

ABSTRACTS OF THE "3RD RABBIT CONGRESS OF THE AMERICAS"

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MAIN PAPERS

RABBITS WELFARE. BLASCO, A. *Dpt. Ciencia Animal. Univ. Politécnica de Valencia. Valencia, Spain. ablasco@dca.upv.es*

The paper starts with some considerations about ethics and welfare. Whereas welfare is a science and its results are not a matter of opinion or assignment of values, ethics is not a science and it depends on our scale of values. Welfare will tell us what a rabbit needs to cope with its environment, but the decisions about what to do, which requirements should be included in the legislation, what should be permitted about rabbit breeding and what should not, are ethical decisions. The European Food and Safety Authority published a document about rabbits' welfare, based on a scientific report provided by a working group. This paper summarizes the most relevant part of their work, with the exception of the area of pathology. The EFSA scientific document followed a risk assessment approach, consisting in identifying the risk for welfare of several breeding activities. After the risk identification, some recommendations were made as well as some suggestions for future research. Here we summarize the main recommendations.

A REFLECTION ON RABBIT PRODUCTION IN EMERGENT COUNTRIES: THE CASE OF MEXICO. BECERRIL-PÉREZ C.M. *Coordinación de Investigación y Desarrollo. Col. de Postgraduados. Montecillo, Texcoco, Edo. de México. Mexico. color@colpos.mx*

Rabbit production and its productive modalities in the country are described in a brief way and the most desirable conditions are outlined so that it can contribute to the well-being of the society through the nutritious and innocuous food production, the generation of jobs, diminution of poverty and the settling of families to their land. Mexico counts on diverse comparative advantages so that rabbit production can become a relatively important industry within the wide range of animal production activities in the country. In addition, rabbit production can be

considered as the animal activity with greater potential of development of and for Mexicans, avoiding technological reliance from outside.

DEVELOPMENT OF A GENETIC IMPROVEMENT PROGRAMME IN MEAT RABBITS IN URUGUAY. CAPRA G. *gcapra@lb.inia.org.uy*

The introduction of vitrified embryos of two genetic lines developed by the Polytechnic University of Valencia (UPV), allowed INIA of Uruguay the implementation of a genetic improvement programme in meat rabbits. The main objective was that small farmers could access to the improved genetics as a means of reinforcing the consolidation of this emerging economic activity. The programme started with the reconstitution of selection nucleus of the introduced lines: V (Verde) and R (Rosa), and was based on the application of identical selection criteria and the same methodology employed in the centre of origin. At the same time, selection procedures were applied on a differentiated population of rabbits to develop a new maternal line: C ("Celeste"). Two successive stages were scheduled for the diffusion of genetic improvement: a) in the short term, direct supply to the farmers of males of the R sire line and females of V maternal line, and b) in the medium term, the integration of a pyramidal scheme with commercial farmers as multipliers, producing the hybrid F1 female CxV. As a result of this process, Uruguayan rabbit farmers gained access to high potential genetic lines that have effectively adopted into their production systems. However, the generalized adoption of this genetic improvement demanded a patient diffusion strategy that included: validation of the technical proposal in reference and demonstrative farms, progressive adjustment of production technologies, dissemination of technical information and development of training activities. Evidences of the production potential of the improved genetic lines and their crosses in reproductive traits, growth performance and carcass quality are summarized, and relevant aspects of the programme strategies are proposed to debate.

BODY CONDITION IN RABBIT DOES: GLOBAL STRATEGIES CONSIDERING FEEDING AND GENETIC SELECTION. PASCUAL J.J., THEILGAARD

P. *Dpt. Ciencia Animal. Univ. Politécnica de Valencia. Valencia, Spain.*

In the present work, main factors affecting and controlling the body condition of the reproductive rabbit females are reviewed, evaluating how nutritional strategies and genetic selection could affect short-term productive performance traits (litter size, milk production...), but especially in the long term (body condition, life expectancy, health status...). In recent years, different methods have been developed for the monitoring of body condition *in vivo*, such as the non-invasive techniques based on measurement of the electrical conductivity of does and the thickness of their perirenal fat by means of ultrasound, or the control of some blood metabolite that could provide information on the body state of the does, among which the level of leptin and the increase in non-esterified fatty acids after adrenergic challenge would be prominent. The development of these techniques has allowed a better knowledge of the evolution of the body condition of does, both throughout the reproductive cycle and reproductive life, providing better knowledge of the most critical moments, the differences in the management of reserves based on the age of the doe, and the possible effect of body condition on reproductive effectiveness or longevity. The availability of this information will enable the development of global strategies for the reproductive doe in the future, of which some results are already available.

