

## ABSTRACTS OF THE 45<sup>TH</sup> SYMPOSIUM ON CUNICULTURE, ASESCU

ONLINE MEETING, SPAIN, 6<sup>TH</sup>-7<sup>TH</sup> OCTOBER, 2021.

The 45<sup>th</sup> Congress of the Spanish Association of Cuniculture (ASESCU), co-organised by the Spanish Association of Cuniculture (ASESCU) and Grupo Editorial Agrícola-Henar Comunicación Agroalimentaria, was online held on 6<sup>th</sup> and 7<sup>th</sup> October, 2021. The four main talks were mainly focussed on “In-farm composting. Enhancing the value of rabbit manure” by Raúl Moral (University Miguel Hernández, Spain), “Recent advances in artificial insemination” by Pilar Viudes (Instituto Valenciano de Investigaciones Agrarias, Spain), “The necessary transition of rabbit farming in Europe. The French Example” by Davi Savietto (INRAE, France), and “Social networks in rabbit farming. A practical view” by Jesús López (Grupo Editorial Agrícola-Henar Comunicación Agroalimentaria, Spain). A commercial speech on “Building immunity for a healthier world” was also presented by Sandra Gascón (Hipra). Two round tables were also held: the first on “News in veterinary prescription” with the participation of María Hernández (Spanish Ministry of Agriculture) and Mario Malo (Spanish Association of Veterinarians specialised in Rabbit Farming), and the second on “Rabbit meat processing and new products” with the participation of Raül Grau (Universitat Politècnica de València, Spain) and María Luz de Santos (Spanish interprofessional organization to promote the rabbit sector, INTERCUN). Moreover, a total of 14 oral communications were presented by research teams from Spain, Algeria, Venezuela, Portugal and Italy. The congress was attended by around 130 participants from several European, American and African countries. Abstracts of the contributions presented are reported below.

### MAIN PAPERS

#### ON-FARM COMPOSTING. ENHANCING THE VALUE OF RABBIT MANURE

MORAL R., PAREDES C., BUSTAMANTE M.D., PEREZ-ESPINOSA A., AGULLO E., GARCIA-RANDEZ A., ANDREU-RODRIGUEZ J., PEREZ-MURCIA M.D.

Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO). Universidad Miguel Hernández, Escuela Politécnica Superior de Orihuela. Ctra de Beniel km 3.2, 03312 ORIHUELA (Alicante), España.

*raul.moral@umh.es*

Advanced management of rabbit farms must include the concept of circular economy. Although the direct use of rabbit manure in agriculture is common, due to its contents in fertilisers and organic matter, the composting on the farm of this flux can generate an alternative management to value. Composting processes on the farm involve a low-cost treatment, achievable with the machinery itself and with high added value insofar as they allow producers

to reduce the volume and humidity of the material, significantly increase the concentration of nutrients in the mix, improve its storage in adequate conditions and, especially, achieve adequate sanitisation. Composting ensures sanitisation via an intense exothermic process that can also have positive effects in reducing the potential presence of other pollutants linked to animal health. In this work, a comparative exercise of the fertilising capacity of rabbit manure is carried out compared to other sources, an optimised binary-tertiary agrocomposting protocol is proposed using rabbit manure as the main ingredient together with other residual organic materials of proximity, and finally two example practical cases are developed.

#### RECENT ADVANCES IN ARTIFICIAL INSEMINATION

VIUDES DE CASTRO M.P.

Centro de Investigación y Tecnología Animal, Instituto Valenciano de Investigaciones Agrarias (CITA-IVA), 12400 SEGORBE (Castellón), España.

*viudes\_mar@gva.es*

Artificial insemination in rabbits is an extremely useful tool, both to organise the reproductive management of a farm, and for the dissemination of quality genetic material, maintaining sanitary guarantees. Since its introduction on commercial farms, there have been great improvements both in the preparation of the seminal doses and in the insemination technique itself. In this paper, we review the scientific advances of the last decade that have allowed the introduction of innovations in the field of artificial insemination in rabbits.

## THE NECESSARY TRANSITION OF RABBIT FARMING IN EUROPE. THE FRENCH EXAMPLE

SAVIETTO D.

