

**ABSTRACTS OF THE 42ND SYMPOSIUM ON CUNICULTURE, ASESCU
MURCIA, SPAIN, 11TH-12TH MAY, 2017.**

The 42nd Congress of the Spanish Association of Cuniculture (ASESCU) was held in Murcia from 11th to 12th May 2017, hosted by the University of Murcia's Veterinary Faculty. The main papers focussed on analysing the situation of rabbit farming in the Murcia region, the demedicalisation of rabbit health management, a new law on farmers' organisations and the main presentation forms of infections associated with *Staphylococcus aureus*. A specific session was devoted to explaining the objectives and progress of the research projects supported by the partnership between the Spanish Institute of Agricultural Research (INIA) and the Rabbit Meat Marketing Board (INTERCUN). In addition, two round tables were held, one on the alternatives to massive use of antibiotics and the other on the farmers' organisations. Moreover, a total of 28 communications were presented both in working sessions with oral communications and posters (reproduction and genetics, pathology, ethology and welfare, management and production, nutrition and feeding and meat quality). The meeting was attended by more than 160 participants, including researchers from Spain, Portugal, Brazil, Venezuela and Ecuador, among other countries. Abstracts of the contributions presented are reported below.

REPRODUCTION AND GENETICS**CONSEQUENCES OF FOOD RESTRICTION DURING PREGNANCY OF RABBIT DOES ON FETOPLACENTAL GROWTH**

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The aim of the current study was to evaluate the consequences of food restriction during gestation on fetoplacental development in multiparous rabbit does. Ninety-eight does were randomly distributed in 4 experimental groups according to the duration and period of gestation in which the restriction was applied (40% of voluntary feed intake during first pregnancy): restricted in the first week (R07, n=26), second and third week (R721, n=26) and in the first three weeks (R021, n=22) or never restricted (control, n=21). In the last week of gestation

all animals were fed *ad libitum*. On day 28 of gestation, 4 does from each group were euthanised to evaluate fetoplacental development and at the end of gestation productive parameters were analysed. All restricted groups significantly increased their voluntary feed intake when the food restriction period ended. Foetuses from control and R07 groups tended to be heavier than the other groups and their placentas were also larger. However, the different restriction patterns affected neither the fertility, nor the prolificacy nor the weight of kits at parturition. In conclusion, food restriction of 40% during the first week of gestation maintained the same fetoplacental development as the control group by means of an increase in placental efficiency to preserve the survival of the foetuses. The increase in the restriction period to 2 and/or 3 wk negatively affected fetoplacental development, although there were no significant differences at parturition.

SELECTION FOR RESIDUAL VARIANCE OF THE LITTER SIZE: CONSEQUENCES ON LITTER SIZE COMPONENTS

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A divergent selection experiment on residual variance of litter size was carried out in rabbits. The aim of this work was to analyse the effects of selection, lactation status and season on litter size and its components. Ovulation rate (OR) and number of implanted embryos (IE) were measured by laparoscopy at 12 d of the second gestation in females. At the end of the second gestation, litter size was measured as total number of kits born (TB2). Embryonic (ES), foetal (FS) and prenatal (PS) survival were estimated as IE/OR, TB2/IE and TB2/OR, respectively. Ovulation rate was similar in both lines; however, after eleven generations of selection, the line selected for homogeneity in litter size showed 1.62 embryos more at implantation and higher embryonic survival (0.11) than the heterogeneous line, leading to higher litter size at birth. Lactating females showed higher OR (13.4 oocytes) than non-lactating females (12.0 oocytes), but similar TB2. Litter size at birth was lower in summer than in autumn (-0.67 kits) due to lower FS (-0.07) and PS (-0.07). In conclusion, selection for residual variance of litter size has shown a negative correlated response in litter size, by means of lower embryonic survival. Both the state of lactation and the season affect the components of litter size, but only summer decreases litter size at birth.

