

EFFECTS OF A FERMENTED PRODUCT OF *SACCHAROMYCES CEREVISIAE* ON GROWTH, HEALTH AND MORTALITY OF RABBITS AT TWO DIFFERENT SLAUGHTERING AGES

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ABSTRACT

During 2 successive repetitions, 1,684 “46 days old” Hycole rabbits were split between 2 treatments, a Control and one with 1 kg/ton of *Diamond V Original XPC*, a source of *Saccharomyces cerevisiae*, to evaluate its effects on the mortality, the growth, the feed intake and the feed conversion ratio (FCR) between 46 and 89 days. Every day, the mortality was registered and the feed intake estimated. The rabbits were weighted at 46, 56, 70 and 89 days. An index evaluates the daily refuse of feed, the “feed intake dropping index”. In the first repetition, the *Diamond V Original XPC* decreased of 44.7% the 46-70 days mortality ($P = 0.011$) and increased of 3.1% the 70 days weight ($P = 0.005$) but no significant effects were observed in the second one with higher performances than the first repetition. The mortality 46 - 89 days decreased significantly of 38.5% and 31.6% in the both repetitions but the weight at 89 days was not affected. The “feed intake dropping index” decreased between 62 and 76% for the 2 periods 46-70 days and 46-89 days ($P < 0.001$). In conclusion, the *Diamond V Original XPC* is an interesting solution to improve the growth and to decrease the mortality of rabbits, particularly in a context of deteriorated performances or for improving mortality in the production of “heavy rabbits”.

Key words: Rabbit, probiotic, *Saccharomyces*, mortality.

INTRODUCTION

Among the natural additives developed to improve the performances and the health of rabbits (Maertens et al., 2006), the yeast *Saccharomyces cerevisiae* has been studied with products corresponding to 2 technologies: *Biosaf SC 47* from *Lesaffre* (Maertens and De Groote., 1992; Kimse., 2009; Kimse et al., 2012; Belhassen et al., 2016) and *Levucell* from *Lallemand* (Rotolo et al., 2014). A third source of *Saccharomyces cerevisiae*, the *Diamond V Original XPC* from *Diamond V* is used in Ruminants, pig, horse, poultry and fishes (Xu et al., 2003) but has not been tested in the rabbit. This work researches the effects of *Diamond V Original XPC* in growing rabbits and compares its results with the ones obtained with the 2 other sources of *Saccharomyces cerevisiae* already studied. It was carried out on a number of animals (1,684) higher than the other publications, giving good conditions for a statistical interpretation of the mortality. Besides, considering the different markets situation, it was carried out for “middle size rabbits” slaughtered at 70 days (1.4 to 1.6 kg of carcass weight) and for “heavy rabbits” slaughtered at 89 days (1.8 to 2.0 kg of carcass weight). A part of these results concerning the results at 70 days of age has already been published (Colin et al., 2019).

MATERIALS AND METHODS

General presentation

This work took place at Earl 3L (29830 – Ploudalmézeau (France) in October - November 2018 involving 872 rabbits and in December 2018 - January 2019 involving 812 rabbits (2 repetitions); it consisted in comparing a Control feed with one bringing 1 kg/t of “*Diamond V Original XPC*”.

Animals

The 1,684 rabbits of the 2 repetitions, corresponding to the Hycole genetic, were 46 days old at the beginning of the experimentation. They were housed in collective cages of 6 rabbits/cage grouped in modules of 6 cages. The cages of the same module received the same feed and these 2 ones were distributed alternately in the building to avoid a "location effect". The ages at sale were 87 days for the first group and 91 for the second one (average: 89 days).

Feeds

Diets and feed programs have already been published (Colin *et al.*, 2017). In the experimental feed, the *Diamond V Original XPC* was incorporated at a rate of 1 kg/t. No other additive was used.