THE SMALL-SCALE RABBIT PRODUCTION MODEL: INTERMEDIATE FACTORS. LUKEFAHR,

S.D. *Dpt. Animal & Wildlife Sci., Texas A&M Univ.-Kingsville, Kingsville, TX, USA. s-lukefahr@tamuk.edu*

In most countries of the world, the rabbit "industry" largely consists of limited-resource farmers who maintain small-scale operations with the aim of producing more meat and income. At the 8th World Rabbit Congress held in Puebla in 2004, the Small-Scale Rabbit Production Model (SSRPM) was presented. Overall, the SSRPM consists of the three-tiered spheres of internal, intermediate, and external factors that can be used as a planning tool to impact target beneficiaries who are limited-resource farmers, predominately from lesser developed countries. It is critical that the project planner and (or) manager considers the fine detail and dynamics involved between and within factors. The SSRPM is flexible and can be modified according to local conditions. The objective of this paper is to further develop and expand on the intermediate factors of the SSRPM

that involve the dimensions of project development: feasibility, design, implementation, monitoring, and evaluation. A rabbit development programme is based on a well-define goal and supporting objectives. Project feasibility determines whether or not the rabbit project should be started. If the decision is made to initiate the project, then a project design or blueprint needs to be developed. Afterwards, the project is ready to be implemented, which oftentimes begins with the selection of farmers for rabbit training. Once farmers engage in production, they will need to be carefully monitored to ensure that the programme objectives are being met. Lastly, once formally terminated (*i.e.*, funding support is ceased), the project should be evaluated, which results in a report that reflects the lessons learned. In summary, adoption of the SSRPM can serve as a guide to the project planner and (or) manager to help ensure ultimate programme success.

THE CAECAL ECOSYSTEM IN THE GROWING RABBIT: IMPACT OF NUTRITIONAL AND FEEDING FACTORS. GIDENNE T. *INRA Toulouse, St. de Recherches Cunicoles, Castanet-Tolosan.*

thierry.gidenne@toulouse.inra.fr

Understanding the caecal ecosystem and how to control its activity, is a thematic priority, since this could provide new strategies to improve the resistance of the young rabbits to digestive disorders. This review first recalls some basis on the caecal biotope and biocenosis. Some emphasis is devoted to molecular approaches presently developed to address the caecal flora. Then, the effect of the main nutrient (cell wall polysaccharides, proteins...) on the caecal ecosystem is reviewed. Lastly, the impact of some feeding strategies (feed intake level or antibiotics addition) on the caecal ecosystem is presented.

SHORT PAPERS

AGE RELATED CHANGES IN THE MUSCLE FIBER TYPE FREQUENCIES AND CROSS-SECTION AREAS IN STRAIGHTBRED AND CROSSBRED BOTUCATU RABBITS. BIANOSPINO E.¹, MOURA A.S.A.M.T.¹, WECHSLER F.S.¹, FERNANDES S.¹, DAL-PAI-SILVA, M.²

¹UNESP, *Fac. Medicina Veterinária e Zootecnia, Dpt. Produção Animal, Botucatu-SP, Brasil, anamoura@fca.unesp.br.* ²UNESP, *Inst. Biociências, Dpt. Morfologia, Botucatu-SP, Brasil*

This study was designed to investigate the effects of age and genetic group on the frequencies and cross-section areas of muscle fiber types in rabbits. A total of 48 straightbred and crossbred Botucatu rabbits, males and females, were involved in a split plot design

with a 2x2 (genetic groups × genders) factorial arrangement. The rabbits were weaned at 35 d of age and sequentially slaughtered, four per genetic group x sex combination, at 42, 63 and 84 d of age. The flexor *carpi radialis* muscle was dissected, histological sections (10 μm) were obtained and the frequencies and cross-section areas of myofiber types *FG* (*Fast Glycolytic*), *FOG* (*Fast Oxidative Glycolytic*) and *SO* (*Slow Oxidative*) were determined. There were genetic group x sex, genetic group x slaughter age and sex x slaughter age interaction effects on the frequencies of muscle fiber types. A transition of *FG* to *FOG* fibers, with the advancement of age, was observed, especially in straightbreds and females. The cross-sectional area of *FOG* fibers was larger in crossbreds, but no differences were found between genetic groups concerning *FG* and *SO* fibers. The cross-section areas of all three types of fibers showed linear association with age at slaughter. In all three ages, *FG* fibers showed the largest area, followed by *SO* and by *FOG*. The *carpi radialis* muscle was heavier in the crossbreds; this difference may be explained by the higher proportion of *FG* fibers, whose cross-section area was the largest, associated with the clear hypertrophy of *FOG* fibers in this genetic group.

