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The effect of Yea-Sacc^{1026} in the ration for dairy cows on production and composition of milk

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ABSTRACT

A yeast culture preparation, Yea-Sacc^{1026} (Alltech, Inc.), was introduced into dairy cow rations at 10 g/d over the winter period to determine its effect on cow productivity.

Twenty-four Holstein-Friesian × Black-and-White dairy cows were divided by the analog method into two groups of 12 cows each. The test was carried out over the period from 5 to 85 days following calving.

Fat corrected milk yield was significantly higher ($P<0.05$) in the experimental than in control group (16.5 kg vs 15.6 kg/d). Milk fat percentage and milk protein content increased by 4.5% and 2.9% ($P<0.05$), respectively in the group fed viable yeast culture. Yeast culture (YC) supplementation increased fat yield ($P<0.01$) and protein yield ($P<0.05$) by 7.8% and 6.1%, respectively.

KEY WORDS: yeast, dairy cows, milk yield, milk composition

INTRODUCTION

Yeast cultures lately become an important natural ingredient in diets for all species of livestock at different physiological stages (lactation, postpartum, pregnancy). Among the microbiological feed additives that can improve feed efficiency, live cultures of the yeast species, *Saccharomyces cerevisiae*, seems to be especially important.

Dietary supplementation with viable YC has been reported to increase the productivity and feed utilization both in lactating dams and growing organisms (Beck, 1991; Edwards et al., 1990; Edwards, 1991; Glade, 1991; Glade 1992; Gombos, 1991; Günther, 1990; Hubert et al., 1989; Newbold and Piva, 1991; Williams et al., 1991).

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The effectiveness of dried live YC is limited only to the digestive tract, but the response to natural feed additives is closely connected with management conditions (hygiene, stress, diet composition, health etc.) and type of feeding system. The response to growth promoters is greater when management conditions are not optimal (Wenk, 1990).

The results of many studies have shown the stimulatory effects of supplementing dairy cows with dietary, dried live YC on greater milk yield and higher milk solids content. The effect of live YC on rumen metabolism and digestion has been described in detail by Edwards (1991), Erasmus (1991), Glade and Sist (1989), Glade (1992), Günther (1990) and many other authors.

In general, the inclusion of yeast culture in diets for livestock can modify ruminal metabolism and stabilise the digestive tract environment. The main influence on the ruminal environment involves: increase in total anaerobic, including cellulolytic bacteria (Dawson and Newman, 1987; Dawson et al., 1990; Edwards, 1991; Harrison et al., 1988; Wiedmeier et al., 1987), elevation of ruminal pH and total VFA production (Edwards, 1991; Günther, 1990), increase microbial protein synthesis and microbial N flow to the duodenum due to YC addition (Edwards, 1991; Erasmus, 1991; Newbold and Piva, 1991; Williams, 1989), change of the acetate: propionate ratio, although the results in this area are not univocal (Edwards et al., 1990; Edwards, 1991; Gombos, 1991; Wiedmeier et al., 1987).

The increase numbers of cellulolytic bacteria improve the digestibility of feed fibre fractions and protein (Glade and Sist, 1989; Glade, 1991; Gombos, 1991; Wohlt et al., 1990; Wohlt et al., 1991) which, in turn, stimulates dry matter intake.

Yeast culture has been fed to dairy cattle with positive results. Improvement in dry matter intake (Günther, 1990; Williams et al., 1991; Wohlt et al., 1991), milk yield (Beck, 1991; Günther, 1990; Hubert et al., 1989; Newbold and Piva, 1991; Williams et al., 1991; Wohlt et al., 1991), fat and protein content (Günther, 1990; Williams et al., 1991) have been reported.

This experiment was carried out to determine the effect of Yea-Sacc^{1026} on the yield and composition of milk from dairy cows during early lactation under North-Eastern Polish management conditions.

MATERIAL AND METHODS

Twenty-four Holstein-Friesian × Black-and-White dairy cows were divided by the analog method into two groups of 12 animals each. Cows were fed diets without (control) or with yeast culture, Yea-Sacc^{1026}, at 10 g/head/day (experimental). Yea-Sacc^{1026} (Alltech Inc., USA) was added to concentrate mixture B once a day during the morning feeding (5 a.m.). The experiment was undertaken during the period from 5 to 85 days following calving. Dairy cows were offered typical feed rations (Table 1).

