

EFFECT OF DIET SUPPLEMENTATION WITH OXYTETRACYCLINE COMBINED OR NOT WITH DIFFERENT FEED-ADDITIVES ON FATTENING PERFORMANCE IN THE RABBIT

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Abstract - Two trials were conducted in two different places with a 2 x 2 factorial experimental design, to evaluate, during the fattening period, the influence of the addition of oxytetracycline (200 ppm) alone or with live yeast (*Saccharomyces cerevisiae*, Sc 47, 10⁶ CFU/g of feed) in the trial 1 or with flavophospholipol (4 ppm) in the trial 2. A total of 4 x 300 rabbits weaned at 30 days was employed for trial 1 and 4 x 108 32-days weaned rabbits for trial 2. Diets with oxytetracycline (OTC) were distributed during the first 4 weeks of the experiment and the others were employed during the whole period of the study: 49 days for trial 1 and 39 days for trial 2 or during the final part of the experiment. A digestibility study of the first trial feeds was performed with 4 cages of four rabbits per diet. Mortality, growth rate and feed conversion ratio were not significantly different between control and experimental groups, whatever the trial. Nutrients digestibility was not modified by the addition of OTC and/or addition of live yeast. The average Digestibility coefficients were 64.5 - 72.2 and 23.8 for organic matter, nitrogen and crude fibre respectively. In both trials, the greater growth rate was observed for the Control group without any addition: 41.2 and 45.6 g/day for trials 1 and 2 respectively. In trial 2, a greater growth rate (+5.5% on average) was observed immediately after weaning with flavophospholipol addition, but this effect disappeared after.

INTRODUCTION

Fattening rabbits can be driven to health problems and mortality due to an imbalance of the digestive flora, under the influence of environmental factors. In order to prevent these health problems, several products are available on the market, and some are employed more or less extensively in the practice:

- Antibiotics and especially **oxytetracycline** (OTC) used on a preventive or on a curative basis,
- probiotics, like **live yeast**, used as a regulator of the digestive flora.
- growth factors such as **flavophospholipol**,

The goal of the present study was to estimate the consequences of the utilisation of these three products on the growth performance of fattening rabbits, raised in correct environmental conditions.

Two trials have been conducted in two different places, in order to determine the practical consequences during the weaning-to-slaughter-weight period, of the utilisation of diets supplemented with OTC combined or not with live yeast or flavophospholipol.

MATERIAL AND METHODS

Both trials have been conducted with the same type of feed. The basis was made of barley 10%, wheat 7.3%, wheat bran 23%, cacao shells 2%, soya meal 4.5%, sunflower meal 16%, dehydrated alfalfa 23%, beet pulp 6%, cane molasses 6%, rape seed oil 0.8%, minerals and vitamins 1.4%.

The goal of the 2 trials was to compare the following supplementations in a factorial 2x 2 design:

- Control feed without additive or antibiotic,
- feed supplemented with Oxytetracycline (200 ppm),
- feed supplemented with *Saccharomyces cerevisiae* Sc 47(10⁶ CFU/g of feed) for trial 1, or with flavophospholipol (4 ppm) for trial 2,

- feed supplemented with OTC and one of the two above mentioned feed additives, with the same concentrations.

Trial 1 : Study of Oxytetracycline (OTC) and live yeast (YEAST) supplementation

Animals - The trial was carried out in the Magneraud INRA Centre. A total of 1200 crossbred rabbits weaned at 30 days, from INRA 1067 does x Hyplus line males, were divided in 4 homogenous groups of 300 on live weight basis. The animals were placed in collective cages of 6, and were fed *ad libitum* during the 7 weeks of the trial. Rabbits were weighed individually at the beginning of the trial and after 28 and 49 days of experiment. In addition, 4 x 16 rabbits of the same age and origin, were placed in collective « digestibility » cages of 4 individuals for the feed's digestibility evaluation (LEBAS *et al.*, 1994).

Feeds - The chemical composition of the 4 experimental feeds is indicated on Table 1. The 4 feeds were distributed *ad libitum* during the 4 first experimental weeks. During the 3 last weeks of the trial, only the 2 feeds without OTC were employed: control diet for the Control and the OTC groups, and yeast diet for the Yeast and the OTC+Yeast groups. The final 3 weeks period without OTC was employed in relation with the French legislation trying to reduce antibiotics utilisation. Feed intake was controlled for each cage and for the 2 experimental periods (4 weeks + 3 weeks).