Experimental Procedure

Mortalities were recorded daily to calculate the percentages of mortality; rabbits were weighed at 46, 56, 70 days and for sale to calculate the average weights and the ADG between these ages. The measure of morbidity is important to judge the health status of rabbits during nutritional experiments (Bennegadi *et al.*, 2001) but is difficult to apply in tests with a large number of rabbits bred in collective cages. A simplified method was carried out consisting in evaluating qualitatively every day the refusals of feed distributed the day before: 0 corresponds to a total intake of the ration; 5 to a total refusal. This value is then divided by the number of cages assigned to the treatments to get the "feed intake dropping index". The values for the total periods correspond to the averages of the data recorded during the time intervals composing them weighted by their duration expressed in days.

Statistical Analysis

Growth performances, morbidity and feed conversion ratio were studied by variance analysis (ANOVA). The same method was used for the mortalities after Boolean transformation of the data by assigning the value 1 to dead rabbits and the value 0 to live ones (Teillet *et al.*, 2011).

RESULTS AND DISCUSSION

Mortalities were low from 46 to 56 days (less than 1 percentage unit) which is not classical and is difficult to explain; they were higher between 56 and 70 days and between 70-89 days (Table 1). The *Diamond V Original XPC* reduced significantly the mortality between 56 and 70 days (- 44.7%) in the first repetition (P = 0.011) and highly significantly between 70 and 89 days (- 31.7%) in the second one (P = 0.008). Globally, the mortality was reduced highly significantly between 46 and 70 days (- 46.4%) for the first repetition (P = 0.005) and significantly between 46 and 89 days (- 38.5% and - 31.6%) for the both ones (respectively, P = 0.005 and P = 0.016). The reduction of the mortality before 70 days in the first repetition is coherent with the results of Maertens and De Groote (1992) and of Kimse (2009) obtained with another origin of *Saccharomyces cerevisiae* (Biosaf SC 47 Lesaffre). The absence of significant difference for the mortality 46 – 70 days in the second repetition can be explained by a mortality in this repetition lower than in the first one. Besides, the strong decrease of the mortality between 70 and 89 days and for the total period 46 – 89 days demonstrates the interest of this product for a production of "heavy rabbits". Globally, the "feed intake dropping index" was low from 46 to 56 days; it increased a lot between 56 and 70 days and decreased between 70-89 days (Table 1). In the 2 repetitions, the *Diamond V Original XPC* reduced very highly significantly this "feed intake dropping index" between 56 days and 70 days (- 62.3% and - 76.5%) (P<0.001) and for the 2 periods 46-70 days (- 65.2% and - 76.6%) and 46-89 days (- 58.5% and - 56.7%) (P<0.001). The lower "feed intake dropping index" with the *Diamond V Original XPC* is coherent with the reduction of the morbidity observed by Kimse (2009) when *Saccharomyces cerevisiae* is incorporated in the feed, probably in relationships with an improvement of the digestive health.

Table 1: Mortality and “feed intake dropping index”

Treatments	Age	Control	<i>Diamond V Original XPC</i>	P
<i>Repetition 1</i>				
Number of rabbits		456	416	
Mortality	46 - 56 d	1.3	0.5	0.199
	56 - 70 d	11.4	6.3	0.011
(% weaned rabbits)	70 - 89 d	7.2	5.5	0.320
	46 - 70 d	12.7	6.8	0.005
Mortality 70-89 days (% “70 days old” rabbits)	46 - 89 d	20.0	12.3	0.005
		8.3	5.9	0.215
“Feed intake dropping index”.	46 - 56 d	7.23	1.7	0.006
	56 - 70 d	22.6	8.5	<0.001
	70 - 89 d	4.8	3.9	0.436
	46 - 70 d	16.1	5.6	<0.001
	46 - 89 d	11.8	4.9	<0.001
<i>Repetition 2</i>				
Number of rabbits		392	420	
Mortality (% weaned rabbits)	46 - 56 d	1.0	0.5	0.367
	56 - 70 d	7.1	6.7	0.796
	70 - 89 d	15.8	9.3	0.008
	46 - 70 d	8.2	7.1	0.599
Mortality 70-89 days (% “70 days old” rabbits)	46 - 89 d	24.0	16.4	0.016
		17.2	12.0	0.007
“Feed intake dropping index”.	46 - 56 d	0.97	0.30	0.418
	56 - 70 d	15.2	3.6	<0.001
	70 - 89 d	10.3	6.5	0.888
	46 - 70 d	8.9	2.1	<0.001
	46 - 89 d	9.5	4.1	<0.001