TABLE 1

Composition of daily ration at average yield of 16 kg FCM

Feeds	kg
Cereal-leguminous silage	25.0
Meadow hay	5.0
Fodder beets	13.0
Dried sugar beet-pulp	0.5
Concentrate mixture B*	4.0
Daily ration contains:	
– dry matter (kg)	16.13
from concentrate (kg)	3.55
– crude protein (kg)	2.03
– net energy (MJ)	81.9
– crude fibre (kg)	4.4
Concentration in DM of the diet:	
– crude protein (%)	12.57
– net energy (MJ)	5.08
– crude fibre (%)	27.07

* Composition, %: ground barley 19, wheat bran 20, oat bran 20, ground field bean 10, ground pea 10, ground yellow lupine 5, rapeseed oil meal 13, dicalcium phosphate 0.2, $CaCO_3$ 1.8, NaCl 0.5, Polfamix B 0.5

Crude protein content in concendrate mixture B was 18% and net energy (NE) 5.96 MJ. The diet was rich in crude fibre which made up about 27% DM. The silage from cereal-leguminous crops contained: 24.3% DM; 96 points in the Flieg scale, pH – 4.02, NH_3N/total N – 8%, butyric acid – 0 per cent.

Total daily milk production and percentage contents of protein and fat in milk were estimated every 2 weeks. Fat, protein, lactose, dry matter and non-fat solid in milk samples on days 0 (initial value), 30 and 75 of feeding were estimated using Milko-Scan.

RESULTS AND DISCUSSION

Average daily FCM yield before treatment was very similar in both groups and within the same group (Table 2). Also, the fat and protein yields were very similar in both groups.

Cows supplemented with yeast culture produced 72 kg FCM more than controls (Table 2). The average daily FCM yield was 16.5 kg vs 15.6 kg ($P < 0.05$), respectively. A notable increase (8.6%) in experimental group could be observed on 30 day of treatment (Table 3, Fig. 1). A similar increasing tendency (5.0%–7.9%) was noticed on day 45, 60 and 75 of feeding (Fig. 1). The differences between groups in FCM yield were 7.1% ($P < 0.05$) and 7.9% ($P < 0.05$) on days

TABLE 2

Milk production, feed intake and utilization per 1 kg FCM

Specification		Group	
		control	experimental
Number of cows		12	12
Initial yield:			
milk	(kg)	16.53±1.41	16.65±1.34
FCM	(kg)	15.32±1.56	15.63±1.21
milk fat	(%)	3.51±0.48	3.59±0.52
milk protein	(%)	2.74±0.20	2.78±0.20
fat yield	(g/day)	580±83	598±74
protein yield	(g/day)	453±48	463±46
Average daily yield:			
milk	(kg)	16.84±0.95	17.36±0.99
FCM	(kg)	15.60[a]±0.96	16.50[b]±0.66
milk fat	(%)	3.51±0.26	3.67±0.22
fat yield	(g/day)	591[A]±47.7	637[B]±27.6
milk protein	(%)	2.72[a]±0.09	2.80[b]±0.08
protein yield	(g/day)	458[A]±29.7	486[B]±30.9
In ration intake:			
dry matter	(kg)	16.42	16.72
crude protein	(kg)	2.08	2.15
net energy	(MJ)	83.92	85.95
Efficiency per 1 kg FCM:			
net energy	(MJ)	5.38	5.21
crude protein	(g)	134	130
dry matter	(kg)	1.05	1.01

a, b – $P<0.05$; A, B – $P<0.01$, statistically different from control group
± – standard deviation

60 and 75 of treatment. Improvements in milk yield have also been reported by Beck (1991), Gombos (1991), Newbold and Piva (1991), Williams et al. (1991), Wohlt et al. (1990) and Wohlt et al. (1991). Günther (1990) investigated the effect of *Saccharomyces cerevisiae* on cow productivity and reported a significant increase in milk (+17.4%), fat (+17.4%) and protein yields (+16.3%) during the first 100 days of lactation. Edwards (1991) and Wohlt et al. (1991) suggest that an increase in microbial activity in the rumen provides more VFA and a greater supply of microbial protein, which can explain the improvement of animal performance. Wohlt et al. (1991) reported an earlier and higher peak milk yield in cows fed diets with YC. A similar tendency was found in this study (Table 2, Fig. 1). The addition of Yea-Sacc[1026] caused an earlier and higher increase in milk production and enabled milk yield to remain on an unchanged level in