For the digestibility study, the faeces collection was made 4 consecutive days during the 4th week of the first period. The faeces and feed samples were stored at -18°C until chemical analysis for dry matter, ash, nitrogen, crude fibre and energy

Table 1 : Chemical composition of the 4 feeds employed in the trial 1
(dry matter percentage and components as dry matter percentage)

Diets	CONTROL	OTC	YEAST *	OTC + YEAST *
Dry matter	88.33	88.29	88.93	88.58
Ash	8.49	8.42	8.49	8.43
Crude fibre	16.62	16.21	16.53	16.22
Crude protein	19.67	19.62	19.20	19.72
Gross energy (kcal)	4437	4437	4436	4443
Lipids (1)	3.6	3.6	3.6	3.6
Starch (1)	16.6	16.6	16.5	16.5
Calcium(1)	1.1	1.1	1.1	1.1
Phosphorus (1)	0.6	0.6	0.6	0.6

(1) calculated ; * : feed with live yeast contained slightly more than 10⁶ CFU/g of feed of *Saccharomyces cerevisiae* whereas the level detected in Control and OTC feeds, was lower than the detection level allowed by the microbiological method employed.

Trial 2 : Oxytracycline (OTC) and Flavophospholipol (FLAV)

Animals - This trial was carried out in a commercial experimental farm. It started at weaning time (32 days) and 432 rabbits of the HYPLUS strain were involved (same genetic origin as in trial 1). They were divided in four groups of 108 animals corresponding to 18 cages of 6 rabbits. The trial duration was 39 days. Rabbits were weighed individually at the beginning and on days 11, 29 and 39 of the experiment.

Feeds - The chemical composition of the 4 experimental feeds is indicated on Table 2. The 4 feeds were distributed *ad libitum* during the 29 first experimental days. During the 10 last days of the trial, only the 2 feeds without OTC were employed: control diet for the Control and the OTC groups, and flavophospholipol diet for the FLAV and the OTC+FLAV groups. The final 10 days period without OTC was the minimum French legal duration without utilisation of this antibiotic before slaughter. Feed intake was controlled only on the experimental groups basis with controls after 11, 29 and 39 days of experiment.

**Table 2 : Chemical composition of the 4 feeds employed in the trial 2
(dry matter percentage and components as dry matter percentage)**

Diets	CONTROL	OTC	FLAV	OTC + FLAV
Dry Matter	87.75	87.97	87.95	87.60
Ash	8.72	8.78	8.72	8.99
Crude fibre	16.58	16.41	16.18	16.75
Crude protein	18.21	17.85	17.98	18.49
Starch (1)	15.7	15.7	15.7	15.7

(1) calculated

Statistical analysis

The results of each of the 2 trials were analysed with the SAS-STAT package (SAS, 1988) according to the factorial design employed : antibiotics at 2 levels, feed-additives at 2 levels and interaction. For the trial 1, the variance analysis was based on cages data and included also the effect of the date of weaning (3 consecutive weanings), and the initial weight as covariable. For the trial 2, the analysis was based on individual weights with initial weight as covariable. Mortality was analysed with the Fisher's exact chi-square test.

RESULTS

TRIAL 1 : Study of Oxytetracycline (OTC) and live yeast (YEAST) supplementation

Preliminary observation - An all in all out policy was realised in the experimental rabbitry, three weeks before this first trial has been carried out. Probably in relation with this situation, the mortality rate was less than 1% of the 1200 rabbits involved; mortality was not related to the experimental diets employed.

Fattening performance

- Feed intake :

The feed intake was not affected during the first period by the OTC addition in the diet and no residual effect was observed during the second period (Table 3). During the first period, the presence of live yeast in the diet induced a significant decrease of feed intake in comparison with the group supplemented with both OTC and live yeast. During the second period, the same trend was observed and for the whole experimental period, the same effect of low feed intake associated with live yeast addition, was significant.

- Live weight :

After seven weeks of fattening, the Control group reached the highest weight of 2639 g, whereas the weight was the lightest for the Yeast group, only 2608 g, probably in relation with the lower feed intake mentioned above; but none of the above mentioned differences were significant.

- Average daily gain :

There was no significant difference between the four groups whatever the period considered. The average daily gain was 40.91 g per day, for the seven weeks of the fattening period.

- Feed conversion ratio :

Feed conversion ratios were not different between the four groups, whatever the period considered. The feed conversion ratio was the highest for the OTC+YEAST group, which was also the group which had the highest feed intake.