CHEMICAL COMPOSITION AND NUTRITIONAL VALUE OF COTTONSEED MEAL FOR GROWING RABBITS. GOMES, A.V.C., DÁVILA, N.F.P., CRESPI, M.P.L., COLL, J.F.C., PESSÔA, M.F., ROCHA, J.C.C. *Dpt. Nutrition Sci., Univ. Federal Rural do Rio de Janeiro. Seropédica – RJ – Brazil. Vidal@ufrj.br*

It was evaluated chemical composition of cottonseed meal as well as nutritional value through a digestibility assay using eight White New Zealand rabbits; 4 males and 4 females 50 day old, do not subject to statistical analysis- allocated individually in metabolism cages. It was used direct method; in which the treatment consisted of a diet with 99.1% of cottonseed meal added with a 0.4% mixture of minerals and vitamins and 0.5% of sodium chloride. The experiment had an animal adaptability-period to experimental conditions of 8 days and 4 of total feces collect. Chemical composition of cottonseed meal to dry matter, organic matter, crude protein, neutral detergent fiber, acid detergent fiber, crude fiber, calcium, phosphorus, ether extract, and gross energy, were; respectively, 89.57; 83.38; 38.18; 33.55; 22.93; 13.82; 0.34; 1.26; 0.75% 4169.62 kcal/kg- in natural matter. The coefficients of apparent digestibility of dry matter, crude protein, neutral detergent fiber, acid detergent fiber and gross energy, were; respectively 66.81; 84.65; 41.14; 39.00 and 68.27%. The values of digestible nutrients dry matter, crude protein, neutral detergent fiber, acid detergent fiber, and gross

energy in natural matter, were respectively 59.84; 32.32; 13.80; 8.94% and 2846 kcal/kg.

CHICORY ROOTS (*CICHORIUM INTYBUS*) AS A FEED COMPONENT OF RABBIT DIET: THE EFFECT ON TOTAL TRACT APPARENT DIGESTIBILITY OF NUTRIENTS IN EARLY-WEANED RABBITS.

VOLEK, Z.¹, MAROUNEK, M.^{1,2}, KUDRNOVÁ, E.¹, SKØIVANOVÁ, V.¹ ¹Res. Inst. of Animal Production, Prague 10-Uhřetínives, Cz. Republic. ²Inst. of Animal Physiology and Genetics, Czech Academy of Sci., Prague, Czech Republic. volek.zdenek@vuzv.cz

The aim of this study was to evaluate the effect of a diet containing 10% of dried chicory roots on the total tract apparent digestibility of nutrients. Two diets were formulated: control and chicory diet. The chicory diet contained 10% of chicory roots at the expense of cereals (mainly oats). The diets were similar in the level of crude protein, fat and lignocellulose, but differed mainly in the level of starch and fructans (12.6 and 1.3% vs. 8.4 and 6.4% in the control and chicory diet, respectively). A total of 26 Hyplus[®] rabbits, weaned at 25 days of age, were randomly allocated into two groups (control and chicory group). After a phase of adaptation to the diets, the feed intake and total faecal output were recorded from 36 to 40 day of age. No significant differences in the digestibility of crude protein and NDF were observed. Whatever the diet, the digestibility of fructans was 100%. Compared with control diet, a higher digestibility of cellulose was observed in rabbits fed the chicory diet ($P=0.01$). In these rabbits, a significantly lower digestibility of starch and energy was recorded than in control rabbits (95.9 and 43.1% vs. 97.8 and 57.2% in rabbits fed the chicory and control diets, respectively). It follows from our results that rabbits utilized the chicory diet very well. However, a partial replacement of starch-containing components by chicory roots decreased the content of digestible energy in chicory diet.

CONJUGATED LINOLEIC ACID (CLA) AND SELENIUM (SE) CONTENT OF MEAT OF RABBITS FED DIETS ENRICHED WITH CLA AND SE.

MAROUNEK M.^{1,2}, DOKOUPILOVÁ A.¹, SKØIVANOVÁ V.¹, BERLADYN A.^{2,3} ¹Res. Inst. of Animal Production, Prague, Cz. Republic, marounek.milan@vuzv.cz. ²Inst. of Animal Physiology and Genetics, Czech Academy of Sci., Prague-Krè, Cz. Republic. ³Res. Inst. of Biotech. in Animal Production, S.Z. Gzhyskyi Lviv National Academy of Vet. Med., Lviv, Ukraine

Three groups of 10 rabbits each were fed a basal (control) diet containing 0.12 mg Se/kg, the same diet supplemented with a commercial CLA preparation

Luta-CLA® 60 at 10 g/kg, and the diet supplemented with Se-yeast to increase Se concentration to 0.50 mg/kg. In CLA-fed rabbits, the feed intake was decreased ($P<0.05$), which resulted in non-significant drop in weight gain. CLA increased proportion of saturated fatty acids and linoleic acid at expense of monounsaturated fatty acids in muscle lipids. Concentration of CLA in loin and hindleg meat of CLA-fed rabbits increased from 0.07 to 2.55 and 2.74 g/100 g fatty acids, respectively. Loin and hindleg meat of rabbits fed the Se-supplemented diet contained about four-times more Se (ca 0.4 mg/kg) than meat of other rabbits. Se influenced fatty acid profiles of meat only slightly.