GenPhySE, Université de Toulouse, INRAE, ENVT, F-31326 CASTANET-TOLOSAN, France.

*davi.savietto@inrae.fr*

Rabbit farming in the 21<sup>st</sup> century faces two main challenges: respect for animal welfare and environmental sustainability. The first challenge stems from a portion of society's rejection of the current mode of production, which is based on economies of scale and low food prices. This involves high animal densities, a limited living space and an inadequate supply of environmental enrichments allowing the expression of the behaviour repertoire of the species. The second challenge is structural. It has an impact on almost every area of the modern economy, with food production being a key sector. The accumulation of knowledge regarding the contribution of agriculture and livestock to global warming, soil pollution, the degradation of freshwater reserves and loss of biodiversity demonstrates the lack of sustainability of the current production model. In this context, we observe the evolution of the current production system and the emergence of alternative ones, systems that aim to combine both challenges. This short communication describes a few examples of rabbit growing systems that integrate, at different levels, these two challenges.

## SOCIAL NETWORKS IN RABBIT FARMING. A PRACTICAL VIEW

LÓPEZ COLMENAREJO J.

Grupo Editorial Agrícola, 28013 Madrid, España.

*jlopez@editorialagricola.com*

Social media came into our lives a few years ago and did so to stay. We all have our personal vision of these new ways of communication. They could be called "light" meeting points, characterised by the presence of screens between two interlocutors, which is a handicap to efficient communication. Social networks have meant

a democratisation of information. This fact has, broadly speaking, positive aspects (for example greater access to high-quality first-hand information) and of course negative (proliferation of hoaxes and biased information). The rabbit sector, voluntarily and involuntarily, is present in social networks. Used proactively, they are a very useful tool for internal communication in the sector, a great window through which to quickly communicate to producers, technicians or administration useful information about rabbit production. On the other hand, there is also external communication, towards the consumer, which occurs many times reactively, as in many cases it is communication from a "connoisseur" to a final consumer. Unfortunately, this communication is the one that attracts most attention and affects our day to day. Issues such as animal welfare or the use of antibiotics are subject to the judgement of people whose link with production animals is null or whose reference is companion animals. The challenges are many, but failing to tackle them is not an option.

## DEVELOPMENT OF RABBIT MEAT PRODUCTS. NEW COMMERCIAL FORMATS

GRAU R.

Dept. Tecnología de Alimentos, Universitat Politècnica de València, 46022 VALENCIA, España.

*rgraume@tal.upv.es*

Certain indicators point to a bleak outlook for the rabbit meat sector. They include the decrease in meat consumption, the meat consumption recommendation issued by the FAO, WHO and EACOSAN and the decline in rabbit meat consumption, also penalised by its lack of penetration in the youngest population, which hinders its competitiveness in the medium and long term. Therefore, a strategy is needed to improve its consumption. This could come through the development of new meat products made from rabbit, as its presence in the distribution chain is practically non-existent, although meat products are the most consumed, along with chicken. To develop meat products from rabbit meat, two points should be considered. The development of deboning machines and the combination of rabbit meat with other raw material of animal (poultry) and vegetable (legumes, spinach, vegetable fat, etc.) origin. These actions would make it possible to produce a great variety of meat products, whether fresh, cooked and cured, which could be competitive in the market. Fresh meat products could be produced from the reconstruction of meat fillets employing enzymes such as transglutaminase, as well as hamburgers, fresh sausages, etc. In the case of cooked products, items such as cold cuts of cooked ham, cooked "Frankfurter" sausages, restructured baked or wet cooked meat, etc. Finally, in the case of cured meat products, cured sausages like salami, *salchichón* or *chorizo*, etc. could be

developed. Although technologically the development of these products may be real, their possible final presence in distribution chain lines will depend on other factors which must be considered.

## COMMUNICATIONS

### PRODUCTIVE PARAMETERS IN THREE PATERNAL RABBIT LINES SELECTED FOR FEED EFFICIENCY

PASCUAL M.\*, PILES M.\*, PERUCHO O.†, ALSINA P.\*, SÁNCHEZ J.P.\*

\*Programa de Genética y Mejora Animal, IRTA, Torre Marimón, 08140 CALDES DE MONTBUI, España.

