

NUTRITION

38 - AOUN M., GRENET L.** , MOUSSET J.L., ROBERT P.*

Effect of a supplementation with oxytetracycline or living yeast on the rabbit growth performance.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 277-283.

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Three groups of 80 rabbits weaned at the age of 32 days and at an average weight of 760 g were taken to compare two types of supplementations in the rabbit growth diet, with a non supplemented food : group A received the non supplemented food. Group B was supplemented with oxytetracycline (OTC) at 200 ppm. Group C was supplemented with living yeast (*Saccharomyces cerevisiae* Sc47). Supplementations were made from weaning to slaughter age. Mortality and growth results don't show any significant difference between the three groups, although group B seems to have the best results. Feed to gain ratio are nearly the same in group B and C (3.25 and 3.23) and seems to be better than in group A (3.38). For each group, slaughter yield increases with slaughter age (56.7 % to 59.2 % from 64 days to 77 days). The best slaughter yield is obtained with group B on the slaughter age of 64 and 70 days, with group A on the age of 77 days, but differences are not significant.

39 - FORTUN L., LEBAS F.

Effects of the level and origin of dietary energy on reproduction performance of primiparous simultaneously pregnant and lactating rabbit does.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 285-292.

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The aim of this experiment was to study the effects of the level and origin of dietary energy on foetal growth and mobilisation of body reserves, in concurrently primiparous *post partum* pregnant and lactating rabbit does with standardized to 10 young litters. Does were given control diet (2400 kcal/kg DM; group T, n=23) or highly energetic diet (2900 kcal/kg DM). Energy increase comes mainly from maize starch (group A, n=23) or sunflower oil (group G, n=22). During the first 21 days of lactation+gestation, the digestible energy (DE) intake was higher in group G than in A (799 vs 740 kcal DE/d) and in T (690 kcal DE/d; $P < 0.05$). During the same period, milk production estimated through the litter weight at 21 days, was higher in group G (4.18 kg) than in A (3.58 kg; $P < 0.05$); group T was intermediate (3.8 kg). On day 28 of gestation, the does were slaughtered. The weights of adipose tissues, liver and sum of all the maternal tissues were higher in groups A and G than in T group ($P < 0.05$). Number of dead or live foetuses and foetal live weight were similar in the three groups. These results indicate that the increase the energy level of the diet did not improve foetal growth in concurrently pregnant and lactating does. On the contrary, it could reduce the mobilisation of body reserves but for this purpose, addition of starch is more efficient than lipids if the diets are isoenergetic.

thuringier coat seems like himalayan coat. In the second, the eumelanin of the aa genotype is partially obliterated by the ee genotype. With new experiences, the authors confute the two theories. They propound a new gene at the A locus for the thuringier coat: a^d , recessive on a (black). The dominance of A^+ on a^d is not complete and the phenotype due to A^+a^d genotype is different if there is E^+ or E^d at the E locus. So the hypothesis that a^d is recessive on a, seems just a little peculiar but it explains the experimental facts.

36 - ROCHAMBEAU H. de, THEBAULT R.G.*, VRILLON J.L.*, ALLAIN D.

Some non-genetic factors on fur quality in two "Rex du Magneraud" strains :

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 263-270.

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This paper describes the growth and the fur characteristics of 3 096 rabbits from two "Rex du Magneraud" strains. The rabbits were weighed at four, eight and twelve weeks. The bristlyness of the fur was quoted at four, eight and eighteen weeks, which was the slaughter age. The length of the down, the compacity and the maturity of the fur were measured at the same time. The bristlyness marks at four and eight weeks had a small coefficient of correlation with the marks at slaughter age ($r = 0.29$ and 0.32). The fur of the Castor strain had less bristles, and a lower compacity than those from the Chinchilla strain. Sex and litter size at weaning had only small effects on these traits. Heavier rabbits at eight and twelve weeks gave more mature furs at slaughter ; these furs had longer downs and a better compacity. The bristlyness marks decreased sharply during the period under review (2 years). A slaughter at eighteen weeks give good quality fur in our breeding systems.

