Possibilities to reduce the feed conversion in rabbit production

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ABSTRACT – Different possibilities to reduce the feed conversion ratio (FCR) both in fatteners and females are discussed. The dietary factor having the largest impact on the FCR in fatteners is the energy concentration. Within practical margins, an increase with 0.5 MJ DE/kg leads to a decrease of the FCR with 0.15-0.20 points. The fibrous rabbit diets can be made more energy dense by using fat or oil rich feedstuffs. In a phase feeding schedule, a significant decrease of the FCR can herewith be obtained in the finishing period. Once fatteners have a weight of 2.0 kg, their FCR exceeds 3.25. The use of a quickly growing sire line (high correlation with FCR) leads to a reduction of the FCR of over 10% during the fattening stage. In females, the number of weaned young is the most determining factor. An increase with 5 young/♀/year decreases the FCR in the maternity with 11%. When simultaneously the post-weaning mortality decrease with 5%, the positive impact on the FCR is even 18%. Losses in the fattening stage, especially in the finishing period have a large impact; e.g. a decrease from 10 till 5% reduces the FCR in the fattening unit with 6.6%. Also a correct restriction of fatteners or non lactating does is helpful to reduce the farm FCR. High stocking density or large group sizes leads to a less favourable FCR. Optimalization of the different factors involved in the FCR leads to a farm FCR around 3.0.

Key words: Feed conversion, Females, Fatteners, Influencing factors.

INTRODUCTION

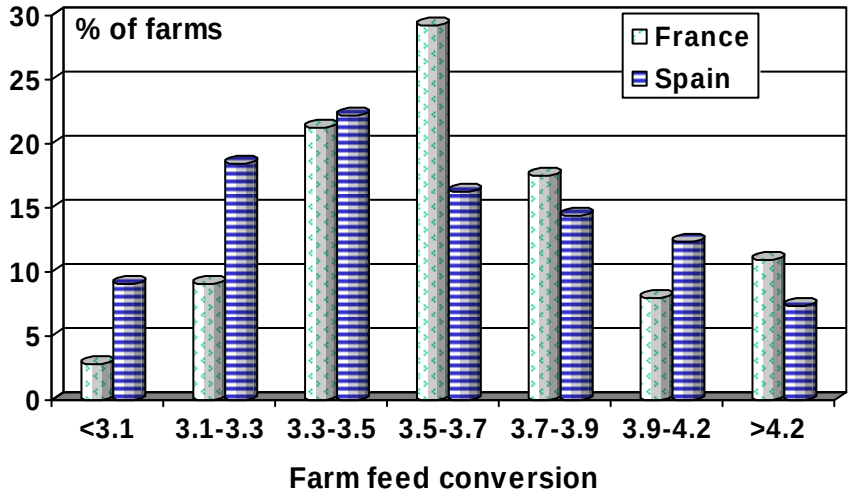
In rabbit meat production, as in other animal species, feeding costs represent the largest part of the production costs. Depending of mainly the investment costs, they amount 60-70% of the total costs. Actually, the production costs of meat rabbits are twice as high as for broilers and 25-35% higher than in pigs. In view of being competitive with those animal productions, a reduction of the feeding costs is of primarily importance.

When speaking about feed conversion ratio, in practise the only figure known is the overall global (farm) feed conversion ratio (FCR). Recent overviews of farm data show an average FCR of 3.60, 3.82 and 3.63 in France, Italy and Spain, respectively (Lebas, 2007, Xiccato *et al.*, 2007; Rosell and González, 2007). However, all these studies stress the big differences between farms (from less than 3.0 till over 4.5) (Figure 1).

In a rabbitry, depending of the weaning date and slaughter weight about 50-60% of the feed is consumed in the fattening unit and 40-50% in the reproduction unit. There are numerous experimental FCR data available in fatteners, however only very few data are available for the reproduction unit. Nevertheless, to reduce the FCR, possibilities have

to be considered both for females and fatteners. The most important being the use of efficient stock, the quality of the feed, limitation of the losses (mortality) and the farm management (e.g. reproduction efficiency, slaughter age). The impact of some of these factors which are of primarily importance to reduce the feed conversion will be discussed. Data obtained at our experimental farm were mainly used for this analysis.