†Programa de Infraestructuras Experimentales del Área de Producción Animal, IRTA, Torre Marimón, 08140 CALDES DE MONTBUI, España.

*mariam.pascual@irta.es*

The productive performance of three rabbit lines selected for increasing feed efficiency in growing of animals in groups is evaluated. Lines come from a common genetic origin and differ in the selection strategy implemented. All animals were housed in collective cages in the same farm. Line GRP was selected by low residual feed intake of the group; line RFI was selected by low individual residual feed intake; and line ADGR was selected by high individual growth under feed restriction. Conventional feeders were used for animals in the GRP line, whereas electronic feeders, developed at IRTA, which record the individual feed intake in rabbits in groups, were used for animals from lines RFI and ADGR. The evolution of the data recorded over the five generations for average daily gain (ADG) and average feed intake (AFI) is shown. The productive traits of the three lines under *ad libitum* feeding are also compared in the fifth generation of selection using cages with conventional feeders (experiment 1) or electronic feeders (experiment 2). The results obtained with the conventional feeders show that line ADGR had greater ADG than the other lines (ADGR: 58.6; vs. GRP: 54.4, and RFI: 55.8 g/d). Line ADGR had also the highest AFI (175 g/d), followed by RFI (166 g/d) and finally GRP (156 g/d). No statistical differences between lines in feed conversion rate were found (ADGR: 3.00; GRP: 2.9; RFI: 3.02 g/g), probably due to an insufficient number of data, as feed intake was measured at cage level. More studies with higher sample size and comparing performance of the selected lines with that of an unselected control population are required to test the response to selection.

### EFFECTS OF ANIMAL SEX AND A FEED RESTRICTION ON THE CARCASS AND DIGESTIVE TRACT CHARACTERISTICS OF RABBITS AT THE END OF THE FATTENING PERIOD

RIBEIRO J.\*, ANDRADE E.\*, MONTEIRO D.†, PINHEIRO V.†

\*Alunos de Doutoramento em Ciência Animal da Universidade de Trás-os-Montes e Alto Douro (UTAD), Quinta de Prados, 5000-801 VILA REAL, Portugal.

†Professores do Departamento de Zootecnia da UTAD, Centro de Ciência Animal e Veterinária (CECAV), Universidade de Trás-os-Montes e Alto Douro (UTAD), Quinta de Prados, 5000-801 VILA REAL, Portugal.

*vpinheir@utad.pt*

The aim of the present study is to evaluate the effect of gender and a moderate feed restriction on carcass characteristics and development of the viscera in rabbits subjected to prolonged fattening and with a view to processing the carcass. The study was conducted in the rabbit sector of the University of Trás-os-Montes e Alto Douro, Vila Real, Portugal. In the experiment, 24 rabbits (12 male and 12 female) of the New Zealand×Californian breed were used, monitored between 62 and 86 d of age. The rabbits were individually housed and randomly distributed between the two treatments, one with feeding at will (*ad libitum* group) and the other feeding at 80% level (restricted group). During the trial, commercial pelleted feed was provided to the animals. At the end of the experiment, ten animals from each treatment were slaughtered to evaluate the development of the digestive tract and carcass characteristics. The feed restriction significantly increased ( $P<0.05$ ) the percentage weight of the liver (+14%) and the dry matter content of the caecum (+17%) and decreased the proportion of total fat in the carcass (reduction from 29%, from 1.87 to 1.33 g/kg LW). The gender of the animal also significantly influenced some parameters ( $P<0.05$ ). In males, there was an increase in the slaughter weight (+167 g), the muscle weight of hind leg (+13.2 g; +7%) and the fore part of the carcass (22.7 vs. 24.6%) and are decrease in the head and liver weight. According to the results obtained, we can state that under the conditions in which the test was performed, the dietary restriction increased the liver weight and decreased the fat content in the carcass.

### USE OF DRIED SAMPLES TO IMPROVE THE DIAGNOSIS OF RABBIT HAEMORRHAGIC DISEASE

SÁNCHEZ A.\*, VALLS L.\*, MORA X.†, MALDONADO J.\*

\*Laboratorios HIPRA S.A., 17170 AMER (Girona), España.

†ASVET Veterinaris S.L., 08410 VILANOVA DEL VALLÈS, España.