37 - VRILLON J.L., THEBAULT R.G., ROCHAMBEAU H. de*

Adoption practice an unusual result observed on a Rex rabbit strain

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 271-276.

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We follow a study expecting a quantitative and qualitative improvement of strains of Rex rabbits called "Rex du Magneraud". Our investigation try to establish a relation between zootechnical traits and fur quality traits. Breeding our 3 strains of Rex rabbits : Chinchilla Rex (CHR), Castor Rex (CR) and Albinos Rex (AR), we noticed a low nursing ability of the CHR strain : 41 % birth to weaning mortality vs 12.5 % and 21.2 % in the AR and CR lines.

We have planned an experiment on 4 groups of litters issued of CHR and AR females. Two groups of litters have been nursed by their own mother and we exchanged the young between the litters of two other groups. The result shows a very high mortality rate from birth to weaning in one group : litters of CHR mothers nursing their own young. The difference is twice as much as for the three other groups : 39.5 % mortality vs 19,4 % to 26.5 %.

The hypothesis of a lack of antibodies production in CHR mothers is put forward.

40 - GIDENNE T.

Volatile fatty acid production in the rabbit : incidence of the dietary fibre level.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 293-300

INRA, centre de recherche de Toulouse, Station de Recherches Cunicoles, BP 27, 31326 Castanet Tolosan Cédex (France)

The volatile fatty acids (VFA) production was estimated using an indirect approach based on measurement of the quantity of organic matter (OM) fermented, in two groups of four female rabbits fed *ad libitum* a control (NDF=23.6%) or a high fibre diet (NDF=35.7%). In parallel to fecal digestibility, ileal digestibility of OM decreased by 18 points between control and fibre group. The proportion of digestible OM apparently digested in small intestine was higher for control (75.2%) than for fibre diet (58.7%), however the quantity of OM disappearing by fermentation between ileum and rectum was not different : 30 g/d for a mean daily intake of 100 g DM. Consequently, the caecal VFA production was estimated to 340 mM/d without significant variations between diets. Mean daily energy supply from caecal VFA was 100 and 83 kcal respectively for control and fibre group, corresponding to 66 and 61% of digestible energy (DE) disappeared between ileum and rectum. It was concluded that caecal VFA contributed to one third of DE intake, either to about half of the maintenance energy requirement.

41 - GIDENNE T., JEHL N.

Digestive incidence in the young rabbit of the substitution of dietary starch by digestible fibre : first results

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 301-308.

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Growth, digestion and caecal fermentations were compared on young rabbits fed a high starch diet "AM" (266 g/kg DM) or with the same diet where 50% of the starch was mainly replaced by digestible fibre "FD" (starch=136 g/kg DM). The digestible fibre originated mainly from wheat bran and beet pulp. Zootechnical parameters and fecal digestibility were measured on two groups of 12 young rabbits fed *ad libitum* with AM or FD diets from weaning. Feed intake, weight gain and feed conversion ratio from 28 to 72 days were not significantly different between the two groups of rabbits. Despite a 50% fall for the starch level between AM and FD, the digestibility of organic matter and energy were similar. Caecal fermentation parameters were measured *in vivo* on healthy animals from two further groups of 9 young rabbits (6 wk old) cannulated at caecum. The FD diet seemed to increase the total VFA concentration (71 vs 87 mmol/L for AM et FD resp., $P=0,13$), without change in VFA molar proportions. Besides, caecal pH tended to decrease (6,3 vs 6,1 in the same order ; $P=0,12$) whereas ammonia remains steady (7,7 mmol/L). A lower sanitary status of AM rabbits was observed (diarrhea, mucus), in spite of a level of lignocellulose (20 % DM) corresponding to the recommendations. The substitution of starch by digestible fibre preserved the health status of rabbits, without reduction of digestibility or growth performances.

42 - JARRIN D., LAFARGUE-HAURET P., RICCA V., ROUILLERE H.

Feeding of rabbit does whose young are weaned at 35 days : effect of the energy and protein contents of the feed.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 309-315.

