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EFFECT OF A DIETARY SUPPLEMENTATION OF LIVE YEAST ON THE ZOOTECHNICAL PERFORMANCES OF DOES AND WEANLING RABBITS

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Abstract

Two dietary levels (0.15% and 1%) of live yeast (Biosaf) were added to both does and their weanlings, in order to evaluate the effects on zootechnical performances. These levels correspond with a dietary concentration of 7.5×10^6 and 5×10^7 cells/g, respectively. In total 60 does and the total number of their 460 weanlings were involved in the experiments. Post-pelleting yeast counts revealed sufficient stability under our conditions of pelleting (<70°C).

Pre-weaning performances were not significantly different between treatments. A tendency ($P<0.1$) to heavier kits' weaning weight (+6%) was noted when fed the 0.15% diet.

Under optimal housing conditions, overall results of weanlings were high but not significantly different. Average daily weight gain between 4 and 10 weeks of controls, Biosaf 0.15% and 1% amounted to 43.0 g; 44.0g and 43.3 g, respectively. Effects of the addition of yeast were much more pronounced under less favourable housing conditions, especially when 0.15% Biosaf was added to the diet. Compared to the control, daily weight gain was significantly improved ($P<0.05$) while mortality was significanly lowered ($P<0.01$). Overall mortality of the two fattening trials was 13.8%, 3.3% and 7.1%, respectively. The results obtained in the experimental groups tended to be more homogeneous.

Introduction

Last years, an increasing number of probiotics are available for animal production. Probiotics are dietary supplements containing beneficial live or reviable micro-organisms. They are added to the diet with the intention of having these organisms to colonize the gut. Their mode of action is generally ascribed to their ability to stimulate the digestion process and/or to contribute to the microbial equilibrium of the gut (for a review see Vanbelle et al., 1990). In contrast with antibiotics, their objective is not to destroy pathogenic bacteria, but to exercise a barrier effect against pathogens by preventing their development and colonisation in order to secure optimal

utility of the feed. For this reasons, the use of these alternative natural products in animal feeding is much less questioned by the consumer lobby.

Because these additives have a cost-increasing effect on the feed, only products which improve significantly animal performances are interesting for practical application. Although encouraging results are reported with numerous livestock species, the zootechnical efficiency is still disputed. Therefore zootechnical trials are necessary to evaluate the efficiency of probiotics as growth promoter or as buffer against pathogenic micro-organisms. For this purpose rabbits are extremely suitable. Not only because they are one of the smallest meat producers, but especially because commercial rabbit production is characterised, among others, by its high losses due to enteric diseases (Peeters, 1988).

One of regulating and stimulating agents of the digestive process are live yeast cultures. Already longtimes used for other purposes, their application as probiotic in animal nutrition is relatively recent. Favourable results are reported in many livestock productions (Chapmann, 1988, Harker, 1989, Fiems et al., 1992) as with rabbits as well (Hollister et al., 1989 and 1990).

This report deals with the effect of a concentrated Saccharomyces cerevisae strain (Biosaf SC 47, S.I. Lesaffre) on the performances of does and weanling rabbits housed under different conditions.

Materials and methods

Animals

Ninety multiparous does, belonging to the female line of the Institute (Maertens, 1990), were randomly divided in three groups and inseminated with sperm from the male line of the Institute, in order to obtain sufficient homogeneous litters on the same day. At parturition, litters were standardized to 8 kits by cross fostering. Two days post kindling, out of each group, 20 does were retained for the experiment. Weaning was performed when kits were 28 days old. All weaned rabbits were used for the fattening trial. Each litter of weanlings was divided, in order to house the kits under different environmental conditions.