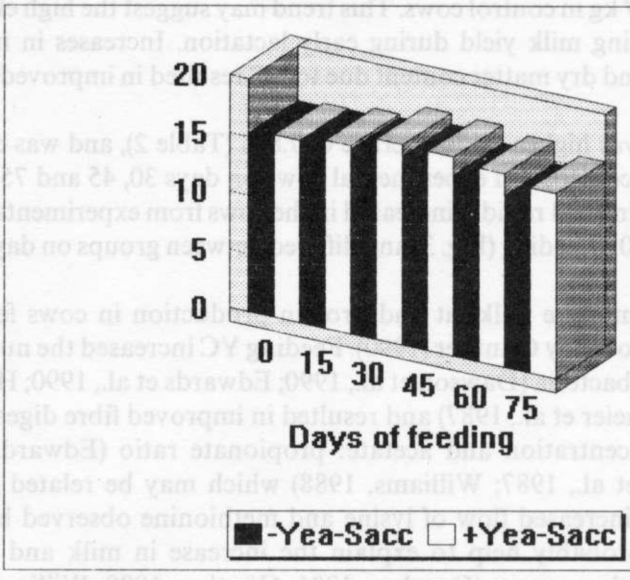

Figure 1. Fat corrected milk yield (kg/day)

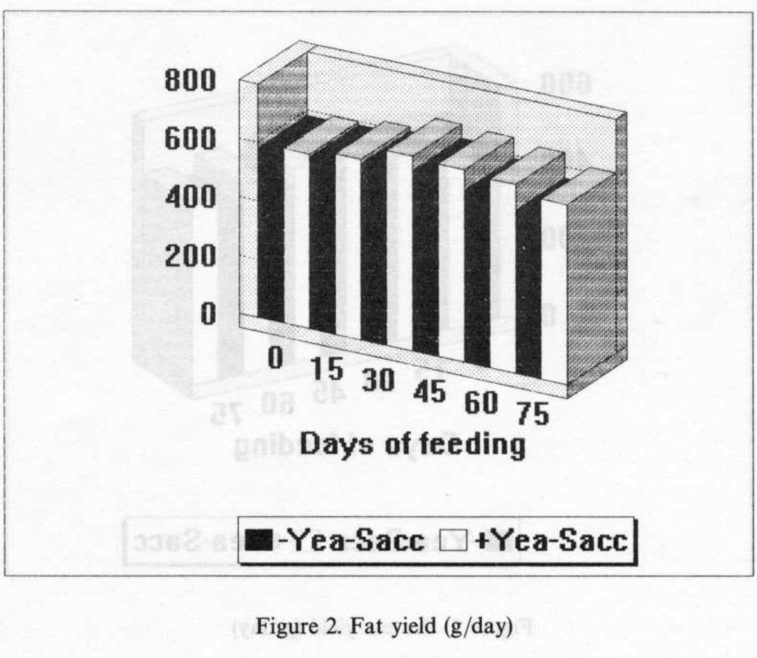

Figure 2. Fat yield (g/day)

comparison to the initial value. However, the difference between initial and final FCM yield was 0.57 kg in control cows. This trend may suggest the high efficiency of YC in maintaining milk yield during early lactation. Increases in milk fat, protein ($P<0.01$) and dry matter content due to YC resulted in improved yield of milk ingredients.

Milk fat yield was higher by an average of 7.8% (Table 2), and was different ($P<0.05$) between control and experimental cows on days 30, 45 and 75 feeding (Fig. 2). Milk protein yield rapidly increased in the cows from experimental group starting from day 30 of feeding (Fig. 3) and differed between groups on days 45, 60 and 75 ($P<0.05$).

The trend to improve milk fat and protein production in cows fed yeast culture was also shown by Günther (1990). Feeding YC increased the number of cellulolytic rumen bacteria (Dawson et al., 1990; Edwards et al., 1990; Harrison et al., 1988; Wiedmeier et al., 1987) and resulted in improved fibre digestibility, ruminal VFA concentration and acetate: propionate ratio (Edwards et al., 1990; Wiedmeier et al., 1987; Williams, 1988) which may be related to milk fat synthesis. The increased flow of lysine and methionine observed by Erasmus (1991) may probably help to explain the increase in milk and protein yield reported in other papers (Gombos, 1991; Günther, 1990; Williams et al., 1991).