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Two diets, differing in energy and protein content, has been continuously given to rabbit does whose young were weaned at 35 days. The Lactation diet (18 % crude protein, 2650 kcal digestible energy/kg) leads to an increase in the female weight at palpation and arise in the average weight of the weaned litter by 2 %. However, compared to the Mix diet (17 % crude protein, 2480 Kcal digestible energy/kg), the Lactation diet triggers an increase in the mortality before weaning (8.5 % vs 5.8 %) and a decrease in the fertility rate (70 % vs 74.4 %). Furthermore, also the rabbits weight is higher at weaning, the rabbits issued from the Lactation diet have through fattening worse growth and mortality results.

43 - LEBAS F., PEREZ J.M., JUIN H.*, LAMBOLEY B.

Effect of the number of growing rabbits per cage on the precision of the digestibility coefficients

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 317-323.

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Three hundred crossbred rabbits (Hyplus), 49 days old, were employed in 3 experimental successive trials, in order to measure the variability of digestibility coefficients obtained with one or with 4 rabbits per cage. In each trial a control diet E and an experimental diet (A, B or C) were employed; each diet was tested with 2 x 10 cages, allowing to a total of 6 independent comparisons between individual and collective caging. The number of rabbits per cage, one or four, has no significant effect on the average dry matter digestibility coefficient (66.28% and 66.47%), on the nitrogen one (73.03% and 72.79%) or on the average digestible energy content of the diets (2827 and 2832 kcal/kg DM). On the other hand, with 4 rabbits per cage the variability, measured through the standard deviation, was reduced by 36% (digestible energy) to 43% (nitrogen) in comparison with individual caging. According with these results, it is possible to obtain the same accuracy in the digestible coefficients determination with 10 cages of one rabbit or with 4 cages of four rabbits each.

44 - MAERTENS L.

Effect of pellet diameter on the growth performance of rabbits before and after weaning

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 325-332.

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A total of 66 does and their litters were fed during the 4th lactation week a diet differing in pellet diameter: 2.5 - 3.2 or 4.8 mm. Weight gain nor feed intake differed significantly before weaning with pellet

diameter. However, the results obtained with the smallest diameter tended to be less favourable. The hypothesis that a small pellet size favours the dietary intake of young rabbits is therefore rejected. A total of 396 weanlings of these does were further used to determine the effect of the same pellet diameters between 28 to 56 days of age and of the change from one diameter to another at weaning. The factorial analysis of the results revealed a significant ($P < 0.01$) effect, on daily weight gain and feed consumption after weaning, of the pellet diameter but also of the diameter fed before weaning. The difference of growth rate in favour of the 4.8 mm pellets was 1.9 g/d compared to the smallest pellet diameter. Especially the change from a large pellet diameter to the small diameter at weaning, had a significant ($P < 0.05$) negative effect on daily weight gain (only 37.5 g/d). On the other hand, the inverse change (from 2.5 to 4.8 mm pellets) resulted in the highest daily weight gain (45.1 g/d). The author suggest that the decreased results with the thinnest pellets could be due to the necessary increased feeding time, which does not allow to reach the same intake. The data of the feed intake support this hypothesis. However, the durability test delivered only 0.6% of meal with the 2.5 mm pellets while a 3 to 5 times higher quantity was found with the 3.2 and 4.8 mm pellets, respectively.

45 - MORISSE J.P., MAURICE R., TRIFOL F.

Incidence of the buffering capacity of feed on biochemical and zootechnical parameters in rabbits.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 333-340.

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By modification of Ca and Na sources, the buffering capacity of a feed was increased from 840 mEq/kg for the control feed (TT) to 950 mEq/kg for the experimental diet (HT). Each of both feed was provided *ad libitum* to seventy two 30 days old rabbits. After 6 weeks, daily gain and feed conversion were unchanged, the sanitary status was excellent in both groups (mortality $\leq 3\%$). In 10 animals euthanised in each group, plasmatic Na^+ K^+ Cl^- HCO_3^- were unchanged but a significant rise in Ca^{++} was observed in HT animals, although Ca concentrations were similar in both groups; in HT animals, uremia was slightly higher (+ 17 %).