Figure 1 – Variation in farm feed conversion ratio in France and Spain obtained in 2006 (adapted from Jentzer, 2008; Rosell and González, 2007).



FEED CONVERSION IN RABBIT PRODUCTION

Definition of feed conversion ratio

As already stated in the introduction, from a practical and economical viewpoint, the **global** (farm) **FCR** is the most extensively used parameter for estimation of feed efficiency in intensive systems. This global FCR is defined for a closed unit (maternity and fattening) as the ratio between the kg of feed consumed (bought)/kg of rabbits produced (sold). In this index the reproduction efficiency and slaughter weight are the main factors that influence the FCR. When the same mortality is considered (10% after weaning) the cummulative effect of both variables results in an increase from 3.07 till 4.03 or 31.3% (Table 1).

Table 1 – Global FCR for different slaughter weights and number of rabbits produced/doe/year (adapted from Maertens *et al*., 2005b).

No rabbits produced/doe/year	40	45	50	55
Slaughter weight (kg)	Global feed conversion ratio			
2.0	3.64	3.39	3.21	3.07
2.25	3.79	3.53	3.34	3.19
2.50	4.03	3.75	3.55	3.39

When the FCR is calculated in fatteners than the FCR is defined as the ratio kg of feed consumed/kg weight gain of rabbits (finishing weight – weaning weight). In this FCR the feed consumption of the rabbits losses (mortality and removed) is included while no weight gain of them is considered. This is correct from an economical vieuwpoint and

defined as **the economical FCR.** If we calculate this FCR in the reproduction unit than the FCR is the ratio between kg of feed consumed/ kg of rabbits weaned + sold old females.

However, if mortality is not one of the target variables in nutrition experiments, the effect of mortality is eliminated and the result is **the technical FCR.** In this way, only the feed consumed by the rabbits reaching the end of the experimental period is taken into account. As a consequence, the technical FCR is lower than the economical FCR. For this correction, we assume that no feed was consumed during the last 2 days preceding the death (Maertens *et al*., 2005a).

Besides the FCR, the efficacy of the feed utilisation is sometimes presented as **feed efficiency** (De Blas *et al*., 1998). From a scientific viewpoint this inverse ratio, namely kg of weight gain/kg of feed consumed, shows a figure which expresses better the efficiency and should therefore been suggested for experimental purposes.

Feed conversion rate as effected by age

Young and quick growing animals have a much more favourable FCR in early fattening stage than near slaughter weight. The different content of tissue accretion (fat *vs* protein and water) and the increased maintenance requirement are responsible for the very quickly increase in FCR above a weight of 2.0 kg (FCR>3.25). In Table 2, recent data obtained at our experimental unit are presented of the technical FCR with a quickly growing strain.

Table 2 – Average values of weight gain, feed consumption and technical FCR during the fattening period.

Age	Weight	Weight gain	Feed intake	Feed conversion	
(days)	(g)	g/d	g/d	Per week	Cumulative
21-30	400-740	38	35 + milk	-	-
30-37	740-1050	44	84	1.91	1.91
37-44	1050-1395	49	114	2.33	2.13
44-51	1395-1750	51	136	2.67	2.32
51-58	1750-2085	48	148	3.08	2.51
58-65	2085-2395	44	160	3.64	2.72
65-72	2395-2680	41	171	4.17	2.94

Diet: 10.0 MJ DE/kg Moderate temperature conditions (15-23°C) Cages without mortality

Genetic possibilities

Selection for feed efficiency or FCR has been little studied or applied in rabbits. The determination of FCR is a laborous work and it was assumed that a selection for daily gain was closely linked with a more favourable FCR. However, with the development of specific sire lines, growing attention has been drawn to this trait (Larzul *et al*., 2005). Estimated heritability values for FCR range mainly between 0.25 and 0.30 (Piles *et al*. 2004; Larzul *et al*., 2005). Significant differences of over 10% in FCR were observed between 10 sire lines by Larzul *et al*. (2004). When different lines are compared, the favourable effect of using a line selected for growth rate is clearly established in Table 3.