Digestibility performance - As indicated on Table 4, the addition of OTC or of live yeast to the experimental feeds had failed to influence the nutrient's Digestibility or on the digestible energy value of the diets. Therefore, the lower feed intake observed in the YEAST group (Table 3) cannot be related to a higher digestible energy content of the diet.

Table 3 : Average weight, daily gain, feed intake and feed conversion ratio observed during the first trial (least square means)

EXPERIMENTAL GROUPS	CONTROL	OTC	YEAST	OTC + YEAST	Resid. Coeff. of Variat (%)	Probability		
						Otc	Yeast	O x Y
<i>Live Weight (g)</i>								
- Weaning (30 days)	605	601	605	607	10.3	ns	ns	ns
- Weaning + 4 weeks	1847	1844	1826	1844	3.04	ns	ns	ns
- End of trial (79 days)	2639	2623	2608	2628	3.54	ns	ns	ns
<i>Feed intake (g/day)</i>								
- 1st period (4 weeks)	109.6 ^{ab}	109.0 ^{ab}	107.5 ^a	110.0 ^b	4.60	ns	ns	0.035
- 2d period (3 weeks)	156.0	155.0	153.4	156.6	5.77	ns	ns	0.104
- Average	130.3 ^{ab}	129.5 ^{ab}	128.0 ^a	130.8 ^b	4.66	ns	ns	0.041
<i>Daily Gain (g/day)</i>								
1st period	45.45	45.35	44.70	45.34	4.56	ns	ns	ns
2nd period	36.00	34.42	35.53	35.64	8.71	ns	ns	ns
Average	41.23	40.93	40.61	41.01	4.59	ns	ns	ns
<i>Feed Conversion Ratio</i>								
1st period	2.41	2.41	2.41	2.43	2.85	ns	ns	ns
2nd period	4.35	4.41	4.33	4.41	6.92	0.124	ns	ns
Average	3.157	3.165	3.151	3.189	3.02	0.104	ns	ns

Table 4 : Digestibility of the 4 diets employed in the first trial. (none of the differences were significant)

Diets	Control	OTC	YEAST	OTC+ YEAST	Resid. Coeff. of Variation (%)
<i>Digestibility coefficient (%)</i>					
- Dry matter	64.63	64.71	64.63	64.39	1.44
- Organic matter	64.44	64.87	64.42	64.34	1.38
- Nitrogen	73.28	72.14	71.21	72.3	2.26
- Crude fibre	25.10	24.37	23.58	22.05	10.05
- Energy	63.34	63.55	63.18	63.00	1.40
<i>Digestible Energy (kcal/kg DM)</i>	2810	2813	2802	2799	1.40

TRIAL 2 : Study of Oxytracycline (OTC) and Flavophospholipol (FLAV) supplementation

There was no significant difference in mortality or morbidity between the four groups (Table 5). Most of the mortality was due to digestive problems (diarrhoea, enterotoxemia). The dead rabbits are those the initial weight of which was lower than the average weight of the experimental rabbits (difference superior to three standard deviation).

Table 5 : Mortality and culled rabbits in the trial 2.

EXPERIMENTAL GROUPS	CONTROL	OTC	FLAV	OTC + FLAV
Initial No of Rabbits per Group	108	108	108	108
mortality : number	10	10	9	8
percentage	9.26	9.26	8.33	7.41
culled : number	0	1	1	1
percentage	-	0.92	0.92	0.92

As in the previous trial, the addition of OTC to the feed was not able to modify significantly the growth rate of the rabbits (table 6). On the contrary the addition of flavophospholipol was associated to a significantly higher growth rate during the 11 days following the weaning; but this effect disappeared later. It could be also emphasised that the control group obtained the higher final weight.

Table 6 : Individual weight and average daily gain of rabbits during the second trial (least square means)

EXPERIMENTAL GROUPS	CONTROL	OTC	FLAV	OTC + FLAV	Resid. Coeff. of Variat (%)	Probability		
						Otc	Flav	O x F
<i>Live Weight (g)</i>								
- Weaning (32 days)	712	710	713	705	13.3	ns	ns	ns
- 43 days	1263	1266	1281	1286	7.13	ns	0.037	ns
- 61 days	2011	2000	2015	2036	8,17	ns	ns	ns
- End of trial (71 days)	2486	2439	2451	2469	7.67	ns	ns	0.091
<i>Daily Gain (g/day)</i>								
- 32 to 43 days	50.22	50.57	51.93	52,36	16.11	ns	0.037	ns
- 43 to 61 days	41.56	40.78	40.75	41.67	18.02	ns	ns	ns
- 61 to 71 days	47.58	43.89	43.67	43.26	29.95	ns	ns	0.093
- Average 32 to 71 days	45.54	44.34	44.65	45.09	10.79	ns	ns	0.091

The average feed intake was measured only on the groups basis; it was similar for the 4 groups : 121 - 120 - 121 and 123 g/day for the Control, OTC, FLAV and OTC+FLAV groups respectively. The average calculated feed conversion ratios were, in the same order, 2.94 - 3.07 - 2.95 and 2.96. As for growth rate, the better feed efficiency was observed for the Control group.