EFFECT OF CAPRYLIC ACID ON HEALTH STATUS OF WEANED RABBITS EXPERIMENTALLY INFECTED WITH ENTEROPATHOGENIC *ESCHERICHIA COLI* O103.

SKØIVAN, M.^{1,2}, SKØIVANOVÁ, E.², MAROUNEK, M.^{2,3}
¹Czech Univ. of Agri., Prague-Suchdol, Czechia. ²Res. Inst. of Animal Production, Prague-Uhřetínives, Czechia.
³Inst. of Animal Physiology and Genetics, Prague, Czechia. skrivan.milos@vuzv.cz

The aim of this study was to evaluate the effect of caprylic acid and triacylglycerols (TAG) of medium-chain fatty acids (MCFA) on health status of weaned rabbits, experimentally infected with enteropathogenic *Escherichia coli* (EPEC) O103 strain E22. Forty Hyplus rabbits weaned at the age of 35 days were used. Rabbits of the experimental groups received a diet supplemented with caprylic acid or Akomed R (triacylglycerols of caprylic, capric and lauric acid) at 0.5% and 1%, respectively. Rabbits from the positive control and experimental groups were orally infected with EPEC O103. Rabbits from the negative control were free of this pathogen. Mortality of animals treated with caprylic acid (3/10) was lower than in control rabbits, infected with *E. coli* (7/10), but effect of treatment was not statistically significant. Both caprylic acid and Akomed R significantly decreased counts of *E. coli* in the stomach and caecum content. It can be concluded that caprylic acid seems to be able to improve health status of weaned rabbits.

EFFECT OF DIFFERENT SOLUTIONS ON THE HYPOOSMOTIC SWELLING TEST FOR RABBIT FRESH SEMEN. AMORIM, E.A.M., TORRES, C.A.A., SANTOS, L.V.L., AMORIM, L.S., SILVA, J.F. *Dpt. of Animal Sci., Federal Univ. Viçosa, Viçosa – MG, Brazil, eamufv@yahoo.com.br*

The objective was to evaluate rabbit sperm membrane integrity using the hypoosmotic swelling test (HOST)

with different solutions. Twenty-four semen samples were collected from four mature rabbits (six collections per rabbit) at three days intervals. Different solutions were used: distilled water, sucrose (100 mOsm/L), fructose and sodium citrate (100 mOsm/L) and sodium chloride (NaCl). After macroscopic evaluation, the HOST was performed by mixing 10 µL of each sample with 1 mL of each solution and incubated for 30 min. at 37°C. Afterward, 20 µL of every sample was smeared on a microscope slide and observed in oil immersion using a phase contrast microscope. A minimum of 100 spermatozoa was observed and classified as non-coiled and coiled (coiled plus strongly coiled). The HOST data showed a difference ($P<0.01$) between the samples incubated in distilled water and sucrose versus fructose and sodium citrate and sodium chloride solutions. Results suggest that the distilled water and sucrose solution are the most effective medium for use in HOST in rabbit fresh spermatozoa.

EFFECT OF REARING METHODS ON THE LIFETIME PRODUCTION OF RABBIT DOES.

SZENDRŐ ZS.¹, GYOVAI M.¹, MAERTENS L.², BIRÓNÉ NÉMETH E.¹, RADNAI I.¹, MATICS ZS.¹, NAGY I.¹ ¹Univ. of Kaposvár, Fac. of Animal Sci., Kaposvár, Hungary. ²Centre for Agricultural Res., Dpt. of Animal Nutrition and Husbandry, Melle, Belgium Pohnl@mail.atk.u-kaposvar.hu

The objective of the study was to examine the effect of birth weight (35-45, 53-58 and 65-70 g), milk supply (nursing by one or two does), feeding regime (*ad libitum* or restricted = 80-85% of *ad libitum* group) and age at first insemination (15.5 or 18.5 weeks) on the lifetime production of rabbit does. None of the examined factors affected significantly the number of parity, number of kits born total or alive, but the group of rabbits nursed by two does and feed restricted achieved higher production. Compared to the conventional rearing method (nursing by one doe and fed *ad libitum* between weaning and first mating), the group of rabbits nursed by two does and fed restricted till 4 days before the first insemination achieved higher number of litters by 12% (6.0 vs. 6.7), number of total born rabbits by 14% (53.1 vs. 60.3) and number of born alive by 16% (48.9 vs. 56.5).