Although very divergent correlations are presented between growth rate and FCR (Larzul *et al*., 2005) it is generally agreed that especially heavy sire lines have a lower FCR. The use of such lines has partly contributed to the decreased of farm FCR from 4.0 in 1990 till 3.60 in 2006 (Lebas, 2007).

In commercial farms, increasing use is made of the cross between a fertile dam line and a sire line selected for growth rate and by consequence FCR. Based on recent published results, growth rates of 50g/d between 35 and 63 days and a technical FCR in the range of 2.6-2.7 are obtained on such crosses (Garcia-Ruiz *et al*., 2006; Gidenne *et al*., 2007).

Table 3 – Comparison of the FCR of different Spanish lines (Feki *et al.,* 1996).

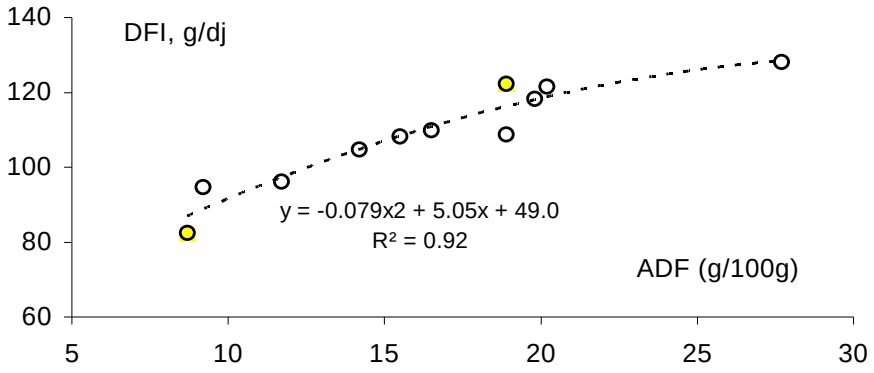
Line	V	R	C
Selection purpose	Litter size	Growth rate	Global production
Weight at 63 days (g)	2 116	2 598	2 251
Growth rate (g/d)	37.9	48.0	39.2
FCR*	3.01	2.63	3.07

* covariated

Nutrition

Feed effciency is adversely linked with the dietary digestible energy content (DE) as already been shown 30 years ago by Lebas (1975) and confirmed in many experiments. A rabbit regulates its feed intake according to the energy need, as for other mammals. In monogastric animals the glycemia plays a key role in food intake regulation, while in ruminants the levels of volatile fatty acids in blood have a major role. Since rabbit is a monogastric herbivore, it is not clear which is the main blood component regulating feed intake, but it is likely to be the blood glucose level (Gidenne and Lebas, 2005). However, because of the close relationship between dietary fibre and DE content, daily feed intake (and by consequence FCR) is even more correlated with the less digestible fibre (ADF) than with the DE content (Figure 2) (Gidenne and Lebas, 2005).

Figure 2 – Intake and dietary lignocellulose level (ADF).



Based on the relationship between dietary DE content and intake, improved FCR ratio can be obtained with energy dense diets. However, due to the dietary fibre requirements

of rabbits and the low digestibility of different fibre classes (Gidenne, 2003), rabbit diets have a low energy content (DE or ME) compared to poultry and pig diets.

When respecting the fibre requirements, energy dense diets can be obtained using fat addition (and to a lesser content also digestible fibre). The DE content of fats (or oil) is nearly 3 times as high as that of cereals (Maertens *et al*., 2002). However, because of the necessity that rabbit diets have to be pelleted, the addition is limited to 2-3% because of its negative impact on the pellet quality (Maertens, 1998). But if we take into account that a replacement of 2% of cereals by 2% of fat (oil) results in an increase of the dietary DE content with 0.44 MJ/kg, a decrease of the FCR with about 0.15 can be expected or 5-7%. Recently this effect was again demonstrated by Corrent *et al*. (2007). In their trial, rabbits did not reduce their feed intake and by consequence the higher daily energy intake resulted in a more favourable feed conversion (Table 4). Because the AA were adjusted to the dietary DE content, also daily weight gain tended to be higher with the energy dense diets.