TOWARDS AN OPTIMAL RABBIT LITTER SIZE

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Based on the concepts developed by David L. Lack, who noted that nestling survival of altricial birds decreased as clutch size increased, the relation between litter size (offspring born alive: ba) and the offspring survival during lactation (sl) and the relation between ba and the number of offspring weaned (nw) of 5 rabbit strains developed at Universitat Politècnica de València were studied. The relationship between ba and sl was not linear. For lines selected to increase the litter size at weaning (maternal lines; $n=4$), this relation approximated to a convex upward parabola, while for the line selected for growth rate (paternal line) this relation approximated to a sine curve. The relation between ba and nw was similar among maternal lines: the nw increased linearly between 2 and 11 born alive, reaching a plateau of ≈ 11 weaned offspring for >12 born alive. For the paternal line, we observed two linear phases, the first with a steeper slope between 2 and 10 ba followed by a second phase with a soft slope from 11 and 16 born alive. After matching the relation between

ba and sl with the relation between ba and nw, the data suggest an optimal litter size (i.e. the best compromise between sl and nw) of around 12 born alive.

FAT MOBILISATION BETWEEN SECOND INSEMINATION AND WEANING IS POSITIVELY RELATED TO THE REPRODUCTIVE SUCCESS IN PRIMIPAROUS DOES

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Body condition using bioelectrical impedance and productive traits were recorded in 172 rabbit does during the first 5 inseminations (AI) (performed 11 d post-partum and weaning at 25 d). The experimental period lasted from the first positive AI to the parturition corresponding to the 5th AI. Rabbit does were classified a posteriori into two groups: Elite (pregnant in all AI) and Normal rabbit does (at least, once lactation period completed). In the first AI, Elite rabbit does were lighter (3930 vs. 4087 g; $P=0.025$) and had lower body fat proportion (15.7 vs. 17.2%; $P=0.042$) than the other rabbit does, but they had a similar body protein content (17.8 vs. 17.9%). The Elite group also showed a higher body protein proportion at first parturition (17.9 vs. 17.7%; $P=0.012$) and first weaning (18.1 vs. 17.9%; $P=0.027$). Fat and protein mobilisation/deposition between AI1-parturition 1 or parturition 1-AI2 did not differ between the two groups, but Elite rabbit does presented the double fat mobilisation between AI 2 and first weaning (27.9 vs. 14.1%; $P=0.004$).

PREDICTION OF MILK PRODUCTION OF RABBIT DOES IN LACTATIONS OF 25 D FROM THE LITTER WEIGHT

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The aim of this work was to predict the milk production of rabbit does with lactation periods of 25 d from litter weight at 20 d of lactation and number of parturition. Experimental period lasted from 1st to 5th insemination (performed 11 d post-partum). Milk production (MP; at least 2 lactations/rabbit doe) and litter weight at 20 d of lactation were recorded in 116 rabbits (calibration group). Another 16 rabbits were used to validate the model obtained (validation group). The

prediction equations obtained for milk production were: MP_{primiparous}=983.7 (±141.7)+1.534 (±0.039)×Litter weight at 20 d; and PL_{multiparous}=983.7 (±141.7)+1.582 (±0.047)×Litter weight at 20 d. The mean prediction relative error was lower for the first lactation than for the second and successive lactations (4.68 vs. 7.06%).

PATHOLOGY

NEW MOLECULAR AND ORGAN CULTURE METHODS OPEN UP NEW RESEARCH PERSPECTIVES FOR EPIZOOTIC RABBIT ENTEROPATHY

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Different methods have been used in numerous attempts to characterise the aetiology of Epizootic Rabbit Enteropathy (ERE). In order to develop a new *in vitro* method that would allow the screening of causative agents, we used intestinal explant and cell cultures to determine the expression of inflammatory markers induced by ERE caecal filtrates. The *in vitro* method developed for the selection of possible pathogens must now be cross-checked with controlled infection assays. Likewise, new sequencing techniques have been used to compare caecal bacterial populations (microbiota) from rabbits in farms that use antibiotics or that do not use them –with different ERE incidence– and also from wild rabbits. Data obtained suggest that animals bred with antibiotics may lack protective bacteria, so the isolation of these bacteria is our next research objective.

PASTEURELLA MULTOCIDA CAPSULAR TYPING BY qPCR. DIRECT APPLICATION IN RABBIT CLINICAL SAMPLES

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Pasteurellosis, caused by *Pasteurella multocida* serotypes A, D and F, is one of the main bacterial diseases on Spanish rabbit commercial farms. So far, different conventional PCR techniques have been described for capsular characterisation. The aim of this study was to develop novel real time polymerase chain reaction (qPCR) technique assays for capsular typing of *P. multocida* strains. Good results have also been obtained by direct

application of these assays in rabbit clinical samples. Due to their high sensitivity, specificity and lower cost in terms of money and time, they are very convenient for application in a diagnostic laboratory.