EFFECT OF TYPE AND OXIDATION LEVEL OF THE DIETARY FAT ON THE PERFORMANCE OF FATTENING RABBITS. CASADO, C., PASCUAL, J.J., MOYA, V.J., BLAS, E., CERVERA, C. *Univ. Politècnica de Valencia. Dpt. Ciencia Animal. Valencia. Spain. Ccervera@dca.upv.es*

Two experiments with 155 fattening rabbits (31 by treatment) were carried out in order to study the effect of type and oxidation level of the fat included in the diet on the voluntary feed intake and growth of animals. Five diets were formulated using the same raw material and including 3% of fat. In the first experiment, diets with animal fat (rich in saturated fat), sunflower oil (rich in n-6 PUFA) and linseed oil (rich in n-3 PUFA) were compared. In the second experiment, the diets included fresh, per-oxidised and highly-oxidised sunflower oil. The use of animal or vegetable fat and the richness in n-3 or n-6 PUFA of vegetable oils did not have any significant effect on the growth of rabbits. However, voluntary feed intake and growth of rabbits just after weaning (28 and 30 days of live) were significantly affected by oxidation level of oil, being higher with fresh oil (48, 39 and 46 g DM of daily feed intake, $P < 0.10$; and 56, 37 and 41 g of daily growth, $P < 0.01$; the fresh, per-oxidised and highly-oxidised diets, respectively). Consequently, the live weight of rabbits at 30 days old was higher when fed the fresh oil and these differences were maintained until 44 d (1291, 1231 and 1243 g, respectively).

EVALUATION OF APPARENT DIGESTIBILITY OF THE SIMPLIFIED DIETS BASE ON FORAGE AND NUTRITIONAL VALUE OF FIBROUS SOURCES FOR RABBITS DOES. MACHADO L.C., FERREIRA W.M., FARIA H.G., SCAPINELLO C., ALVES C.S.A., OLIVEIRA C.E.A., SOUZA J.D.S., PRATES R.C. *Animal Sci. Dpt. Minas Gerais Federal Univ. MG - Brazil.* luizmachado@ufmg.br

This research was made to evaluate the apparent nutrients digestibility and nutritive value of fiber sources of simplified diets, based on forage and corrected with synthetic amino acids and oil, to rabbit does. It was conducted with 24 animals white new zeland does, with ten months of age, housed in cages with a faeces collect system, in a experimental design completely randomized, with three treatments and eight replicates per treatment. The experimental diets consisted of reference diet (REF), alfalfa hay based diet (*Medicago sativa*) (FAL), cassava upper third foliage hay (*Manihot esculenta* Crantz) (FRM), variety yellow cacau, picked up with 14 months of age. It tempted to reach the minimum requirements quoted by literature in the formulation. The apparent digestibility was influenced by kind of diet studied where the REF treatment shows the bigger digestibility following by FAL treatment and FRM treatment that shows the smallest digestibility. The digestive protein and the digestible energy found to cassava upper third foliage hay were 9.6% and 1149.81 Kcal/KgDM, respectively, while for the alfalfa hay were found 12.92% and 2205.59 Kcal/

KgDM of digestive protein and digestible energy respectively.

EVALUATION OF SIMPLIFIED DIET BASED ON CASSAVA UPPER THIRD FOLIAGE HAY FOR RABBIT DOES. MACHADO L.C., FERREIRA W.M., FARIA H.G., SCAPINELLO C., ALVES C.S.A., OLIVEIRA C.E.A., SOUZA J.D.S. *Animal Sci. Dpt., Minas Gerais Federal Univ. MG - Brazil.* luizmachado@ufmg.br

This research was carried out to assess the effect of a simplified diet based on forage corrected with synthetic amino acids and oil on the reproduction of does. The experimental diet consisted of cassava upper third foliage hay (*Manihot esculenta* Crantz) (FRM), variety yellow cacau, harvested at 14 months. An attempt was made to reach the minimum requirements quoted by literature. Ten white-five month-old -New Zealand does, individually housed, in a completely randomized experimental design, were used. The parturition interval adopted varied from 42 to 45 days. Consumption was limited till 21 days of pregnancy and *ad libitum* for the last ten days of pregnancy or during lactation. The does did not reproduce due to an insufficiency of energy and protein to support the reproductive rhythm proposed. During the experimental period the animals maintained their weight ($P > 0.05$), and the average amount of food spent was of 180 g DM day⁻¹. The results were unexpected.

EVALUATION OF SIMPLIFIED DIETS BASED ON ALFALFA HAY FOR RABBIT DOES. MACHADO L.C., FERREIRA W.M., FARIA H.G., SCAPINELLO C., ALVES C.S.A., OLIVEIRA C.E.A., SOUZA J.D.S. *Animal Sci. Dpt. Minas Gerais Federal Univ. MG - Brazil.* luizmachado@ufmg.br