Table 4 – Effect of dietary DE content on growth and FCR during the finishing period (Corrent *et al.,* 2007).

	Diets			P
Energy content (MJ DE/kg)	10.25	10.67	11.08	
Ether extract (%)	2.45	3.44	3.95	
Weight gain(g/d) between 48-70 d	47.2	48.2	50.3	0.06
Feed intake (g/d) between 48-70 d	168.8	163.5	168.4	>0.10
Feed conversion	3.60 a	3.40 b	3.36 b	<0.01

The use of more energy dense diets to improve the FCR is especially interesting during the finishing stage. Shortly after weaning feed consumption is low and optimizing digestive health is of primary importance. However in the second fattening stage rabbits are less sensitive to digestive disorders and about 2/3 of the feed is consumed in this period. A phase feeding program, including more energy dense diets in the finishing stage reduces the FCR. Based on several studies a decrease of the FCR with 0.15-0.20 points for 0.5 MJ DE/kg can be expected (Maertens and Villamide, 1998). However, more trials are necessary to verify if this relationship is linear (especially with fat addition) and between which margins of dietary energy content.

The addition of **fat to diets for does** has a positive impact on the milk yield of does (Pascual *et al*., 2003). However, the effects on weaning weight of young are not very pronounced. Taking into account the negative effects on does' energy balance during lactation and on fertility, high energy diets based e.g. high amounts of animal fat addition are not desirable also not for the young before weaning (Pascual *et al*., 2003). A decrease of the FCR when using diets with an energy content above the actual recommendations (11.0 MJ/kg, Lebas 2004) is not proved. Nevertheless, dietary fat addition has shown to have some potential to reduce thermal stress because energy intake tends to be higher with energy dense diets (Fernández-Carmona *et al*., 2000).

The direct impact of different additives to reduce the FCR is inconsistent (Falcao-e-Cunha *et al.,* 2007). However, if these additives (e.g. coccidiostatics) reduce the mortality or improve the gut health an indirect decrease of FCR is obtained.

Mortality

It is evident that mortality has a very large impact on the FCR. Possibilities to reduce the mortality as an all-in all-out management, the use of high health stock and an adapted feed were discussed elsewhere (Maertens, 2007). Fortunately, significant progress has been made the last years concerning the relationship fibre fractions – digestive trouble prevention (Gidenne and Garcia, 2006) and protein nutrition and digestive health (Carabaño *et al*., 2008).

The impact of mortality on the **fatteners' FCR** is presented in Table 4. For this calculation the weight gain and feed intake data for a 5 weeks fattening period (between 30 and 65 days of age) as presented in Table 2 were used. Both the effect of increasing mortality (from 0 to 20%) and when the mortality occurred (week 1, week 2-3 or during the last week, respectively) is presented.

If mortality occurs in early fattening stage, by consequence the economical FCR increases only slightly. However, if the losses (mortality and culled rabbits) are concentrated at the end of the fattening period the FCR is 11.2% and 26.1% higher for a mortality rate of 10 and 20%, respectively (Table 5).

Table 5 – Economical FCR in the fattening unit as affected by mortality and age of losses.

Age when mortality occurs	Mortality (%)				
	0	5	10	15	20
Week 1	2.72	2.74	2.76	2.78	2.81
Middle	2.72	2.78	2.85	2.92	3.00
End	2.72	2.86	3.02	3.20	3.43

However losses in the fattening unit have also consequences on the FCR in the reproduction unit. Before weaning these rabbits have consumed feed and moreover the feed consumption of the mother has to be divided over less weaned rabbits. These effects will be treated in the management paragraph.