The weights at 46 days were heavy with the 2 diets (Table 2), consequence of the high growth before weaning. The *Diamond V Original XPC* has no effect on the weights at 56 days and at 89 days. It increased highly significantly the weight at 70 days (+ 3.1%) in the first repetition (P = 0.005) but has no effect in the second one. This difference can be explained by a “70 days weight” high in the second repetition but lower than the ones generally registered in the farm for the first one. In the first repetition, the ADG between 56 and 70 days was highly significantly higher (+ 7.9%) with the *Diamond V Original XPC* (P = 0.004) compared to the control and the one between 70 and 89 days significantly lower (-15.4%). The results of the first repetition agree with Maertens and De Groote (1992) reporting an increase of 4.3% of the 70 days weight and the ones of the second repetition with Belhassen *et al.*, (2016) who don’t see any effect. Kimse (2009) has already indicated differences for the effects of *Saccharomyces cerevisiae* between the experimentations. Besides, the weights at 89 days are not modified, in accordance with the observations of Rotolo *et al.*, (2014) on rabbits of 84 days. The feed intake was lower for the control feed than for the *Diamond V Original XPC* in the first repetition. But it didn’t change in the second one in agreement with Kimse *et al.*, (2012); Rotolo *et al.*, (2014); Belhassen *et al.*, (2016). The FCR was lower with the *Diamond V Original XPC* at the two ages and in the 2 repetitions, probably in relation with the decrease of mortality in this treatment.

CONCLUSIONS

The incorporation of 1 kg/t of the *Diamond V Original XPC* has different effects between the 2 repetitions. In the first one, it decreases highly significantly the mortality 46-70 days and increases highly significantly the weight at 70 days but no significant effects are observed in the second one. The difference between the 2 repetitions can be explained by better performances in the second repetition than in the first one. Consequently, it seems that the *Diamond V Original XPC* is more efficient in a context of degraded performances. The mortality 46 - 89 days decreases in the both repetition. Globally, the “feed intake dropping index” decreased very highly significantly in the 2 repetitions, probably in relationships with the decrease of mortality. In conclusion, the *Diamond V Original XPC* is an interesting solution to improve the growth and viability of rabbits, particularly in a context of deteriorated performances or for the production of “heavy rabbits”.

Table 2: Growth performances

Treatments	Age (d)	Control	Diamond V Original XPC	rsd	P
<i>Repetition 1</i>					
Weight (kg)	46	1.472	1.477	0.082	0.683
	56	1.851	1.858	0.094	0.637
	70	2.230	2.301	0.153	0.005
	89	2.687	2.691	0.213	0.900
ADG (g)	46 -56	37.9	38.1	6.9	0.873
	46 -70	30.3	32.9	5.5	0.004
	70 - 89	28.5	24.1	11.8	0.021
	46 - 89	29.6	29.6	5.1	0.975
Feed intake (g/d)	46-70	101,8	109,0	NA	NA
	46-89	112.8	117.4	NA	NA
FCR	46-70	5.66	4.23	0.26	<0.001
	46-89	6.60	5.34	0.46	<0.001
<i>Repetition 2</i>					
Weight (kg)	46	1.570	1.569	0.082	0.934
	56	1.938	1.927	0.086	0.472
	70	2.408	2.419	0.120	0.630
	89	2.962	2.941	0.211	0.595
ADG (g)	46 -56	40.9	39.7	9.2	0.507
	46 -70	36.4	37.0	5.6	0.613
	70 - 89	31.8	31.2	4.9	0.260
	46 - 89	31.6	31.2	4.9	0.317
Feed intake (g/d)	46-70	114.4	114.1	NA	NA
	46-89	115.2	113.6	NA	NA
FCR	46-70	4.23	4.00	0.49	<0.001
	46-89	7.01	5.63	0.49	<0.001

NA: Not available

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