Experimental diets

Experimental diets were prepared at the Institute, in accordance with the recommendations of the INRA (Lebas, 1989). Ingredient and chemical composition of the reproduction and fattening diet as well is shown in table 1. The tested yeast (5×10^9 live cells/g) was added to the diets before the pelleting process. The product was supplied in spherical particles ($\pm$ 0.8 mm ∅), surrounded by a protective cellular shell in order to protect the live cells against pelletization of the diets. The yeast was added at two levels: 0.15% and 1% to both diets, which correspond with a dietary concentration of 7.5×10^6 and 5×10^7 cells/g, respectively. The 1% dose was used only to study possible toxic effects. Pellets (1 cm x 3.2mm ∅) were prepared without steam supplementation. Temperature was around 60°C and always lower than 70°C during pelletization.

Does received experimental diets from the insemination off, till their kits were three weeks old. Afterwards the fattening diets were fed ad libitum. All kits were weaned at the same day (28 - 29 days old).

Housing

Does were housed on wire flat-deck cages (60 x 43cm), equipped with a nipple drinker, an outside placed feeder and nestbox. Temperature was maintained at 18°±2°C. Artificial lighting was provided for 16 h (does) and 9 h (weanlings).

At weaning, 3 kits were randomly selected out of each litter and transferred to a separate room (fattening trial 1). In total 20 replicates of 3 rabbits per pen were housed in cages as described above. The experimental room was artificially heated and ventilated in order to create optimal environmental conditions (± 18°C). Formerly this room was cleaned, desinfected and during 3 months non-occupied. Housing density of rabbits was low (3 rabbits/m^2 floor area).

All other weaned kits were transferred to a fattening unit (fattening trial 2) in order to judge the effect on mortality. They were housed per litter on tree-tier level cages (70 x 60 cm). This unit was occupied with other fatteners and used continueously during several months. Housing density was much higher (± 14 rabbits/m^2 floor area).

Recordings

Does were weighed at parturition and at 3 and 4 weeks post kindling. Kits were weighed before and after standardization as well and at 3 and 4 weeks of age. Weighings were performed individually, in order to judge the homogenicity. At weaning all kits received an ear tag. Post weaning recordings were done two weekly during the fattening period of 6 weeks (fattening trial 1). Feed consumption was recorded per pen but weight gain individually.

In fattening trial 2, daily weight gain over the six-week fattening period was determined. Mortality was recorded daily.

Statistical analysis

Data were subjected to analysis of variance. Post weaning weights were submitted to covariance analysis with weaning weight as covariate. Least significant differences comparisons were made between means, when there was a significant F value. Mortality was judged using the X^2-test.

Results and discussion

1. Yeast stability

Samples of the experimental diets were assayed on their concentration of viable yeast cells (by S.I. Lesaffre). Results demonstrated a very good agreement between the expected and determined number of cells (Table 2). With the exception of the reproduction diet 0.15% (6.9 x 10^6 instead of 7.5 x 10^6/g), always a somewhat higher viable yeast count was obtained. This proves the stability of the yeast under our conditions of pelleting (<70°C). Also in the control diets yeast counts of 4-8 10^3 /g were determined. This phenomenon can be ascribed as a consequence of air contamination and this count was lower than reported by Harrison et al. (1988).

2. Effect on pre-weaning performances

Average weight of the does at different reproduction stages was comparable among treatments (Table 3). Kits' weaning weight tended ($P<0.1$) to be higher compared to the control group and reached 606; 643 and 612g in the control and both yeast treatments, respectively. Pre-

weaning mortality was very low (5% or less) in all groups. An explanation has to be searched into the standardization of litter size and the initial selection (2 days post-kindling) of sufficient good litters.

Litters of both experimental groups were more homogeneous compared to the non-treated group (Table 6). The average intra-litter varation coefficient of weaning weight was 11.4; 6.8 and 9.0%, respectively.

3. Post-weaning performances

A summary of the results of fattening trial 1 is given in table 4. Under optimal housing conditions, average daily weight gain and feed efficiency were not statistically different. The overall high performance level reflects the healthy status of the rabbits. As a consequence mortality was low and any conclusions due to the yeast supplementation could not be drawn.