Management

In practise a 42 days reproduction rythm is quite generally used. However, e.g. fertility rate, litter size and pre-weaning mortality have a very large impact on the number of rabbits weaned per doe and by consequence on the FCR in the reproduction unit. Data concerning this FCR are, to my knowledge, not available in the literature. Therefore based on recent feed intake data obtained at our Institute, a calculation is presented for a unit with weaning at 35 days (Table 6). Productive does and their young consume during the whole lactation on average 18.5 kg. Furthermore, their feed consumption outside the lactation period has to be considered (110 days/year) and also the feed consumption of the young females and females in wait-gestation cages (together 45

ọ/100 ọ). For the calculation of the FCR in a productive maternity we have assumed an average of 7.3 litters/ọ/year and a number of 8.50 weaned young per litter.

Table 6 – Calculation of the FCR in a productive reproduction unit (for 100 does).

Feed consumption	Kg for 100 ♀	Rabbits produced	Kg
1. Lactation: 18.5kg/litter x 7.3 litters/♀/year	13.505	1. 8.50 weaned/litter x 7.3 litters or 62 weaned/♀/year with a weight of 1.0 kg	6.200
2. Only pregnant: 110d x 160g/d	1.760		
3. Young ♀and ♀in wait cages: 45 ♀ x 365d x 150g/d	2.464	2. Sold females: 50 with an economical weight of 3 kg	0.150
Total	17.729	Total	6.350
FCR		2.79	

The FCR obtained in such a productive maternity is only 2.79 but does not take into account the losses of weanlings in the fattening unit. The feed consumption before weaning is lost and deteriorates the FCR in the maternity. In Table 7, the effect of post-weaning losses is presented for different production levels.

Table 7 – FCR in the maternity as affected by post-weaning mortality and production level.

Losses in the fattening unit (%)	N° of weaned young/ọ/year		
	62	57	52
0	2.79	3.03	3.31
5	**2.93**	3.27	3.59
10	**3.09**	**3.45**	**3.79**
15	3.27	3.66	4.01

When 10% losses are considered, the FCR already increases till 3.45 at a production level of 57 young/ọ/year. An increase with 5 young/ọ/year leads to a decrease of the FCR till 3.09 or 11%. The simualtaneous impact of an increase of 5 weaned young and a decrease of 5% of post-weaning mortality results in a reduction with 18% of the FCR (e.g. from 3.45 to 2.93) (Table 7).

Other factors involved in the FCR

Restricted feeding in the fattening unit has proved to be helpful to overcome digestive disorders, especially shortly after weaning but has also a favourable effect on the FCR. According to Gidenne *et al*. (2003), the following relationship was found during the 5 weeks fattening period:

FCR = 2.88 – 0.021 x % feed restriction. This means that a gain of 0.21 points in FCR can be obtained when rabbits are 10% restricted fed. However, this gain has to be considered under the restriction plan as applied in their trials.

Females which are not immediately pregnant have to be restricted fed because overfattening impairs their further reproductive career and leads to reduced performances in the subsequent lactation (Pascual *et al*., 2003). Based on the data of Table 6, an over-consumption of 10g/day leads to increase of 2-3% of the FCR in the maternity.

Fattening rabbits are mainly caged in a group size of 6 to 8. However, it has been shown in several comparative trials that individually caged rabbits have a higher daily weight gain and more favourable FCR. In a recent Spanish study, the difference in favour of individual caging was even 11.8% (Garcia-Palomares *et al.*, 2006). The housing in large groups (pens) or on an alternative soil (e.g. straw) leads always to a deterioration of the FCR (Dal Bosco *et al*., 2002).

Also environmental conditions affect the FCR because of their effect on the requirements for thermoregulation. During the summer, a more favourable FCR is obtained than during the winter despite the lower growth rate. On the other hand, at low temperature (winter) higher growth rates but also a higher FCR is observed compared to the fattening when heat stress occurs (Ramon *et al*., 1996).

Finally feeding wastage due to the feeder design or meal losses can have a significant impact on the FCR. Pregnant females can waste large amounts of feed by scraching it out of unadapted feeders. Another important wastage is due because rabbits doe not eat fines. All mash present in the pellets or formed in the feeding system deteriorates the FCR. Farm data indicate that this loss is quickly 1.5-2% of the total amount of feed.