DETECTION AND ISOLATION OF RABBIT HAEMORRHAGIC DISEASE VIRUS RHDV2/B IN WILD MICROMAMMALS IN NORTHERN SPAIN

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This work explores the natural RHDV2/b infection of wild rabbit-sympatric micromammals. Between 2014 and 2016, several wild rabbit populations kept in semi-freedom enclosures were monitored where four micromammal carcasses were found, dead from natural causes. A duplex real time polymerase chain reaction (PCR) procedure was used to assess the presence of RHDV2/b in all sampled animals. In total, 2 Mediterranean Pine Voles (*Microtus duodecimcostatus*) and 2 White-toothed Shrews (*Crocidura russula*) were found and both shrews resulted positive to RHDV2/b. To assess the infectiousness of the isolates, a batch of laboratory rabbits was inoculated with homogenates obtained from the livers of positive micromammals, where some died showing compatible RHD lesions. Duplex real time PCR analysis of the livers from the rabbits demonstrated the infection and nucleotide sequences of VP60 gene confirmed their genotype as RHDV2/b. This finding is to our knowledge the first report of RHDV2/b in wild micromammals and suggests that the epidemiology of the disease could be more convoluted than initially understood. The study also manifests the importance of implementing good micromammal pest control programmes in rabbitries to avoid the possible entry of the virus in this manner. Further studies are necessary to fully assess the role of micromammals and other animal species in RHD epidemiology.

IMMUNE RESPONSE OF THE RABBIT TO STAPHYLOCOCCUS AUREUS

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Staphylococcus aureus is a bacterium with remarkable interest from a sanitary point of view in commercial rabbitries because it affects rabbits of all ages and causes different types of suppurative lesions. An experimental infection was designed to study the local immune response developed in the animals after intradermal inoculation using the most widespread strain of *S. aureus* (ST121) isolated from farms. One hundred per cent of the animals infected with the strain ST121 developed lesions. The results of the leukocyte populations analysed by immunohistochemical staining revealed an increase in T lymphocytes after 48 h post infection (p.i.), whose levels remained elevated up to 21 d after infection. The number of phagocytic cells (macrophages) increased after 72 h post-infection, reaching their highest values at 7 d p.i., coinciding with the opening and drainage of abscesses. Plasma cells showed a first increase at 48 h p.i., and a subsequent progressive increase between 7 and 21 d p.i. These findings describe the evolution of an intradermal abscess in a rabbit skin infection model, establishing the interaction between the host immune system and the pathogen, and confirming the importance of innate host defence mechanisms against infections produced by *S. aureus*.

CURRENT STATUS OF STAPHYLOCOCCUS AUREUS STRAINS IN RABBIT FARMS

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Staphylococcus aureus is a bacterium widely distributed in rabbitries, causing mastitis, pododermatitis and abscesses. The most prevalent clone is ST121, with A1 II1 δ genotype, followed by ST96. The aims of this study were: (1) to characterise strains of *S. aureus* involved in outbreaks and chronic cases since the year 2014; (2) to determine the geographical distribution of the different *S. aureus* clones in recent years. For this purpose, 34 farms were sampled, from which 124 samples were positive for *S. aureus*. Some 66.7% of the farms with samplings in several years maintained the same genotype, and the strains were apparently not homogeneously distributed. Two new clones

(ST3761 and ST3764) and a new genotype (B1 II1 λ) not previously detected have been identified.

EVOLUTION OF VIRULENCE OF STAPHYLOCOCCUS AUREUS IN THE LAST 15 YEARS

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The most commonly isolated *Staphylococcus aureus* clones from diseased and healthy rabbits are ST121 and ST96. Different studies have shown the limited ability of the ST96 clone to cause infection in the rabbit. However, in recent years an increase in the prevalence of ST96 isolates from rabbit lesions has been observed. This work proposes the hypothesis of a change in virulence of ST96 clones, and to prove this, a retrospective study was carried out comparing both old and recent ST96 and ST121 strains. To compare the virulence of both clones, we intend to perform *in vitro* tests on each of the selected strains.