Under less favourable housing conditions, differences between treatments were more pronounced (Table 5). Rabbits fed the Biosaf 0.15% diet achieved significantly ($P < 0.05$) better average daily gain than controls and they suffered less mortality ($P < 0.01$). When all weaned kits are considered, mortality was 13.8% (control); 3.3% (Biosaf 0.15%) and 7.1% (Biosaf 1%). Differences in favour of the yeast supplementation were significant to highly significant. Although not all died rabbits were autopsied, about 80% of them showed external signs of diarrhoea.

Overall effects of the yeast supplementation are given in table 6. Although about equal number of kits were weaned in all groups, 13% (Biosaf 0.15%) and 10% (Biosaf 1%) more rabbits achieved slaughter weight when fed a yeast supplemented diet. In comparison with the control animals, their final weight was respectively 4% and 1% higher. Intra litter variation tended to be lower on yeast supplemented diets: VC 5.3 % vs 6.4%, respectively.

In the faeces of fatteners, significant counts of yeasts were determined (Table 2). This indicates the viability of the yeast strain and the possible colonisation of the yeast cells in the gut.

Conclusions:

At the recommended incorporation level of 0.15% Biosaf SC 47 (7.5×10^6 cells/g), significant to highly significant improvements of zootechnical performances were determined. Although less pronounced, results showed the same tendency at the overdose of 1%. Yeast supplementation had the most beneficial effect on reducing mortality. These observations are in agreement with those by Hollister et al.(1989 & 1990). They found also that positive effects were more pronounced under suboptimal conditions when high enteritis incidence in control animals occurred.

More research is necessary in order to understand better their mode of action. Studies at the Munich Veterinary Faculty have already shown that a highly concentrated and controlled strain of Saccharomyces cerevisae is able to transit under a viable form all along the digestive tract, carrying the *Escherichia coli* fixed on their membrane (Gedek, 1989). Microbiological and biochemical studies at the site of the well developped rabbit hindgut can prove their inhibiting effect towards pathogenic micro-organisms and their beneficial influence to achieve a well balanced microbial mass.

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Table 1. Ingredient and chemical composition (%/kg) of the basal diets.

Ingredients	Reproduction diet	Fattening diet
Alfalfa meal 20	25.0	-
Alfalfa meal 16	-	33.3
Wheat shorts	23.3	30.0
Wheat	16.0	12.0
Sunflower meal	14.5	5.0
Full fat soybeans	9.0	7.0
Flax chaff	5.5	6.0
Molasses	4.0	4.0
Sodium chloride	.1	.05
L-lysine HCl	.1	-
DL-methionine	-	.05
Vit.-Min. mix	2.5	2.5
Meticlorpindol/methylbenzoquaat	-	.1
Biosaf	0 - 0.15 - 1.0	0 - 0.15 - 1.0
Analysis (%/kg)		
Dry matter	90.5	87.9
Crude protein	18.7	15.7
Crude fat	5.2	4.0
Crude fiber	12.5	15.5
Lysine (calculated)	.9	.75
Ca (calculated)	1.2	1.2
Digestible energy (calc., kcal)	2500	2300

Table 2. Results of the yeast counts in diets and faeces.

	Expected[1]	Counted
Biosaf 0%		
Reproduction diet	$0 - 10^3$	4×10^3
Fattening diet	$0 - 10^3$	8×10^3
Biosaf 0.15%		
Reproduction diet	7.5×10^6	6.9×10^6
Fattening diet	7.5×10^6	8×10^6
Biosaf 1%		
Reproduction diet	5×10^7	6.1×10^7
Fattening diet	5×10^7	6.2×10^7
Faeces of fatteners		
Biosaf 0%		10^2
Biosaf 0.15%		4.9×10^4
Biosaf 1%		1.5×10^5

[1] taking into account the commercial guarantee and the supplemented level

Table 3. Effect of Biosaf on doe and pre-weaning performances (mean ± SEM).