CONCLUSIONS

When using a performant strain, a phase feeding program, adapted management techniques and if the mortality is controlled, both in the fattening unit as in the reproduction unit, a FCR around 3.0 is possible. When the rabbits are slaughtered at a low weight (e.g. Spain), the FCR in the fattening stage is favoured and a global farm FCR below 3 must be an attainable objective.

REFERENCES – **De Blas**, J.C., Taboada, E., Nicodemus, N., Campos, R., Piquer, J., Méndez, J. 1998. Performance response of lactating and growing rabbits to dietary threonine content. Anim. Feed Sci. Technol. 70:151-160. **Carabaño**, R., Villamide, M.J., García, J., Nicodemus, N., Llorente, A., Chamorro, S., Menoyo, D., García-Rebollar, P., García A.I., de Blas, C. 2008. New concepts and objectives for protein-amino acid nutrition in rabbits. In: 9th World Rabbit Congress, June 10-13, 2008, Verona, Italy, pp. 477-490. **Corrent**, E., Launay, C., Troislouches, G., Viard, F., Davoust, C., Leroux, C. 2007. Impact d'une substitution d'amidon par des lipides sur l'indice de consommation du lapin en fin d'engraissement. In: Proc. 12èmes Journées Recherche Cunicole, 27-28 novembre, Le Mans, France, pp. 97-100. **Dal Bosco**, A., Castellini, C., Mungai, C., 2002. Rearing rabbits on a wire net floor or straw litter: behaviour, growth and meat qualitative traits. Livest. Prod. Sci. 75:149-156. **Falcão-E-Cunha**, L., Castro-Solla, L., Maertens, L., Marounek, M., Pinheiro, V., Freire, J., Mourão, J.L. 2007. Alternatives to antibiotic growth promotors in rabbit feeding: a review. World Rabbit Sci. 15:127-140. **Feki**, S., Baselga, M., Blas, E., Cervera, C., Gomez, E.A. 1996. Comparison of growth and feed efficiency among rabbit lines selected for different objectives. Livest. Prod. Sci. 45:87-92. **Fernández-Carmona**, J.,