*alba.sanchez@hipra.com*

Rabbit haemorrhagic disease (RHD) is an acute and highly contagious viral disease affecting domestic and wild rabbits. The presence of the causative agent, the RHD virus (RHDV), is usually confirmed by real-time polymerase chain reaction (RT-qPCR) in liver samples, with the consequent biological risk and additional cost of transport to the laboratory. RHDV antigen detection has shown lower sensitivity than RT-qPCR, and its use is subject to the availability of commercial kits. Other methods are rarely used due to cost and turnaround time. The aim of this study was to adapt and validate an alternative protocol for preservation, transport and analysis of samples for RHD diagnosis based on FTA cards, which fix and inactivate them for subsequent molecular analysis. This protocol (alternative method) was compared with the standard protocol (standard method) in two phases: A proof of concept to assess the RT-qPCR detectability of RHDV2 on FTA (positive/negative), the limit of detection for the two methods in serial decimal dilutions, and the stability of the RNA on FTA over time. Subsequently, RT-qPCR results were compared in clinical samples, using the same liver samples (n=29) fresh (standard protocol) and dried in FTA (alternative protocol). These studies demonstrated that it is possible to bind RHDV2 RNA in FTA for subsequent detection by RT-qPCR, without loss of signal for at least 8 weeks. Moreover, no differences were observed between methods in the number of positive (23/29), although the analytical detection limit and diagnostic sensitivity were marginally higher for the alternative method. These results demonstrate that the use of FTA cards facilitates the logistics of RT-qPCR diagnosis of RHD, reducing costs and turnaround time.

## IS GENOMIC SELECTION FEASIBLE IN RABBITS?

SOSA-MADRID B.S.\*, MANCINI E.†, BLASCO A.\*, IBÁÑEZ-ESCRICHE N.\*

\*Instituto de Ciencia y Tecnología Animal, Universitat Politècnica de València, 46022 VALÈNCIA, España.

†Departamento de Agronomía, Alimentación, Recursos Naturales, Animales, y Ambiente (DAFNAE), Università Degli Studi di Padova, viale dell'Università 16, 35020 LEGNARO (PD), Italia.

*bosomad@posgrado.upv.es*

Genomic selection is one of the cutting-edge techniques used in the breeding industry. However, in the rabbit selection scheme, an in-depth analysis is required for its implementation. This paper presents a study based on simulated data for litter size under seven genotyping strategies. These strategies, designed in scenarios, were evaluated with the parameters: imputation accuracy (PI), accuracy of genomic prediction (PPG), selection response (RS) and percentage of candidate selected correctly

(P\_CSC). All of them compared to the classical BLUP (best linear unbiased estimator) genetic evaluation method where individuals are not genotyped. The first scenario (S1), in which all ancestors were genotyped at high density and the progeny at medium density, showed the best results, PI (0.99), PPG (0.263), RS (0.154), P\_CSC (31.63), especially compared to the BLUP method, with PPG (0.20), RS (0.132), P\_CSC (28.90). However, S1 still presented a prohibitive genotyping cost for implementation. The scenarios with lower genotyping costs presented lower PI, but scenario 6 (S6), in which grand-dams were not genotyped, dams were genotyped at medium density and progeny at low density, showed the best relationship between genotyping cost and PPG. In summary, genomic selection with genotyping imputation is feasible in rabbits. However, a sufficiently large reference population size is critical to ensure the effectiveness of genomic selection. Therefore, strategies allowing the use of nucleus animals and multipliers are key to its successful implementation.

## EVOLUTION OF THE FATTY ACID PROFILE IN RABBIT'S MILK

HADJADJ I., BOTELLA J., GARCÍA M.L., ARGENTE M.J.

Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH), Universidad Miguel Hernández de Elche, 03312 ORIHUELA, España.

*mj.argente@umh.es*

The objective of this work was to analyse the evolution of fatty acids in rabbit milk during the first four weeks of lactation, and the effects of number of lactating kits and the overlap between lactation and pregnancy. Lactation of 14 multiparous females was controlled, 6 with 4 or less lactating kits and 8 with 9 or more lactating kits; in both groups there were females with and without lactation-gestation overlap. An increase in saturated fatty acids (SFA) of 20% was observed at fourth week of lactation, due to an increase in medium chain fatty acids C8:0 and C10:0. While mono (MUFA) and polyunsaturated (PUFA) fatty acids progressively decreased their presence at the end of lactation by 6 and 14%, respectively, as a consequence of the decrease in content of long chain fatty acids C18:1 and C18:2. Litter size and lactation-gestation overlap did not affect the fatty acid composition of rabbit's milk.

