25 (2.70)	0.40
SCC (x1000/ml)	260 (687)	263 (761)	-	-
SCC (ln)	4.50 (0.058)	4.45 (0.058)	-0.05 (0.081)	0.48

Summary

- Live yeasts are influencing rumen fermentation by consuming oxygen and therefore supporting cellolytic microorganisms. Resulting from that the risk of rumen acidosis is less in high production herds with high concentrate levels in the ration.
- In a practical feeding trial with in total 985 dairy cows the influence of $50x10^9$ cfu Live Yeast per cow per day was investigated on feed intake, milk performance and composition.
- Feed intake was not influenced due to the restricted feeding strategy of the farm (Ø 20.7 kg DM/h/d).
- Daily milk yield increased significantly with yeast supply by 1.10 kg (36.9 vs. 38.0 kg/h/d), energy corrected milk by 0.8 kg/h/d.
- The increased milk yield was especially seen within older cows with 2 or more lactations and from lact.day 50 till 150.
- Milk fat and protein percentages decreased slightly due to the higher milk performance, but daily production of milk fat was improved by 24 g/h/d, protein by 26 g/h/d.