INTEREST OF A CONCENTRATE OF LIVE YEAST CELLS-BIOSAF FOR BEEF CATTLE AND DAIRY COWS

J. Tournut - Prof. Ecole Vétérinaire de Toulouse
8 rue Lakanal - 31 000 Toulouse - France

C. Roques - L. Dussert - S. Jonvel
LESAFFRE DEVELOPPEMENT - 146 rue Gabriel Péri - 59706 Marcq en Baroeul - France

Introduction

BIOSAF is a concentrate of live yeast cells of Saccharomyces cerevisiae (strain Sc 47) containing more than 5.10^9 viable cells per gram.
Due to a proprietary process, BIOSAF is presented in round shape particules, naturally coated. This particular process provides a very good resistance to heat shock during the pelleting process, so that the product can be incorporated in pelleted feed.

Conditions of use

BIOSAF is proposed all along the fattening period of fattening bovines, between weight of 60-80 kg and 500-600 kg ; this period can be reduced to 3 months of use.
BIOSAF has to be mixed in complementary or complete feed considering the following daily dosis : 4 g + 1 g/100 kg of live weight of the animal.

Zootechnical efficacy of BIOSAF yeasts

The table 1 collects together zootechnical trials, evaluating the effect of BIOSAF on the growth (ADGW) of fattening bovines (see **table 1**).

The comparison between control group and treated group shows a positive effet of BIOSAF on the growth of the animals, sometimes significant, from 4 to 8 % of ADGW. The increase in treated group average is partially due to an homogeneisation of the growth.

Pr AERTS and al. (UNIVERSITE AGRONOMIQUE DE GAND, Belgique) put forward a modification of the quality of carcass of bull calves by administering BIOSAF yeasts. The results show significative differences ($P<0,05$) between treated animals and control animals considering the % of meat (+ 3.35) and the % of fat (- 2.82), on the basis of an equivalent carcass yield. These differences could be explained by an increase in the quantity of bacterial proteins available for the animal, that means a globally more important flora in the rumen.

Effects on biochemical parameters of rumenal fermentation

Measurements on biochemical parameters of the rumen show that the effect of BIOSAF yeasts depends on the equilibrium of the rumenal flora, this equilibrium possibly depending on the quality of the diet provided.

Studies run by Pr BOUCQUE and al. (National Institute for Animal Nutrition Agricultural Research Centre - MELLE GONTRODE, Belgium) on fistulated sheeps clearly demonstrated that there is an interaction between diet type and yeast treatment regarding the rumen fermentation. On animals fed with a high content of starch (maize silage + cereal concentrates), significant differences appear on the rumenal pH which is increased (6.15 vs 5.78 for the control) and after, stabilized ; the production of iso-acids is also higher in the treated animals.

The administering of BIOSAF yeasts in the case of these diets highly concentrated in starch, can limit digestive acidosis risks caused by excessive production of acids, notably lactic acids.

Pr AERTS studied the effect of BIOSAF on the products of fermentation (Volatil Fatty Acids). Two types of diets (proteic concentrates and maize) were tested. Samples of feed have been incubated "in vitro", with or without BIOSAF, in rumen juice. The results show that the proportions of volatil fatty acids produced were not modified. On the other hand, for both diets, total quantities of VFA and iso-acid were increased and, in the case of concentrate, proportionaly to the quantity of BIOSAF given (see **tables 2.1 and 2.2**).

Pr GEDEK (Ludwig Maximilians Universität - MUNCHEN - GERMANY) and Dr AHRENS (IS Forschungsgesellschaft für Experimentelle Tierphysiologie und Tierernährung - WAHLSTEDT - GERMANY) realized similar tests on lactating rumenal fistulated cows fed with and without BIOSAF.

During the last two weeks of the 5 weeks of administration, 2 h after feeding the first portion of BIOSAF (daily administrated in 2 different times), the concentration of the single acids and as the result of this the total sum of VFA, were increased slightly without altering the acetic to propionic acid ratio. The same trend for the sum of VFA was measured 2 h later.