DISCUSSION

With the good health status during the trial 1, we were not able to show any significant difference between the experimental groups. These results agree with a former publication by AOUN *et al.* (1994), in which the feed supplemented with oxytetracycline at the same level (200 ppm) or with the same live yeast supplementation didn't allow any significant improvement during the fattening period.

Concerning live yeast, the situation confirms previous observations : the improvement of performance is more important with yeast addition when the health is weak. (MAERTENS, 1992). Nevertheless, in trial 2, the four groups performed similarly by in spite of a higher mortality rate (9.3%). So in trial 1, as well as in trial 2, the four groups performed similarly but also very well :

Trial 1 :	Average feed conversion ratio = 3.17	Average daily gain = 40.9 g
Trial 2 :	Average feed conversion ratio = 2.97	Average daily gain = 44.9 g

Some points must be underlined :

The use of feed without additives or antibiotics (Control group), do not affect the zootechnical results concerning rabbits fattening. In both trials, Control group obtained the best average daily gain (41.23 g and 45.54 g respectively in trials 1 and 2). In trial 1, we noticed a significant interaction between oxytetracycline and yeast on feed intake : it will be interesting to verify this interaction on feed conversion ratio and on average daily gain, in not so good raising conditions. In trial 2, which has been conducted in experimental conditions closer to practical conditions (proved by the higher mortality rates), the flavosphopholipol give better growth rate immediately after weaning with or without oxytetracycline. This is in complete opposition with the results observed by MAERTENS *et al.* (1992) which observed a growth rate decrease associated with flavosphopholipol utilisation. Nevertheless, as for these authors the effect observed after weaning was transitory and has disappeared at the end of the experiment.

It may be conclude, that the utilisation of oxytetracycline in good or classical health situation did not produce any alteration of the rabbit's growth performance. The situation is independent of the presence or absence of feed additives such as live yeast or flavosphopholipol.

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Effets d'une supplémentation de l'alimentation par de l'Oxytétracycline combinée ou non avec différents additifs alimentaires, sur les performances d'engraissement des lapereaux - Deux essais ont été menés dans des lieux différents selon un schéma factoriel 2 x 2, pour déterminer l'intérêt sur les performances d'engraissement d'un apport d'oxytétracycline (200 ppm) dans l'aliment, associé ou non soit à des levures vivantes de type *Saccharomyces cerevisiae* Sc 47 (10⁶ CFU/g d'aliment), pour l'essai 1, soit à du Flavophospholipol (4 ppm), pour l'essai 2. L'essai 1 a porté sur 4 x 300 lapins et l'essai 2 sur 4 x 108. Les aliments contenant de l'oxytétracycline ont été distribués pendant les quatre premières semaines d'engraissement alors que ceux contenant les levures ou le flavophospholipol l'ont été pendant toute la période d'engraissement: soit 49 jours dans l'essai 1 et 39 jours dans l'essai 2. Enfin les 4 aliments de l'essai 1 ont été soumis à une étude de digestibilité des nutriments (4 cages collectives de 4 lapins par aliment)

L'analyse des résultats globaux d'engraissement pour la mortalité, la croissance et l'indice de consommation ne montre aucune différence significative entre les différents lots, aussi bien dans l'essai 1, que dans l'essai 2. L'efficacité de l'utilisation digestive des aliments (essai 1) n'est pas non plus modifiée par les différents apports (CUD moyen de 64,5 - 72,2 et 23,8 pour la matière organique, l'azote et la cellulose brute respectivement). Dans les essais 1 et 2, l'aliment témoin, sans aucune addition, a obtenu, en valeur absolue, les meilleures vitesses de croissance (41.2 g et 45.6 g/jour respectivement). Dans l'essai 2, le flavophospholipol seul ou en association avec l'oxytétracycline conduit à une croissance plus rapide au cours des jours suivant le sevrage mais cet effet disparaît ensuite.