The aim of this research was to assess the effect of simplified diets based on forage corrected with synthetic amino acids and oil on the reproduction of does. The experimental diets consisted of reference diet (REF) and alfalfa hay based diet (*Medicago sativa*) (FAL). In the formulation we tried to reach the minimum requirements quoted by literature. Twenty-white-New Zealand does, with five months of age, were used. The animals were housed individually, with ten does for each treatment in a completely randomized experimental design. Two reproductive cycles in a factorial arrangement 2x2 were considered. The parturition interval adopted varied from 42 to 45 days. Consumption was limited till 21 days of pregnancy and *ad libitum* for the last ten days of pregnancy or during lactation. No interaction was observed between the diets with reproductive cycles ($P > 0.05$) in any of the evaluated parameters. The use

of simplified diets affected the productive performance ($P<0.05$), and average weights at birth, at 21 days and at weaning of young rabbits were smaller for the FAL diet. The values of litter size at birth and number of litters alive at birth were higher in the REF treatment ($P<0.05$) and the number of weaning litters was statistically identical ($P<0.05$). Although the FAL treatment showed a higher numerical mortality value, this could not be attributed to any of the diets ($P<0.05$). The amount of food used during the experiment was identical ($P<0.05$) and the does that received the REF diet gained more weight during the experiment ($P<0.05$). Thus, the treatment using simplified diet based on alfalfa hay showed in general inferior results than those obtained in the reference diets.

EVALUATION OF THE EFFECT OF ELECTRICAL STIMULATION ON THE pH AND TEMPERATURE OF THE LONGISSIMUS DORSI AND FEMORIS BICEP MUSCLES ON RABBIT CARCASSES. BARRÓN G.C., ZAMORA F.M., RICO P.J., RODRÍGUEZ H.J., FLORES P.S., CARDONA L.A., GUTIÉRREZ H.E., ACOSTA K., MIGUEL S.C., STRAFFON M.O. *Univ. Nacional Autónoma de México. M.V.Z. Fac. de Estudios Superiores. Cuautitlán Izcalli, Edo. de México. MÉXICO. mag1956@servidor.unam.mx.*

Evaluation of the kinetic of the descent of the pH and the change in the post mortem temperature as results of the effects of the electrical desensitization and/or the electric stimulation post slaughters on the New Zealand race of rabbits. 80 animals were slaughtered and then randomly assigned into one of four treatments; there were 20 rabbits for each one, consisting of 10 females and 10 males each. Animals from treatment I (controlled) were desensitized by cervical dislocation, those from treatment II were desensitized by cervical dislocation and the carcasses were electrically stimulated immediately after the slaughter. The rabbits assigned to treatment III were desensitized by electrical stimulation and the animals from treatment IV received electrical stimulation as a mode of desensitizing and the carcasses were electrically stimulated immediately post slaughter. There were differences ($P<0.05$) between treatments with respect to the values of the initial pH in both studied muscles. The electrical desensitizing did not affect the final pH of the carcasses. It was possible to determine that the method of electrical desensitizing is able to influence the process of acidity of the muscular pH, finding that the values of pH_{0h} were lower in the carcasses of treatments II, III and IV with respect to the control group. The biochemical-physiological explanation of the effect of the electro stimulation could be that this modifies the concentration of Calcium ions available

with which it could be affected, on the one hand, the regulation of the activity of the enzyme Fosforilasa Glycogen and on the other, modifying, favorably the regulation of the system of Calpains/Calpastainas post- mortem.

EVALUATION OF THE PRODUCTIVE PERFORMANCE OF GROWING RABBITS OF 30 DAYS TO SLAUGHTER FED WITH SIMPLIFIED DIETS WITH BASE ON FORAGE. MACHADO L.C., FERREIRA W.M., FARIA H.G., SCAPINELLO C., ALVES C.S.A., OLIVEIRA C.E.A., SOUZA J.D.S., PRATES R.C. *Animal Sci. Dpt. Minas Gerais Federal Univ. MG - Brazil. luizmachado@ufmg.br*

This research was made to assess the simplified diets with base on forage corrected with synthetic amino acids and oil, to growing rabbits provided from does that received this diets. The experimental diets consisted of reference diet (REF), alfalfa hay based diet (*Medicago sativa*) (FAL), cassava upper third foliage hay (*Manihot esculenta* Crantz) (FRM), variety yellow cacau, picked up with 14 months of age. The formulation tried to reach the minimum requirements quoted by literature. There were utilized 42 animals, White New Zealand. The rabbits were distributed following a completely randomized design being three treatments and 14 replicates. The animals were evaluated since 30 days until slaughter at 70 days of age. The daily food was not influenced by the diet ($P<0.05$). The FRM diet showed higher alimentary convention ($P<0.05$). There were differences between the others parameters where the REF treatment was higher for all. The results of FAL treatment were acceptable.