## OVULATION RATE AND PRENATAL SURVIVAL IN RABBITS OF LOCAL ALGERIAN POPULATION AND SYNTHETIC LINE

BELABBAS R.\*, GARCÍA M.L.†, AINBAZIZ H.‡, BERBAR A.\*, ARGENTE M.J.†

\*University Blida1, Biotechnology Laboratory of Animal Reproduction, Institute of Veterinary Sciences, BLIDA, Algeria.

<sup>†</sup>Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH), Universidad Miguel Hernández de Elche, 03312 ORIHUELA, España.

<sup>‡</sup>Laboratory of Research Health and Animal Production, National Veterinary School, ALGIERS, Algeria.

*r\_belabbas@yahoo.fr*

The aim of this study was to estimate the limiting litter size components in rabbit females from a synthetic line (SL; n=32) and a local population (LP; n=34). Ovulation rate, number of implanted, live embryos and resorbed embryos were counted by laparoscopy at 12 d after third mating. Prolificacy and embryonic, foetal and prenatal survival at birth were measured. Total litter size and mortality at birth were also recorded. SL females had a higher ovulation rate compared to the LP does (11.03±0.23 vs. 8.41±0.23 *corpora lutea*;  $P<0.0001$ ). SL displayed a higher number of implanted embryos (10.00±0.25 vs. 7.85±0.25 embryos;  $P<0.0001$ ). No difference was found between groups for number of resorbed embryos. Similar embryonic, foetal and prenatal survival rates were reported between the SL and the LP. Additionally, the total number of newborn was higher in SL than in LP (+1.46 kits;  $P<0.05$ ). In conclusion, ovulation rate seems to be the main limiting factor of litter size in the LP population.

#### USING ARTIFICIAL VISION TECHNIQUES FOR INDIVIDUAL TRACKING OF IN-GROUP HOUSED RABBIT KITS

SÁNCHEZ J.P.\*, MUÑOZ I.<sup>†</sup>, GONZÁLEZ O.\*, PASCUAL M.\*, PERUCHO O.<sup>‡</sup>, ALSINA P.\*, PILES M.\*

\*Programa de Genética y Mejora Animal, IRTA, 08140 CALDES DE MONTBUI, España.

<sup>†</sup>Programa de Calidad y Tecnología Alimentaria, IRTA, 17121 MONELLS, España.

<sup>‡</sup>Programa de Infraestructuras Experimentales del Área de Producción Animal, IRTA, 08140 CALDES DE MONTBUI, España.

*juanpablo.sanchez@irta.es*

Our research group is developing devices, methods and algorithms that quantify the different characteristics that intervene in the definition of food efficiency. Traditionally these traits were consumption and weight gain, but with the consideration of new technologies we are including others, for example physical activity, behaviour or energy dissipation measured through the variation in body temperature. Measuring the activity of animals housed in a group requires the analysis of image sequences, which involves the identification of each animal in each of the images and establishing the relationship between the different positions of the same animal in the successive images. After this identification, the trajectory of their movements can be determined and thus their physical activity and behaviour can be quantified. In the present work,

we present the breakthroughs achieved in the first stages of development and implementation of an artificial vision technology based on deep neural networks. When there is a great distance between the kits in the images in which we want to make the detection, a very precise identification is achieved with few images (mAP<sup>3</sup>0.95). On the contrary, if the rabbits are crowded, the quality of the identification deteriorates remarkably, but by increasing the size of the training set and applying data augmentation techniques, we achieve relatively high identification qualities (mAP=0.83). If the identification is good, the tracking of the kits in the successive frames poses no major problem. We can conclude by stating that we have an artificial vision system which, although it has to be improved, already allows individualised monitoring of fattening kits. Nonetheless, we expect to improve its implementation so that this monitoring can be done in real time.