REAL TIME DUPLEX-PCR DETECTION AND ISOLATION OF INFECTIVE RHDV2/B DURING A MUCOID ENTEROPATHY OUTBREAK

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This work describes the duplex real time polymerase chain reaction detection and isolation of infective RHDV2/b virus from duodenum, spleen and thymus from a 50-d old rabbit dead during a mucoid enteropathy outbreak in a Spanish commercial rabbitry. The outbreak lasted 31 d, resulting in 17.5% mortality (1113 individuals) in 42-72 d old rabbits. During the outbreak, no sign or lesion compatible with rabbit haemorrhagic disease (RHD) was found. One 7-wk-old specific minimal disease level rabbit was inoculated intramuscularly with an inoculum obtained from homogenised positive samples, dying after developing the acute form of rabbit haemorrhagic disease RHD. Analysis of the VP60 gene nucleotide sequence confirmed that the isolated virus was RHDV2/b. This finding suggests that RHDV2/b might persist and circulate in a silent way without causing RHD outbreaks.

FIRST CASE OF DETECTION OF *TALAROMYCES MARNEFFEI* IN A HARE (*LEPUS GRANATENSIS*)

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This paper presents the results of a clinical study, which was performed in one hare (*Lepus granatensis*) found dead in Penamacor, Castelo Branco, Portugal. This study consisted of the detection and identification of filamentous fungi in the fur of wild animals. The collected samples were seeded into specific culture media. Fungal identification was based on phenotypic characteristics of the colonies at the macroscopic and microscopic level. In this investigation, we were able to isolate the fungus *Talaromyces marneffi* from the fur of one hare. This result was subsequently confirmed by Nested-PCR. To our knowledge, this is the first documented case of *T. marneffi* in animals in Europe, reported here in a hare.

ETHOLOGY AND WELFARE

BEHAVIOUR, FEAR AND STRESS OF GROWING RABBITS: RESULTS UNDER UNCOMFORTABLE HOUSING CONDITIONS

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Behaviour, reactivity and corticosterone levels were evaluated in 376 growing rabbits reared in large groups (20-27 rabbits per pen) from weaning to slaughter in pens with 2 floor types (wooden slat, 3 cm between slats, vs. plastic slat, 0.7 cm between slats). Rabbits reared on the wooden floor spent more time resting (68.5 vs. 67.0% total observation time; $P=0.05$) in a crouched

position (41.3 vs.35.1%; $P<0.001$) than those reared on the plastic floor. The floor type did not affect rabbit fear towards humans, but rabbits kept on the wooden floor showed fewer "bold" behaviours, i.e. they decreased movement (26.0 vs. 31.2 sec; $P<0.05$) and alert (0.96 vs. 2.32 events; $P<0.01$) and increased exploration (392 vs 354 sec; $P<0.01$) in a new environment, and had fewer contacts with an unknown object (50.3 vs. 87.2; $P<0.001$). The higher hair corticosterone concentration likely indicated a higher stress level in rabbits reared on the wooden floor than in those reared on plastic (14.0 vs. 12.5 ng/g; $P<0.05$).

PRODUCTION OF RABBIT FEMALES HOUSED IN INDIVIDUAL CAGES OR IN COLLECTIVE SEMI-GROUP

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The productive life of 38 rabbit does was measured from 5 parturitions. Half of them were allocated to individual cages and the other half to a mixed housing system (collective cages during pregnancy and late lactation and individual cages from partum to 11 or 18 d post-partum). Productive life and performance at partum were not affected by housing system, but litter size and kit weight at weaning were lower for mixed housing system than for individual cage (9.2 vs. 10 kits and 492 vs. 531 g, respectively). Feed intake, perirenal fat thickness and live weight of does in mixed housing system were lower than in individual cages (317 vs. 344 g dry matter per day; 6.7 vs. 7 mm and 4416 vs. 4514 g, respectively), especially during the 18-28-d post-partum period.