FREE CHOICE METHOD TO INVESTIGATE THE WELFARE OF GROWING RABBITS. SZENDRŐ Zs., MATICS Zs., PRINCZ Z., OROVA Z. *Univ. of Kaposvár, Fac. of Animal Sci. Hungary. szendro@mail.atk.u-kaposvar.hu*

Free choice method was used to investigate the welfare of growing rabbits. Rabbits could move among cages of different size, height or floor type through swing doors. It was established that young rabbits (between the age of 3 and 6w) like huddling together, and they prefer staying in one of the smallest cages. After 6w they moved to the larger cages with similar density to that observed with the smaller cages. Growing rabbits prefer the plastic-net floor but they accept a less preferable wire-net or plastic-slat floor if the stocking density (kg rabbits/m²) is too high. At the temperature of 16-18°C, most of the rabbits (82-86%) stay on wire-net floor and only 14-18% of them chose the deep litter. This preference is independent

of age or stocking density. The rabbits rather chose a higher density (27.5 kits/m²) than staying on deep litter.

GENETIC PARAMETERS BETWEEN PUREBRED AND CROSSBRED RABBIT DOES. SÁNCHEZ¹, J.P. ; BASELGA², M. ¹Dpt. de Producción Animal, Univ. de León, Spain. ²Dpt. de Ciencia Animal, Univ. Politécnica de Valencia, Valencia, Spain. *mbaseлга@dca.upv.es*

A genetic analysis of litter size traits (total born, TB; number born alive, BA and number at weaning, NW) has been carried out involving data of two pure maternal lines of rabbits selected for litter size at weaning during more than 29 generations and the crossbred does between them. The data concerning pure lines concerned all generations of selection. Two types of crossbreds were used, the old and the current type, performing contemporarily because of the use of vitrified embryos. The difference between the number of the generations of the pure lines used to obtain the old and the current type of crossbreds was 12. The estimated heritabilities were 0.126±0.009, 0.098±0.007 and 0.077±0.006 in purebreds for TB, BA and NW. The corresponding values in crossbreds were 0.122±0.032, 0.052±0.011 and 0.019±0.006. The genetic correlations estimated between crossbreds and purebreds were 0.740±0.183 for TB, and 1±0.001 for BA and NW. The response in the crossbreds to the within line selection of the maternal lines, along the 12 generations separating both types of crossbreds, was per generation, 0.111, 0.101 and 0.055 young/litter respectively for TB, BA and NW. These values were higher than the responses estimated in the pure lines in a previous experiment (0.095, 0.088 and 0.085 young per litter for TB, BA and NW) for TB and BA, but lower for NW. This result for NW was in disagreement with other experiments that reported higher responses in crossbreds than in purebreds also in this trait. Another non expected result in this experiment, probably related with the previous one, was the extremely low value of the heritability of NW in the crossbreds compared to the purebreds. The estimated values of the heritabilities and genetic correlations were used to predict the ratio of the response in crossbreds to the response in purebreds. The actual ratios were always higher than the predicted ratios for all traits. This disagreement could be explained by two related causes. One is that the effect of the inbreeding has not been considered to evaluate the response in the purebreds. The other is that the models explaining the traits in pure lines and crossbreds should include effects of dominance.

INFLUENCE OF FASTING USED FOR OESTRUS INDUCTION ON THE PERFORMANCE OF RABBIT DOES. EIBEN Cs.¹, TÓBIÁS G.¹, GÓDOR-SURMANN K.¹, KUSTOS K.², SZIRA G.² ¹Res. Inst. for Animal Breed. and Nutr. Gödöllő, Hungary, *eiben@katki.hu*. ²Lab-Nyúl Ltd., Gödöllő, Hungary

The effect of short term fasting and re-feeding before insemination (AI) on reproduction and performance of current litters was studied with 240 Pannon White does. The control group (C) was fed *ad libitum* and nursed freely until weaning at 35 d. In group of farm practice (1X), the diet was also freely available but the females nursed once a day between 1 and 14 d and freely afterwards. In treated group (T), the biostimulation was the change of feeding, i.e. a 24 h fasting with 48-50 h *ad libitum* re-feeding prior to AI and similar nursing system was used as in 1X group. In T and 1X groups, sexual receptivity increased (0.47 and 0.45 vs. 0.27; $P=0.029$) and kindling rate was by 8% and 14% higher than in C group (78.7, 85.5, 71.1%; $P=0.05$). The number of total born per litter seemed to be 1.0 newborn higher in T group (11.2 vs. 10.2 and 10.3; $P=0.152$). Controlled nursing combined with fasting but also controlled nursing decreased the litter weight (7179, 7451 vs. 7900 g; $P=0.001$) and young weight (944, 966 vs. 1033 g; $P=0.001$) of current litters at 35 d. After weaning, T rabbits gained less than those in 1X and C groups between 35 and 70 d (36.1 vs. 40.5 and 40.8 g/d; $P=0.001$). Mortality rate was the same before weaning (3.7-5.0%) but it was higher for T and 1X rabbits during fattening (12.3, 13.5 vs. 7.9%; $P=0.01$). The kg of slaughter rabbits per doe was lower in T than in 1X and C groups (14.5 vs. 17.5 and 17.5 kg; $P=0.009$). In T group, despite the best receptivity the advantage in reproduction was low and it can be lost due to the poorer development of current progeny.