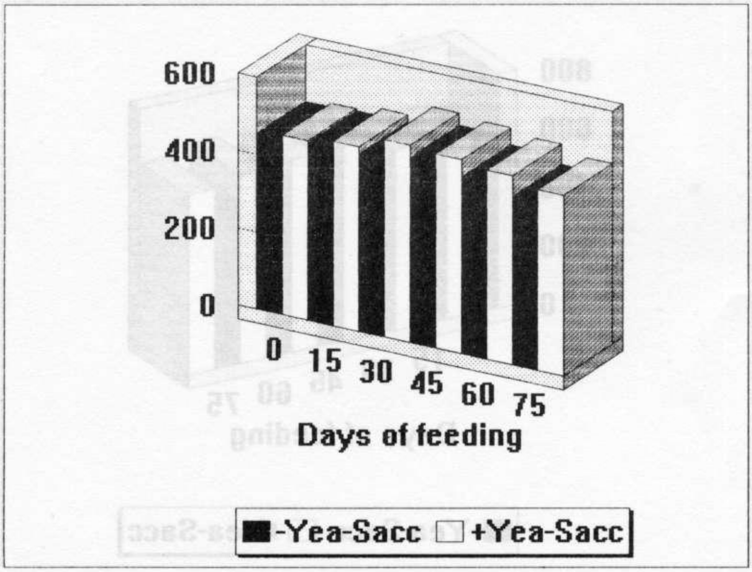

Figure 3. Protein yield (g/day)

The favourable effect of the viable yeast culture of *Saccharomyces cerevisiae* species was also noted on feed utilization for milk production (Table 2). The feed conversion efficiency expressed in net energy and crude protein per 1 kg FCM was improved by about 3% in the Yea–Sacc[1026] group, which can contribute to a reduction of costs in milk production.

TABLE 3

Chemical composition of milk (%)

Specification		Group	
		control	experimental
0 day:	n	12	12
fat		3.51±0.48	3.59±0.52
total protein		2.74±0.20	2.78±0.20
lactose		4.89±0.16	4.79±0.23
dry matter		11.84±0.60	11.86±0.53
solids-non-fat		8.33±0.22	8.27±0.28
30 day	n	12	12
fat		$3.55^{a}\pm0.18$	$3.72^{b}\pm0.20$
total protein		$2.70^{A}\pm0.04$	$2.84^{B}\pm0.07$
lactose		4.80±0.10	4.71±0.13
dry matter		$11.76^{A}\pm0.22$	$11.97^{B}\pm0.25$
solids-non-fat		8.21±0.08	8.25±0.17
75 day:	n	12	12
fat		3.52±0.29	3.71±0.30
total protein		$2.73^{A}\pm0.06$	$2.80^{B}\pm0.05$
lactose		4.74±0.16	4.75±0.13
dry matter		11.68±0.38	11.96±0.42
solids-non-fat		8.16±0.18	8.25±0.15

a, b – $P<0.05$; A, B – $P<0.01$, statistically different from the control group
± – standard deviation

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STRESZCZENIE

Wpływ preparatu Yea-Sacc^{1026} na wydajność i skład mleka

Preparat Yea-Sacc^{1026} (Alltech Inc., USA), zawierający żywe kultury drożdży, dodano do dawek dla krów mlecznych w ilości 10 g/dzień/szt. celem zbadania jego wpływu na wydajność i skład mleka w okresie żywienia zimowego od 5 do 85 dnia po wycieleniu.

Dwadzieścia cztery krowy rasy hf × cb podzielono metodą analogów na dwie grupy żywieniowe po 12 zwierząt: kontrolną i doświadczalną (dodatek drożdży).

Wydajność FCM była większa o 5,8% ($P < 0,05$) u krów otrzymujących preparat Yea-Sacc[1026] (16,5 kg vs 15,6 kg/dzień). Zawartość tłuszczu i białka w mleku wzrastała w grupie doświadczalnej odpowiednio o 4,5 i 2,9% ($P < 0,05$) w porównaniu z kontrolną.

Zastosowanie kultur drożdży wpłynęło na wzrost wydajności tłuszczu o 7,8% ($P < 0,01$) i białka o 6,1% ($P < 0,05$) w porównaniu z grupą kontrolną.