Effects on microbial flora of the rumen

Pr GEDEK and Dr AHRENS have demonstrated, on fistulated cows, that giving BIOSAF favourably modifies the digestive flora of ruminants. They put forward a reduction of variations in microbial populations.

The content of living yeasts cells, measurable in the rumenal fluid (10^5/ml of fluid) accurately corresponds to the numbers supplied. The rumenal and faecal floras of treated animals were more important. Certain microbial populations were more specifically increased, particularly lactobacilli in the rumen and in the faeces, but especially strictly anaerobic gram- bacteria, significantly augmented in the rumen (multiplied by 10). It can be assumed that the increase in total VFA observed by Dr AHRENS is caused by increased counts of the gram- anaerobic bacteria. In this group, as well cellulolytic or those which are involved in cellulose digestion (Selenomonas ruminantium) as amylolytic bacteria are covered. Because the results of the ADF degradation rate of roughages in the rumen showed no clear effect in improving fiber digestion, it could be assumed that the yeast stimulates specially the growth of the amylolytic bacteria in this group of microorganisms. These species are able to use, among others, lactic acid. This could be the reason for steady pH values under yeast feeding, although the counts of lactobacilli increased. This rise in this population might explain the more pronounced effect regarding pH and iso-acids productions, noticed by Pr BOUCQUE when animals are fed with highly concentrated starch diets.

(see table 3 and graph)

Pr GEDEK measured that, under BIOSAF treatment, in the feces, only 5 % of the amylolytic bacteroidaceae of the rumenal fluid are found, while under control phase, 16.3 % of these bacteria are detected. It can be assumed that BIOSAF leads to a better qualitative and quantitative bacterial protein utilization by the host. Additionnal research is planned to verify that.

This hypothesis could explain the higher % of meat measured by Pr AERTS on carcasses in the case of bull calves treated with BIOSAF.

CONCLUSION

Research focused on biochemical and microbial aspects of the gastro-intestinal tract of ruminants established that the significative differences appear, when live yeast BIOSAF is ingested, in the case of diet with a high content of starch. The use of diet highly concentrated in starch is more and more developped, due to the intensification of breedings ; in this type of diet, BIOSAF could participate to the stabilization of the fermentative patterns of the rumen or could be proposed as a preventive solution to the potential troubles.

These studies help us to better understand the way of action of live yeast cells in the rumen, and to try and explain good performances obtained on field tests, both on beef cattle and dairy cows.

As BIOSAF strain Sc 47 causes changes within the bacterial populations of the rumen of dairy cows, but also minimizes the variation in their numbers at the same time, it can be said that the yeast culture has flora stabilizing and bioregulating properties, and acts as a probiotic when it is used as a feed additive.

SUMMARY

BIOSAF is a concentrate of live yeast cells of Saccharomyces cerevisiae (strain Sc 47) containing more than 5.10^9 viable cells per gram. Its original coating confers a particularly good stability to the live cells, even under pelletization.

In a fondamental study run on fistulated dairy cows, it has been shown that with a 10 grams daily intake of BIOSAF, there is a new rumenal flora equilibrium instituted.

Live yeast cells transit under a viable form all along the digestive tract.

When ingested by ruminants, BIOSAF modifies the balance of the microflora and increases more specifically certain microbial populations (gram– anaerobic bacteria multiplied by 10), particularly amylolitic bacteria. Via amylolitic bacteria, the administering of BIOSAF can improve the fermentation process of starch and reduces the quantities of lactic acid. This interaction can play a decisive role in the rumen stability and the animal health.

Complementary studies tend to demonstrate that the effect of BIOSAF yeasts, expected on biochemical parameters of rumenal fermentation, is linked to the type of diets provided to the animals. Responses would be better in the case of diets highly concentrated in starch.

On a zootechnical aspect, different European Institutes and users established that BIOSAF integrated in the bull calves diets has a beneficial effect on the growth (from 4 to 8 % of ADGW) and the quality of carcass (increases the % of meat and decreases the % of fat).