Diet	Control 0%		Biosaf 0.15%		Biosaf 1%	
No. of does	20		20		20	
Weight of the does (g)						
- at insemination	4411 ±459		4392 ±427		4326 ±310	
- at parturition	4289 ±358		4258 ±382		4173 ±338	
- 21 days post kindling	4482 ±400		4540 ±364		4424 ±416	
- at weaning	4354 ±414	(=100)	4453 ±359	(102)	4335 ±381	(99.5)
Weight of the kits (g/kit)						
- at parturition	59.6 ±16.4		58.6 ± 8.2		59.4 ±14.5	
- after standardisation	61.8 ± 7.8		61.6 ± 6.2		62.7 ± 7.4	
- day 21	365 ±27.5		378 ±31.2		373 ±35.1	
- at weaning	606 ±49.2	(=100)	643 ±56.7	(106)	612 ±65.3	(101)
Litter size (alive)						
- at parturition	9.25 ±2.8		10.7 ±1.7		9.55 ±2.3	
- after standardization	8.00 ±0.0		8.00 ±0.0		8.00 ±0.0	
- day 21	7.60 ±0.5		7.70 ±0.7		7.75 ±0.5	
- at weaning	7.60 ±0.5	(=100)	7.65 ±0.7	(101)	7.75 ±0.5	(102)

Differences between treatments are not significant ($p < .05$)

Table 4. Summary of weight gain, feed efficiency and mortality of weanling rabbits under optimal housing conditions (fattening trial 1).

Diet	Control		Biosaf 0.15%		Biosaf 1%	
	mean[1]	VC[2]	mean	VC	mean	VC
Initial weight,g (28 days)	612	7.4	642	7.3	610	11.2
Weight at 70 days	2419	4.5	2490	5.9	2428	5.8
Average daily gain (g)	43.0	4.8	44.0	6.6	43.3	5.5
Average daily feed intake (g)	142.8	7.2	144.1	7.1	141.5	5.9
Feed efficiency	3.32	4.6	3.28	3.6	3.27	4.0
Mortality (number)	2/60		1/60		0/60	

Differences between treatments are not significant ($p < .05$)
[1] 20 replicates of 3 kits/diet [2] VC: variability coefficient (%)

Table 5. Influence of Biosaf on weight gain and mortality of weanling rabbits housed under less favourable conditions (fattening trial 2).

Diet	Control	Biosaf 0.15%	Biosaf 1%
Number of rabbits	92	93	95
Initial weight (g)	606 (=100)	636 (105)	613 (101)
Final weight (g)	2359 (=100)	2460 (104)	2382 (101)
Average daily gain (g)	41.7^{a} (=100)	43.4^{b} (104)	42.1^{ab} (101)
Mortality (number)	19^{A}	4^{B}	11^{AB}
Total mortality (trial 1 + 2): in %	13.8^{Aa}	3.3^{Bb}	7.1^{ABb}

a,b: $p<0.05$ A,B: $p<0.01$

Table 6. Performances of all kits between birth and finishing weight, based on individual weighings.[1]

Diet	Control		Biosaf 0.15%		Biosaf 1%	
	Mean	VC(%)	Mean	VC(%)	Mean	VC(%)
At birth and after standardization						
- initial number	160 (=100)		160 (100)		160 (100)	-
- weight (g)	62.3 (=100)	12.3	62.1 (99.7)	8.6	62.6 (100.5)	10.0
At 3 weeks						
- number	152 (=100)		154 (101.3)		155 (102.0)	
- weight (g)	365.7 (=100)	10.2	378.5 (103.5)	7.5	372.9 (102.0)	9.2
At weaning (4 weeks)						
- number	152 (=100)		153 (100.7)		155 (102.0)	
- weight (g)	608 (=100)	11.4	643 (105.8)	6.8	612 (100.7)	9.0
At 10 weeks						
- number	131 (=100)		148 (113.0)		144 (109.9)	
- weight (g)	2385 (=100)	6.4	2472 (103.7)	5.3	2401 (100.7)	5.3

[1] Mean of litter means and mean of intra litter variation