MANAGEMENT AND PRODUCTION

EMPTYING THE FARM TO FILL THE POCKET: TECHNICAL AND ECONOMIC IMPACT OF THE ALL-IN ALL-OUT SYSTEM IN RABBITRIES

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The research includes two studies carried out in farms of the SAT “Cunicultores de Cataluña” (SAT CC) in the frame of a project focused on the prudent use of antibiotics, funded by the Spanish Ministry of Agriculture and Fisheries, Food and Environment (MAGRAMA). The first analysis included 45 farms and studied differences in farm structure, management, productivity and level of use of antibiotics (IFTA) in maternity and fattening between farms with the possibility of practicing the all-in all-out system (pAIAO) and farms with continuous production (C). The technological index, technological index of biosecurity, mortality at fattening, feed conversion index and the IFTA in does were more favourable for pAIAO farms than for C farms (6.97, 8.75, 6.4%, 2.54 g/g, and 0.81 vs. 5.41, 5.38, 12.2%, 4.56 g/g, and 1.67, respectively). The second activity compared the farm structure, management, productivity and profitability of farms practicing all-in all-out (AIAO) to farms using the C system. All the parameters studied were favourable for the AIAO system, but no effect was found for the IFTA during fattening. The Net Present Value, Internal Rate of Return and Pay Back economic indexes indicated that rabbitries are not profitable independently of the system used. The Income Over Feed Cost was higher and the production cost per kg of rabbit was lower in farms with AIAO (93.9€/female and year and 1.35€/kg, respectively) than in farms C (47.2€/female and year and 1.77€/kg, respectively). In conclusion, sustainability would be higher in farms using the AIAO system.

ARE EXTENSIVE PRODUCTION SYSTEMS AN ALTERNATIVE TO REDUCE THE USE OF ANTIBIOTICS?

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This work compares a semi-intensive system (Artificial Insemination or AI 11 d post partum [pp]) with weaning of the kits at 36 d (S11W36) vs. extensive system (AI 25 d pp) with extremely long weaning (50 d, S25W50) in a private company in industrial conditions. The more extensive system is an attempt to reduce different production costs, such as the use of antibiotics and reproductive hormones. The conception rate for primiparous does in the semi-

intensive system is lower. Prolificacy decreases faster for the extensive system compared to parity order. It also exhibits a lower overall meat production, mainly explained through the lower number of parturitions per year. Food Conversion Ratio is observed to be similar over years and systems. The cost of veterinary treatments and salaries are lower for the extensive system and it eventually leads to a lower meat production cost. One relevant aspect is the reduction of antibiotics in the extensive system, which entails an improvement in product quality. In conclusion, when the aim is to increase meat production an intensive system is recommended, however when the concern is to reduce costs and the use of antibiotics then extensive ones are to be preferred.

EFFECT OF GENETIC LINE, DIET AND GENDER ON RELATIVE GROWTH IN RABBITS

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In the current rabbit meat production market, the need for added-value products arises. It is thus relevant to know the relative growth of parts and tissues for different genetic lines and diets. In this work, 3 genetic lines Ebro (EB) and Grimaud (GR), both selected for growth rate, and Hyla, selected for litter size), both males and females, fed with 2 different diets high energy diet (HE) and control diet (C) and a slaughter age from 8 to 16 wk, were analysed. The EB line was found to be convenient, as it showed earlier growth for skin, foreleg and intramuscular fat, and later development of scapular and inguinal fat. However, the GR line showed earlier growth for loin and later for bone. Regarding the diet effect, rabbits fed the HE diet showed later liver growth, skin and scapular fat, and earlier maturing for loin, muscle hind leg and thoracic depth.

OBTAINING HIGH ADDED VALUE PRODUCTS IN RABBIT PRODUCTION: EFFECT OF GENETIC LINE AND DIET ON GROWTH TRAITS

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The aim of the current work is to search for a genetic line and a feed to produce rabbits with greater slaughter weight to obtain added-value products that open the door to new markets. To carry out the study, 2294 rabbits were selected at 7 wk of age (males and females, one from each litter) from three sire genetic lines (Ebro [EB], Grimaud [GR] and Hyla [HY]). Half of each line was fed a different diet (control diet and high energy diet) until they reached 16 wk of age, when the assay was completed. The lines selected for growth rate (EB and GR) showed faster rates of growth than the maternal line HY. This superiority of EB and GR was increased when they were fed an energy diet. The EB line presented lower feed conversion ratio (FCR) than the HY line, whereas the FCR of the GR line was not different from the other two lines. In addition, FCR decreased with high energy diet.