Stomachal and intestinal pH were unchanged in both groups but in HT animals VFA caecal concentrations were lower and NH_3 slightly higher. Although not significant (likely on account of the low number of animals) those differences are interesting by their mutual coherence and by their connection with the rise observed in plasmatic urea. Further studies are required to confirm the tendencies observed in the present work.

46 - PADILHA M., LICOIS D.*, GIDENNE T.**, CARRE B.***, FONTY G.****

First results on the relations between the microflora and some biochemical parameters of the caecal content of the rabbit before and after the weaning.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 341-346.

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Using a method of sequential slaughtering, some microbiological and biochemical parameters of the caecal content were studied in 15- to 49-days-old rabbits. The ammoniac level was constant before weaning (11.5 mmol/L) but decrease by 40% after weaning (29 d.). Whereas the *E. coli* counts were reduced up to the weaning, the pH regularly decreased during all the period studied. The total volatile fatty acids concentration increased between day 15 (8 mM/L) and day 25, then it levelled off under 40 mmol/L. The molar proportions in propionate and minor VFA were high at day 15 but decreased when the animal began to eat solid feed. The ratio C3/C4 reversed at weaning while the acetic acid proportion did not change. The total anaerobic microflora was early at a high level (10^9 - 10^{11} bact./g of caecal content) and did not change during the experiment. On the contrary, under our breeding conditions, the cellulolytic microflora seems to colonize the intestinal tract slowly and at a low level.

47 - PARIGI-BINI R., XICCATO G., DALLE ZOTTE A., CARAZZOLO A.

Influence of different levels of dietary fibre on digestibility, performance and carcass and meat quality of rabbits.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 347-354.

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Three diets (5P, 10P and 15P: 5, 10 and 15% of wheat straw, respectively) differing in the level of crude fibre (15.7 vs 18.5 vs 22.4% DM, respectively) were given *ad libitum* to 3 groups of 8 rabbits each (of both sex), from 45 to 80 days of age. The digestibility of nutrients and energy of the experimental diets were determined by the individual collection of faeces of all rabbits from 52 to 55 day of age. In order to evaluate the effect of diets on the carcass and meat quality, the rabbits were slaughtered at 80 days of age.

As crude fibre level increased, the apparent digestibility of nutrients and energy decreased. The nutritive value of the diets decreased, too (from 11.58 to 10.53 to 9.69 MJ DE/kg DM). Rabbit growth was not influenced by the diets, because of the compensation of digestible energy intake by the rabbits (1.55 vs 1.56 vs 1.50 MJ/d), also with the 15P diet. Consequently, the feed intake and conversion ratio increased. High level of dietary fibre increased the incidence of the full gastrointestinal tract, especially of the stomach, and gave higher values of pH of the caecal content (6.3 vs 6.0; $P < 0.05$). Nevertheless, the VFA concentration of the caecal content was not significantly influenced by the fibre level. The high-fibre diets significantly increased the water content of the hindleg meat (from 719 to 723 to 727 g/kg; $P < 0.05$) and, as a trend, decreased the lipid content (from 49.9 to 47.3 to 42.6 g/kg; $P < 0.10$), but the other physico-chemical traits were not influenced.

48 - PEREZ J.M.

Digestibility and energy value of dehydrated lucerne meal for rabbits : influence of chemical composition and technological process.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 355-364.

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Three experiments (123 digestive balances) were carried out to determine the digestibility of major nutrients (OM, CP, CF, fibre components) of several types of dehydrated lucerne pellets and to define the effect of their chemical composition on the energy value for rabbits. Twelve batches of lucerne differing by their protein (16 to 26% DM) and crude fibre content (19 to 31% DM) were tested. Digestibility measurements were performed with 49-day-old New Zealand White male rabbits (10 minimum per treatment) according to the European reference method including an adaptation period of 7 days followed by a 4 days collection period. Animals were fed *ad libitum* on diets containing 100% lucerne. Organic matter digestibility of the experimental diets decreased linearly ($P < 0.01$) with cell wall content on the basis of 1.2 point per point of crude fibre (CF) in the dry matter. A close relationship was found between digestible energy (DE) value of lucerne and CF level, expressed by the following equation :

$$DE \text{ (MJ/kg DM)} = 13.93 - 0.196 \text{ CF (\%DM)}$$

$$r = -0.91 \quad ETR = 0.35 \text{ (3,9\%)} \quad (n=12).$$

49 - PEREZ J.M., BOURDILLON A.*, JARRIN D*, LAMBOLEY B., LEBAS F., LE NAOUR J.** , WIDIEZ J.L.***

Determination of *in vivo* digestibility in rabbits with the European reference method : interlaboratory study

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 365-374.