#### WILD RABBITS AS A RESERVOIR FOR METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS*

MARTÍNEZ-SELJAS C., MORENO-GRUA E., PEREZ-FUENTES S., VIANA D., CARDELLS J., LIZANA V., AGUILÓ-GISBERT J., CORPA J.M., SELVA L.

Dept. de Producció i Sanitat Animal (PASAPTA), Universidad Cardenal Herrera CEU, C/ Tirant lo Blanc 7, 46115 ALFARA DEL PATRIARCA (Valencia), España.

*carmenmartinezseijas@uchceu.es*

*Staphylococcus aureus* is an opportunistic pathogen, affecting humans and many other mammals. It is a bacterium with great ability to adapt to environments, so that it has a high facility to develop resistance to antimicrobials, which is a problem for animal and public health. The rabbit is one of the usual hosts of *Staphylococcus aureus*, and the role of asymptomatic carriers in rabbit farms has been observed many times as a reservoir for a high incidence of diseases. However, not much is known about the wild rabbits which, despite being free, can also act as a reservoir for the infection of humans and other animals. To better understand the presence of *Staphylococcus aureus* and particularly Methicillin-Resistant *Staphylococcus aureus* (MRSA) in wild rabbits, a sampling of hunting prey obtained by hunters in high-density reserves of the Valencian Community was carried out. Surprisingly, a high prevalence of *S. aureus* carriers was found, and a large percentage of the positive isolates turned out to be MRSA. The prevalence percentage was variable between villages, with certain districts having a prevalence of MRSA greater than 50% among positive isolates. The most frequent anatomical location was the ear, and most of the isolates belonged to two clonal complexes: CC130 and CC425, although others were isolated but with a very low prevalence.

## INFLUENCE OF HANDLING STRESS ON PRODUCTIVE PARAMETERS IN FATTENING RABBITS EVALUATED BY INFRARED THERMOGRAPHY

JAÉN-TÉLLEZ J.A., SÁNCHEZ-GUERRERO M.J., VALERA M., GONZÁLEZ-REDONDO P.

Dept. Agronomía, Área de Producción Animal, Universidad de Sevilla, 41013 SEVILLA, España.

[juanantonio.jaentellez@gmail.com](mailto:juanantonio.jaentellez@gmail.com)

Rabbits often experience stress when they perceive certain stimuli, such as handling. The physiological response of animals to stress is associated with feeding efficiency, so that, in general, animals that react less to stressful stimuli show higher productive performance. The aim of this study was to evaluate the impact of stress caused by handling, evaluated by infrared thermography, on the performance parameters of fattening rabbits of a strain with phenotype of the Spanish common breed. Thirty-nine rabbits were analysed during a 38-d fattening period. The stress of the rabbits was evaluated by the temperature difference in the inner ear before and after being handled (DIF), using the following scale: level 1 (not stressed):  $DIF \leq 0^\circ\text{C}$ ; level 2 (slightly stressed):  $0^\circ\text{C} < DIF \leq 5^\circ\text{C}$ ; level 3 (stressed):  $5^\circ\text{C} < DIF \leq 10^\circ\text{C}$  and level 4 (very stressed):  $DIF > 10^\circ\text{C}$ . Temperatures were recorded two days a week. On each sampling day, the temperature was first measured when the animal had not been disturbed and had been in its cage since the previous sampling day, and a second measurement was taken 10 min after handling it by holding it in the arms of the caretaker for 60 s. Rabbits with higher stress levels showed higher values of average daily gain (ADG), daily feed intake (DFI) and feed conversion ratio (FCR), which increased from 22.5 to 29.1 g/d, from 44.7 to 90.4 g/d and from 2.5 to 3.2, respectively. In conclusion, the changes in animal welfare caused by the reactivity of rabbits to management factors such as handling affect productive performance, since the higher the stress due to handling (higher increase in temperature), the less efficient the animals were.

## MICROBIOME AND RESILIENCE IN RABBITS, CAUSE OR EFFECT?

CASTO-REBOLLO C.\*, ARGENTE M.J.†, GARCÍA M.L.†, BLASCO A.\*, IBÁÑEZ-ESCRICHE N.\*

\*Instituto de Ciencia y Tecnología Animal, Universitat Politècnica de València, 46021 VALÈNCIA, España.

†Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH), Universidad Miguel Hernández de Elche, 03312 ORIHUELA, España.

[cricasre@posgrado.upv.es](mailto:cricasre@posgrado.upv.es)

The ability to modify the gut microbiota using probiotics has been increasing in interest because they have an

effect on traits of interest in livestock. Resilience is an example of an interesting trait, but is difficult to measure directly. To this end, the environmental variance (VE) of traits has been proposed as indicator of animal resilience. In two rabbit lines selected divergently for high and low VE, and used in this study, differences in resilience among animals were found. Rabbits belonging to the line with a low VE were more resilient than rabbits from the line with a high VE. The aim of this study was to identify bacteria, genes and metabolites from caecum of the rabbits which could modulate the VE and resilience. Data was transformed using the additive log-ratio transformation to consider their compositional nature. The relevant bacteria, genes and metabolites were identified using a partial least square-discriminant analysis (PLS-DA). All models showed a classification performance for each rabbit line higher than 88%. We highlighted the species *Limosilactobacillus fermentum*, *Alistipes shahii* and *Acetatifactor muris*, as they could be involved in the health status of the animal. Moreover, genes and metabolites related to the phenylalanine, tyrosine and tryptophan metabolism were highlighted. This metabolism could be a key pathway to control the survival and virulence of pathogens. This is a pioneer study which unravels the relation between the microbiome and their metabolites with the VE an animal resilience. Probiotics and inhibitors of the genes from the phenylalanine, tyrosine and tryptophan metabolism could be important to modulate these two traits. However, further studies are needed to validate the results.

## EXPLORATORY STUDY OF ACCEPTANCE AND PREFERENCE OF RABBIT MEAT AND OTHER WHITE MEAT HAMBURGERS BY YOUNG CONSUMERS

LACALLE-RUIZ E., GONZÁLEZ-REDONDO P.

Departamento de Agronomía, Escuela Técnica Superior de Ingeniería Agronómica, Universidad de Sevilla, 41013 SEVILLA, España.

[pedro@us.es](mailto:pedro@us.es)

Hamburgers are considered ideal to increase the consumption of rabbit meat among young people. This study aimed to compare the acceptance and preference of rabbit burgers with those of pork, chicken and turkey by means of an untrained panel of 45 young consumers (average age: 23.5 yr; 53.5% men) from Seville (Spain). The following aspects were evaluated: a) acceptance of organoleptic characteristics and global acceptance, using a hedonic scale (1 to 9 points), and b) order of preference (1<sup>st</sup> to 4<sup>th</sup> place) of commercial hamburgers. The burgers were grilled and subsequently tasted following the methodology for acceptance and preference studies in untrained consumers. Global acceptance and sensory attributes, except for texture (6.9 points in rabbit), differed

between burgers ( $P<0.05$ ). The smell was better valued in the rabbit (6.8 points) and turkey burgers and worse in the pork hamburger, with the chicken burger being intermediate. The colour, appearance and juiciness of the rabbit (6.5, 6.8 and 6.9 points, respectively), pork and turkey burgers were valued better than that of chicken burger. The flavour of the rabbit (7.2 points) and turkey burgers was better accepted than those of pork and chicken burgers. The elasticity of the rabbit (6.6 points) and pork burgers was valued better than that of chicken, with that of turkey burger being intermediate. Global acceptance was similar for rabbit (7.1 points), pork and turkey burgers and worse for that of chicken burger. Rabbit (average order, 2.27), turkey and pork burgers, without differences between them, were preferred to chicken burger ( $P<0.001$ ). Sex did not influence in any case ( $P>0.05$ ). In conclusion, rabbit burgers are rated at the same level as pork and turkey burgers and better than chicken burgers, showing potential to enhance rabbit meat consumption by young people.

#### SEMEN QUALITY AND LONGEVITY OF MATERNAL AND PATERNAL RABBIT LINES IN AN ARTIFICIAL INSEMINATION CENTRE

BIELSA A.\*, ARGENTE M.J.†, GARCÍA M.L.†

\*Granja Jordán S.L., 50793 FABARA, España.