RABBIT PRODUCERS' ORGANISATIONS. MOTIVATIONS, REGULATION AND CONNECTIONS WITH THE REALITY OF THE RABBIT MEAT PRODUCTION SECTOR

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Both the European Union and the Spanish Ministry of Agriculture and Fisheries, Food and Environment (MAPAMA) are aware of the imbalances caused by value chains in different agricultural sectors. To this end, they have set out measures and actions that seek to rebalance them. These institutions acknowledge that the production sector is in a greatly weakened situation, and Producers' Organisations (OPs) are one of the tools proposed to improve it. The rabbit production sector in Spain is one of the most affected by the imbalances of its own value chain. The Spanish government has issued two Royal Decrees (RD) of measures to support rabbit meat producers. Royal Decree 541/2016 of 25 November, which regulates the recognition of producers' organisations and their associations in the rabbit sector, and Royal Decree 350/2016, of 7 October, which lays down the regulatory basis of grants for the promotion of new inter-regional producers' organisations in the agricultural sector. In this research, both regulations were analysed and different stakeholders in the rabbit value chain were subsequently interviewed to determine the legislation's degree of alignment with the reality of the sector. We concluded that the requirements set out in the rules governing the

recognition of Rabbit Producers' organisations (OPC) and the granting of subsidies for their development may give rise to a new model that will involve a paradigm shift in production, whose strategic objectives will be adjustment to the reality of the current world economy and rebalancing of the rabbit value chain to ensure both technical and economic improvements for farmers.

NUTRITION AND FEEDING

DETERMINATION OF THREONINE REQUIREMENTS FOR GROWING RABBITS USING PLASMA UREA NITROGEN LEVEL

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The protein content in growing rabbits' diets has been reduced to minimise digestive disorders. In this context it is necessary to adjust the amino acid profile, especially those limiting amino acids (lysine, methionine and threonine). Of all 3, threonine (tre) is the least studied. This work evaluated the levels of threonine suitable in growing rabbits using plasmatic urea nitrogen level (PUN). Three experimental diets were formulated, all using the current recommendations for lysine (lys) and sulphur amino acids (saa). For this diet, tre content was introduced at 6.2 g/kg (MMX) or by more or less 15% (MMH; 7.2 g/kg or MML; 5.33 g/kg). A total of 99 rabbits (33 per feed) were used. PUN was analysed from a samples obtained at 08:00 h (under *ad libitum* feeding) and at 21:00 h (3 h after refeeding after a fasting). Average PUN level was the same ($P < 0.05$) at 08:00 h, which may be due to caecotrophy. On the other hand, at 21:00 h the PUN level of animals that were fed with high levels of tre was lower. Although further studies are needed, these results could show that threonine requirements for growing rabbits are higher than currently advised, when current recommendations of lysine and sulphur amino acids are used.

EFFECT OF LEVEL OF SOLUBLE FIBRE AND INSOLUBLE FIBRE ON THE PERFORMANCE OF RABBIT DOES AND THEIR LITTERS UNTIL SECOND PARTURITION

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The aim of this work was to study whether the effect of dietary level of soluble fibre (SF) on performance of rabbit does and their litters depends on the level of insoluble fibre (IF). To this end, diets were formulated according to a 2×2 factorial design with two levels of IF (33.5 vs. 42.0% neutral detergent fibre, on dry matter [DM] basis) and 2 levels of SF (6.8 vs. 11.8% DM). The 4 diets: low in IF and SF, low in IF and high in SF, high in SF and low in IF, and high in SF and IF, were fed to 96 nulliparous does (24/diet). The level of insoluble and soluble fibre did not influence the number of kits born alive (12.4 kits/litter; $P=0.43$). However, the increase of soluble fibre improved the number of kits at weaning (25 d), obtaining 0.8 kits more per litter than those fed the low soluble fibre diets ($P=0.017$), with no effect on the litter weight at weaning. Litters from does fed with the high level of insoluble fibre were heavier at weaning (by 9%; $P=0.013$). These results implied that the average mean kit weight at weaning increased with the level of insoluble fibre and decreased with the level of soluble fibre ($P=0.022$).