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A collaborative study was undertaken to assess the reproducibility of several methods for *in vivo* determination of digestibility in rabbits. For all the digestibility coefficients (dDM, dOM, dE, dCP, dCF, dNDF, dADF), and the energy digestible content, reproducibility was estimated from 4 diets measured in 4 laboratories by using their own procedure or the European reference method. On the whole, 312 digestive balances were carried out on the basis of 8 to 10 rabbits per diet for each method at the end of the experiments. A highly significant laboratory effect was observed with the own procedures mainly for the ED content which differed between the 4 laboratories. In comparison with the individual laboratory procedures, the reference method improved the reproducibility notably for the digestibility of dry matter (between-laboratories coefficient of variation = 2,4 vs 3,9%), organic matter (CV = 2,5 vs 4,5%), and crude protein (CV = 2,3 vs 4,1%).

50 - XICCATO G., COSSU M.E. *, CARAZZOLO A., CARABAÑO R.** , RAMOS M.**

In vitro evaluation of the nutritive value of rabbit diets. Efficacy of different digestive enzymes.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 375-383.

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In order to validate in two laboratories an enzymatic method of *in vitro* digestibility of rabbit diets and evaluate the efficacy of different

enzymes, 19 rabbit diets were analysed to determine the *in vitro* digestibility of organic matter (vMO). The analyses were performed by using Viscozyme enzyme on the same set of diets, both in Padua (V.PAD) and in Madrid (V.MAD). In addition, in Padua the efficacy of Viscozyme was compared to that of other enzymatic treatments performed during the 3rd phase of the reference method: Bio-Feed Plus, Energex or No-Enzyme (absence of enzyme). Multiple regression equations based on vMO and/or chemical composition of the diets were calculated by step-wise analysis, to estimate the *in vivo* nutritive value (digestibility of organic matter, dMO, and digestible energy content, ED). The reference method resulted to be suitable in the estimation both of dMO and DE ($R^2 = 0.71-0.80$; coefficient of residual variability - CVR = 2.6-3.2%), enabling to improve significantly the nutritive value estimation based on the chemical composition of the diets ($R^2 = 0.54-0.58$; CVR = 3.8-4.2%, using crude fibre or NDF as predictors). The two laboratories, although utilising the same method and enzyme (Viscozyme), obtained significantly different results, especially with the diets rich in fibre and poor in DE, and gave different regression equations ($P < 0.05$). Comparing the different enzymes, Viscozyme (both in Padua and Madrid) and Energex resulted to be the best predictors of the nutritive value; on the contrary, Bio-Feed Plus and No-Enzyme were comparable in efficacy to the chemical data. The multiple regression equations based on *in vitro* and chemical analysis further increased ($P < 0.05$) the precision of the estimate of the nutritive value ($R^2 = 0.77-0.85$; CVR = 2.4-3.0%).

MEAT QUALITY

51 - CABANES-ROIRO A., OUHAYOUN J.*

Influence of slaughter age on carcass and meat characteristics of rabbits slaughtered at the same live weight

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 385-391.

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Two rabbits groups from the same weaning group were slaughtered at 62 or 73 days at the same individual live weight (2.45 kg). Rabbits early reaching this weight (62 days) have better growth performance. But their slaughter characteristics (slaughter yield, meat to bone ratio and hindquarters cuts) are lower (eg. 53.2 vs 56.1 % for slaughter yield). pH level measured on 3 hind leg muscles is greater for 73 days old rabbits but slaughter age doesn't influence cooking losses. Sensory properties of the 2 groups are compared (hind leg and loin) and show some appearance and texture differences. Hypothesis of greater potential adult live weight of precocious rabbits (62 days) is discussed.