Santiago, S., Alqedra, I., Cervera, C., Pascual, J.J. 2000. Effect of lucerne-based diets on the reproductive performance of rabbit does at high environmental temperatures. In: Proc. 7th World Rabbit Congress, Valencia, Spain, Vol. C: pp. 203-208. **Garcia-Palomares**, J., Carabaño, R., Garcia-Rebollar, P., De Blas, J.C., Corujo, A., Garcia-Ruiz, A.I. 2006. effects of dietary protein reduction and enzyme supplementation on growth performance in the fattening period. World Rabbit Sci. 14:231-236. **Garcia-Ruiz**, A.I., Garcia-Palomares, J., Garcia-Rebollar, P., Chamorro, S., Carabaño, R., De Blas, J.C. 2006. Effect of protein source and enzyme supplementation on ileal protein digestibility and fattening performance in rabbits. Span. J. Agric. Res. 4: 297-303. **Gidenne**, T. 2003. Fibres in rabbit feeding for digestive troubles prevention: respective role of low-digested and digestible fibre. Livest. Prod. Sci. 81:105-117. **Gidenne**, T. Lebas, F. 2005.Le comportement alimentaire du lapin. In: Proc. 11èmes Journées Recherche Cunicole, 29-30 novembre, Paris, France, pp. 183-196. **Gidenne**, T., Garcia, J. 2006. Nutritional strategies improving the digestive health of the weaned rabbit. In: Maertens L. and P. Coudert (Eds), Recent Advances in Rabbit Sciences, COST and ILVO Publication, Melle (Belgium), pp. 229-238. **Gidenne**, T., Feugier, A., Jehl, N., Arveux, P., Boisot, P., Briens, C., Corrent, E., Fortune, H., Montessuy, S., Verdelhan, S. 2003. A post-weaning quantitative feed restriction reduces the incidence of diarrhoea, without major impairment of growth performances: results of multi-site study. In: Proc. 10èmes Journées Recherche Cunicole, G. Bolet (Ed.), ITAVI publ., pp. 29-32. **Gidenne**, T., De Dapper, J., Lapanouse, A., Aymard, P. 2007. Adaption du lapereau à un aliment fibreux distribué avant sevrage: comportement d'ingestion, croissance et santé digestive. In: Proc. 12èmes Journées Recherche Cunicole, 27-28 novembre, Le Mans, France, pp. 109-112. **Jentzer**, A. 2008. Performances moyennes des élevages cunicoles professionnels en 2007. Présentation rapide des résultats RENACEB et RENALAP. Cuniculture Magazine 35: 39-44. www.cuniculture.info. **Larzul**, C., de Rochambeau, H. 2005. Selection for residual feed consumption in the rabbit. Livest. Prod. Sci. 95:67-72. **Larzul**, C., de Rochambeau, H. 2004. Comparison of ten rabbit lines of terminal bucks for growth, feed efficiency and carcass traits. Anim. Res. 53:535-545. **Lebas**, F. 1975. Influence de la teneur en énergie de l'aliment sur les performances de croissance chez le lapin. Annales de Zootechnie 24:281-288. **Lebas**, F. 2004. Reflexions on rabbit nutrition with a special emphasis on feed ingredients utilizatio. In: Proc. 8th World Rabbit Congress, Puebla, Mexico, pp. 686-736. http://world-rabbit-science.com/. **Lebas**, F. 2007. Productivité des élevages cunicoles professionnels en 2006. Résultats de RENELAP et RENACEB. Cuniculture Magazine 34: 31-39. www.cuniculture.info. **Maertens**, L. 1998. Fats in rabbit nutrition: a review. World Rabbit Sci. 6**:**341-348. **Maertens**, L. 2007. Strategies for the reduction of antibiotic utilization during rearing. In: Proc. Giornate di Coniglicoltura ASIC 2007, Fiera di Forli, 26-27 September 2007, pp. 1-11. **Maertens**, L., Villamide, M.J. 1998. Feeding systems for intensive production. In: De Blas C., Wiseman J. (eds), The Nutrition of the rabbit. CABI Publishing, CAB International, Wallingford Oxon (UK), pp. 255-272. **Maertens**, L., Perez, J.M., Villamide, M., Cervera, C., Gidenne, T., Xiccato, G. 2002. Nutritive value of raw materials for rabbits: EGRAN tables 2002. World Rabbit Sci. 10:157-166. **Maertens**, L., Cornez, B., Vereecken, M., Van Oye, S. 2005a. Efficacy study of soluble bacitracin (Bacivet S®) in a chronically infected epizootic rabbit enteropathy environment. World Rabbit Sci. 13:165-178. **Maertens**, L., Cavani, C., Petracci, M. 2005b. Nitrogen and phosphorus excretion on commercial rabbit farms: calculations based on the input-output balance. World Rabbit Sci.13:3-16. **Pascual**, J.J., Cervera, C., Blas, E.,

Fernández-Carmona, J. 2003. High-energy diets for reproductive rabbit does: effect of energy source. Nutr. Abstr. Rev. 73:27R-39R. **Piles**, M., Gomez, E.A., Rafel, O., Ramon, J., Blasco, A. 2004. Elliptical selection experiment for the estimation of genetic parameters of the growth rate and feed conversion ratio in rabbits. J. Anim. Sci. 82: 654-660. **Ramon**, J., Gomez, E.A., Perucho, O., Rafel, O., Baselga, M. 1996. Feed efficiency and postweaning growth of several Spanish selected lines. Proc. 6th World Rabbit Congress, Toulouse, France, pp. 351-353. **Rosell**, J., González, F.J. 2007. Resultados de Gestión Técnica 2006. Cunicultura, Octubre 2007, pp. 3. **Xiccato**, G., Trocino, A., Fragkiadakis, M., Majolini, D. 2007. Enquête sur les élevages des lapins en Vénétie: Résultats de gestion technique et estimation des rejets azotés. In: Proc. 12èmes Journées Recherche Cunicole, 27-28 novembre, Le Mans, France, pp. 167-169.