†Centro de Investigación e Innovación Agroalimentaria y Agroambiental (CIAGRO-UMH), Universidad Miguel Hernández de Elche, 03312 ORIHUELA, España.

mariluz.garcia@umh.es

The aim of this study is to compare quality semen and longevity of 4 genetic lines in an artificial insemination centre. A total of 50 993 ejaculates from 688 males were evaluated. A and L lines are maternal lines selected for litter size at weaning and R and C lines are paternal lines selected for daily gain in the fattening period. Volume of ejaculates and motility, measured between 0 and 5, were recorded. Age of the males when they were culled or died was analysed. Bayesian methodology was used for the statistical analyses. C paternal line showed higher volume and motility (1.24 mL and 3.69) than R line (1.07 mL and 3.55) and maternal lines (A, 0.92 mL and 3.33; L, 1.01 mL and 3.62). Longevity is higher in maternal lines (25 and 20 mo for A and L line, respectively) than paternal lines (16 and 14 mo for C and R lines, respectively), the difference being relevant between A line and paternal lines ( $Pr=1.00$ ). In conclusion, C line had the highest quality semen and maternal lines had higher longevity than paternal lines due to the different generational interval.

#### INTERPRETATION OF THE OESTROUS CYCLE OF THE DOE AS THE BASIS OF REPRODUCTIVE EFFICIENCY

MELÉNDEZ C.

Universidad Pedagógica Experimental Libertador, Instituto Pedagógico Barquisimeto, "Luis Beltrán Prieto Figueroa", Avenida José María Vargas con Avenida Las Palmas, BARQUISIMETO, Estado Lara, Venezuela.

carloscant@gmail.com

Several authors have described the oestrous cycle of the female rabbit as a rigid and well defined physiological event. However, in practical experience, various manifestations of oestrus are observed in the domestic rabbit (*Oryctolagus cuniculus*) in terms of duration, appearance of the vulva and percentage of fertility. The objectives of this work were to infer on the various manifestations of the oestrous cycle of the rabbit and its impact on rabbit production. To this end, a herd of breeding rabbits from a meat line was used, consisting of 160 does in production and 24 breeding males, under conditions typical of tropical countries. The data referring to the oestrous cycle of the reproductive rabbits were collected according to the date of delivery and the date of the next service in a system of production records. As a result, a scheme was designed with the relationship between the days of rest between delivery and the next service, according to the number of kits born and surviving in the current litter. The number of kits weaned per doe in each delivery was increased from 3.60 to 6.30. In conclusion, the applied work methodology allowed the reduction of the birthing interval and the increase in the number of kits weaned per doe per year. The number of kits weaned is more relevant than the slaughter weight of kits from smaller litters.

#### REPRODUCTIVE PARAMETERS OF THREE PATERNAL LINES WITH DIFFERENT POTENTIAL FOR GROWTH AND RESILIENCE

GONÇALVES C., MARTÍNEZ-PAREDES E., RÓDENAS L., BLAS E., CAMBRA-LÓPEZ M., PASCUAL J.J.

Instituto de Ciencia y Tecnología Animal, Universitat Politècnica de València, Camino de Vera s/n, 46022 VALENCIA, Spain.

capeigon@upvnet.upv.es

A total of 203 nulliparous rabbit females from 3 paternal lines were selected: R line, selected by growth rate; RF line, from the selection of elite animals from the R line; and RLP line, obtained by backcrossing the RF line with the robust LP line. Controls of the main reproductive parameters were carried out at the 1<sup>st</sup> AI, and at parturition, 18 and 28 days postpartum until the 3<sup>rd</sup> parturition, as well as the stayability of the females. Both stayability and fertility percentages of the R females were significantly lower than

those of the RF females during the first reproductive cycle (-16 and -12 percentage points, respectively;  $P<0.05$ ), and from that moment, those of RLP females (-24 and -8 percentage points, respectively;  $P<0.05$ ). On the other hand, the R line had a significantly lower number of kits born than the RF and RLP lines (on av. -1.2 total births and -1.7 live births;  $P<0.05$ ). In addition, the survival of the kits throughout lactation was higher in the RLP line compared to the other two lines (+0.5 kits at weaning;  $P<0.05$ ). With these results, it can be concluded that the introduction of resilient genetics in an elite paternal line contributes to improving fertility and prolificacy, as well as the survival of rabbit females and their litters.

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