EFFECTS OF THE DIETARY INCORPORATION OF COWPEA (*VIGNA UNGUICULATA*) STOVER UNTREATED AND PRE-TREATED WITH WHITE-ROT FUNGI (*PLEUROTUS CITRINOPILEATUS*) ON PERFORMANCE AND DIGESTIBILITY OF RABBITS

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The objective of this study was to evaluate the effect of the incorporation of untreated and treated cowpea stover with *Pleurotus citrinopileatus* white-rot fungus on the productive performance of growing rabbits (live weight, feed intake and conversion feed rate) and digestibility of diets. A total of 80 animals were randomly allocated among five dietary treatments; incorporation of 0% (FF0), 5% (FF5) and 10% (FF10) of untreated stover, and 5% (FF5T) and 10% (FF10T) of fungus treated stover. The trial was conducted between the 35th and 63rd days of age, with rabbits housed individually and fed *ad libitum* with non-medicated diets. The final live weight was affected by the inclusion level of untreated cowpea stover ($P=0.0401$),

while control animals reached a higher weight than in the treatment with 10% stover incorporation (2365 vs. 2196 g). The final live weight of the animals fed treated stover was also higher ($P>0.05$) than the animals fed with untreated straw (2323 vs. 2264 g). No changes between treatments ($P<0.05$) were observed in any of the other variables analysed (average daily feed intake, weight gain, feed conversion and nutrient digestibility). The results obtained indicate that the incorporation of cowpea stover did not affect the general parameters of animal performance and nutrient digestibility, except for the final weight of the animals. The results demonstrate that the treatment of cowpea stover with *Pleurotus citrinopileatus* inhibited the negative effects of cowpea stover incorporation in diets of growing rabbits.

EFFECT OF FEED RESTRICTION AND ANIMAL DENSITY ON PERFORMANCE AND CARCASS YIELD OF GROWING RABBITS

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The objective of this study was to compare the effect of feed restriction on growing rabbits housed in cages with 8 animals/cage or 5 animals/age. Three feeding regimens were established: *ad libitum*, and 2 levels of restriction, 80% and 90% of the *ad libitum* daily ration. Animal density did not show an effect on animal performance or carcass yield. Animals fed *ad libitum* showed higher weight gain, feed intake and carcass yield, but lower stomach and digestive tract weights than those which were under feed restriction. When the level of restriction was increased, weight gain, feed intake and carcass yield of animals was reduced. From this study it could be concluded that performance and carcass yield of animals is not dependent on the animal's density.

GROWTH PERFORMANCES AND DIGESTIBILITY IN GROWING RABBITS SUBJECT TO WATER RESTRICTION

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The aim of this work was to study the productive performance and digestibility of nutrients in fattening

rabbits, subject to different times of water availability. In the first trial, we monitored 144 hybrids (NZ×C) rabbits of both sexes, divided into four groups (36 animals in each group) to determine their productive performance. In the second trial, we worked with 36 animals (9 animals in each group) to determine the diet digestibility. In both trials, we compared a water restriction treatment to a control treatment (C) with permanent access and 3 different times of access: 3 h/day in the morning (A3M; 9:00 to 12:00 h); 3 h/day in the evening (A3T; 18:00 to 21:00 h) and 6 h/day (A6M; 9:00 to 15:00h). The rabbits were controlled from 35 d (weaning age) to 57 d, and the individual animal weight and food consumption were monitored weekly to determine productive performances. During weighing the rabbits were observed to determine morbidity. Daily weight gain was significantly affected by water restriction ($P<0.05$), with a decrease of 23% for A3M. The A3T and A6M treatments also decreased by 16 and 10% compared with the control group, but without significant effect. Despite this differential growth, final body weight was not significantly affected by the treatment. A restricted access to drinking water of A3M, A3T and A6M induced feed restriction in growing rabbits to 87, 85 and 86% of the *ad libitum* level ($P>0.05$), respectively, but without significant effect. Feed conversion ratio were only improved with hydric restriction in A6M, but no significant effect ($P>0.05$). No effects of treatments on mortality and morbidity were observed and digestibility of the diet was not affected.

EFFECT OF LEVEL OF SOLUBLE FIBRE AND INSOLUBLE FIBRE LEVEL ON THE FAECAL DIGESTIBILITY AND BODY CONDITION OF NULLIPAROUS RABBIT DOES UNTIL SECOND PARTURITION