Table 1

Effects of BIOSAF on the growth of bull calves :

PARTNERS	COOP TWENTE	COOP J.B.A.	NAT. INST. OF ANIMAL NUTRITION	FRENCH INSTIT. OF BREEDING	PREVITAL	COOP J.B.A.	UNIV.AGRO OF GENT
(Country)	(NL)	(F)	(B)	(F)	(F)	(F)	(B)
Dosis Biosaf (g/kg feed)	1.6	1.6	1.3	1.2	1	1.15	1.2
Starting weight (kg)	70	110	173	376	388	450	530
Number animals / treatment	27 Croisé Franç.	40 Montbéliards	36 Bl.Bl.Belges.	24 Charolais	25 Limousins	70 Char.x Salers	15
Duration (days)	106	110	154	229	225	100	115
Control ADGW (g/day)	759	1184	753	750 (W.carcass)	920 (W.carcass)	1247	1397
Improvement (g/day) (in %)	25 +3.3%	72 +6.1%	37 +4.9%	42 +5.6%	30 +3.3%	105 +8.4%	62 +4.4%

Table 2.1

Effect of a supplementation of BIOSAF yeasts on the volatil fatty acids concentrations (sample of concentrate incubated during 24 H in rumen juice)

Molar proportions	Supplements (% of the concentrate) None	0,35	0,70
Acetate	66.8	65.6	66.4
Propionate	21.0	21.6	20.5
Butyrate	12.2	12.7	12.6
Acetate / Propionate	3.18	3.04	3.24
Total VFA (mM)	138.9	158.0 + 13.7 %	174.5 + 25.6 %

Table 2.2

Effect on the volatil fatty acids concentration of a 0.70 % BIOSAF yeasts supplementation (samples of maize incubated during 4 and 8 H in rumen juice)

Molar proportions	4 H		8 H	
	Control %	*BIOSAF* %	*Control* %	*BIOSAF* %
Acetate	31.9	42.2	65.7	66.1
Propionate	35.9	30.2	21.1	19.5
Butyrate	26.1	20.4	12.2	13.3
Acetate / Propionate	0.89	1.40	3.13	3.39
Total iso-acids	4.4	7.6	0.4	1.7
Total VFA (mM)	108.8	144.5	138.7	165.7

Table 3

EFFECT OF BIOSAF ON MICROBIAL COUNTS
(Unity : ml/g in Log)
OF RUMEN (R) AND FAECAL FLORA (F) OF DAIRY COWS (n = 4)

Comparison between treated periods and not treated periods, 3 weeks each

Period	Lactobacillus		Strictly anaerobic Gram+ bacteria		Strictly anaerobic Gram− bacteria		Coliforms		Enterococci		Yeasts		Anaerobic fungi
	R	F	R	F	R	F	R	F	R	F	R	F	R
TREATED													
Average variation	6,0	6,7	6,6	7,2	5,2	4,0	3,9	5,0	2,5	1,9	5,0	4,2	3,9
	R (5,2–6,9) F (5,9–8,2)		R (5,9–8,2) F (6,2–8,5)		R (4,5–7,6) F (3,3–5,4)		R (2,0–5,3) F (3,0–5,8)		R (1,7–5,4) F (3,0–5,8)		R (2,5–6,0) F (1,7–4,9)		(3,2–4,6) (3,2–4,6)
NOT TREATED													
Average variation	5,7	6,6	6,6	7,0	4,2	3,4	3,9	4,9	2,5	2,2	2,2	2,4	4,2
	R (4,2–6,8) F (4,7–7,8)		R (4,1–7,5) F (3,3–7,6)		R (2,0–5,4) F (1,7–5,4)		R (1,7–5,4) F (1,7–5,4)		R (1,7–3,4) F (3,0–5,8)		R (1,7–3,4) F (3,9–5,8)		(3,4–5,0) (1,7–5,7)

Graph

EFFECT OF BIOSAF ON MICROBIAL SPECTRUM OF RUMENAL FLUID (R)
AND FAECAL FLORA (F) OF 4 DAIRY COWS (ml/g)