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The aim of this work was to study whether the effect of dietary level of soluble fibre (SF) on digestibility and the evolution of body composition of rabbit does until the second parturition depends on the level of insoluble fibre (IF). To this end, diets were formulated according to a 2×2 factorial design with two levels of IF (33.5 vs. 42.0% neutral detergent fibre, on dry matter [DM] basis) and 2 levels of SF (6.8 vs. 11.8% DM). The 4 diets were fed to 96 nulliparous does (24/diet) that were used to determine body composition by bioelectrical impedance analysis (BIA) at artificial insemination, pre-partum, post-partum

and weaning (25 d). In the digestibility trial, we used 32 rabbits does in their first pregnancy (16/diet). Feed intake increased by 13% ($P=0.036$) with the high level of IF because faecal digestibility of DM and energy decreased by 12% and 2% for protein ($P=0.023$). The highest level of SF increased faecal digestibility of DM and energy by 5% ($P<0.001$). The DP/DE ratio increased with the IF level and decreased with SF (especially in HighIF and HighSF diets. $P<0.001$). The increase in SF level increased body fat and energy and decreased body water on day 29th of gestation (pre-parturition), especially in the HighIF group ($P=0.066$). At weaning, body protein content tended to be lower in animals fed with diets LowIF/HighSF and HighIF/High SF than in those fed LowIF/LowSF and HighIF/HighSF ($P=0.054$), without any effect on body fat.

MEAT QUALITY

COMPOSITION OF RABBIT MEAT FATTY ACIDS DEPENDING ON THE GENETIC LINE AND DIET

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The effect of 2 diets with different fibre levels on rabbit meat fat profile composition was estimated for a total of 150 animals from three different genetic lines (Ebro [EB] and Grimaud [GR], selection by growth rate and Hyla [HY] selected by maternal aptitude). The animals were fed a control diet (C) (25% fibre) and another with energy level (HE) (17% fibre). After slaughter at 8 and 12 wk of age, we analysed the nutritional content of the meat of a hind leg, obtaining the percentage of intramuscular fat and the fatty acids profile. We observed that the intramuscular fat content decreased according to age, as did the omega 6/omega 3 ratio ($P<0.05$). The maternal aptitude line (HY) presented significant differences compared to EB and GR in the polyunsaturated fatty acids content at 12 wk, with a higher concentration of these fatty acids. With respect to both diets, there were differences in palmitic acid (C16:0) at 12 wk, with a higher content in animals fed the HE diet (28.97 ± 0.05) than in those fed the C diet (27.75 ± 0.05). Thus, the fat content can be influenced by age, by the genetic line, and to a lesser extent by the diet.

COMPARISON OF THE QUALITY OF CONVENTIONAL RABBIT MEAT AND ECOLOGICAL RABBIT

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This is a comparative study of the quality of organic meat vs. that of conventional rabbit. The meat was acquired after slaughter of the animals. Organic cuniculture produced more redness ($P<0.05$), darker meat ($P<0.001$) and higher water holding capacity ($P<0.001$) than conventional rabbit. Softer and more cohesive meat is obtained in organic production. Organic rabbit meat has a more intense aroma ($P<0.001$) and typical flavour ($P<0.05$) of the species. In addition, less hard ($P<0.001$) and less fibrous ($P<0.01$) meat was obtained in the ecological meat. These differences were due to different breeding systems.

COMPARISON OF MEAT QUALITY BETWEEN RABBIT LINES SELECTED FOR DIFFERENT TRAITS

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Nowadays, consumers are concerned about health, nutritional value and the sensory characteristics of meat. However, selection and genetic progress leads to rabbits slaughtered at earlier ages at the same commercial weight, which could affect the meat characteristics. In this study, we analysed the quality of 2 rabbit meat lines selected for different traits: litter size (maternal line, ML) and growth rate (terminal sire line, PL). Twelve animals were used in the experiment, 6 carcasses per line. Rabbits were dissected, and from each carcass both loins (*Longissimus dorsi*) were separated for analysis. Colour, pH, water holding capacity (WHC), cooking loss, moisture, fat and protein content were measured. Texture profile analysis (TPA) was used to assess the textural properties. Likewise, sensory attributes were evaluated by a semi-trained panel. There were no differences between both lines in live-weight at slaughter age. However, PL had a less developed loin than the other line. The pH values showed differences between lines, being higher in ML. A lower moisture and higher protein percentage were also found in the ML. Differences were detected in a^* and b^* colour parameters, which were higher in PL. The WHC was significantly higher in ML, whereas cooking loss was lower in this line. The TPA method showed differences in springiness, and the sensory analysis found differences in rabbit flavour. These results provide evidence that there are divergences between these lines with regard to rabbit carcass and meat quality.