PASTURE FINISHING OF RABBITS USING THE MORANT STYLE HUTCH. MCNITT J.I.¹, GAGER J.¹, MALEKIAN F.¹, BOND A.¹, MELLIEON JR.¹, PARKER L.¹, MCMILLIN K.W.² ¹Southern Univ. Agr. Res. and Extension Center. Baton Rouge, LA USA. *james_mcnitt@suagcenter.com*. ²Dpt. of Animal Sci., Louisiana State Univ. Agr. Center, Baton Rouge, LA USA.

Two trials were carried out using the Morant style hutch to evaluate the effect of outdoor finishing of rabbits on meat quality. Rabbits reared in conventional cages were used as controls in both trials. In the first trial, the rabbits were placed in pens on pasture at 33.8±0.21 days of age and were harvested at 72.8±0.21 days of age. The pen reared rabbits grew more slowly than those in cages resulting in lower ($P<0.01$) rates of gain, lighter ($P<0.01$) carcasses, and

lower ($P<0.05$) dressing percentages (21.7 ± 1.65 vs. 36.2 ± 2.71 g/d; 946 ± 80.7 vs. 1356 ± 58.9 g; and $53.2\pm$ vs. $59.9\pm 1.5\%$, respectively). There were no differences in the colours of the biceps femoris, external oblique, and trapezius muscles measured by reflectance spectrophotometry) except for the trapezius in the pastured animals with higher ($P<0.05$) a^* (redness) and b^* (yellowness) values (9.36 ± 1.03 and 8.78 ± 0.61 vs. 6.51 ± 0.76 and 7.01 ± 0.45 , respectively). Due to high mortality in trial 1, the rabbits in trial 2 were not placed on pasture until 44.5 ± 0.21 days of age and were harvested at 58.5 ± 0.21 days of age. There were no effects of housing on productivity traits or mortality. The b^* value for the external oblique muscle from the caged rabbits was 8.64 ± 0.33 while that from the penned rabbits was 7.56 ± 0.33 ($P<0.05$), but there were no differences in L^* (lightness) or a^* . There were no differences in shear force needed to cut across 13-mm cores from muscles of the right rear leg with a Warner Bratzler blade (TA.XT.Plus Texture Analyzer, Texture Technologies, Scarsdale, NY). Consumer acceptance was measured on loin and left hind leg samples for tenderness, juiciness, flavour and overall acceptability on a 9-point hedonic scale by 17 to 21 faculty, staff and student evaluators. The only difference was a higher ($P<0.05$) tenderness score for the caged (6.9 ± 0.11) than for the penned rabbits (6.6 ± 1.1).

PERFORMANCE OF GROWING RABBITS FED WITH DIFFERENT LEVELS OF COTTONSEED MEAL. DÁVILA N.F.P., GOMES A.V.C., CRESPI M.P.L., COLL J.F.C., PESSOA M.F., ROCHA J.C.C. *Dpt. of Nutrition Sci., Univ. Federal do Rio de Janeiro. RJ – Brazil. Vidal@ufrj.br*

It was used 32 White New Zealand rabbits of both sexes (16 males and 16 females) 41 day old, to evaluate levels of cottonseed meal over performance and carcass yield. Animals were allocated individually and distributed in randomized design with 4 treatments, being a basic ration without cottonseed meal (0%) and three replacement levels of soybean meal protein by cottonseed meal (33; 66 e 100%) and eight replicates. At the end of the experiment (76 days) animals were slaughtered to evaluate carcass yield. It was observed an increase ($P<0.05$) on ration daily intake and feed conversion, but the average daily weight gain and carcass yield were not affected, suggesting that cottonseed meal (38% PB) can substitute soybean meal protein in growing rabbits ration.

PERFORMANCE OF GROWING RABBITS FED DIETS CONTAINING A PREBIOTIC AND/OR A PROBIOTIC. LUI J.F¹, ZANATO J.A.F, OLIVEIRA

M.C.², CAVALCANTE NETO A.¹, JUNQUEIRA O.M.¹, MALHEIROS E.B.¹, SCAPINELLO C.³ ¹*Animal Sci. Dpt., São Paulo State Univ. SP, Brazil. jeffrey@fcav.unesp.br.* ²*Animal Sci. Dpt., Univ. of Rio Verde. GO, Brazil.* ³*Animal Sci. Dpt., State Univ. of Maringá, PR, Brazil.*

This study aimed at evaluating the performance of growing rabbits fed diets containing a prebiotic and/or a probiotic. Forty New Zealand White rabbits, weaned at 35 days of age, were distributed in a completely randomized experimental design into five treatments (T_1 = negative control diet with no probiotic, a probiotic, or an antibiotic; T_2 = positive control diet with 0.05% Zinc Bacitracin; T_3 = diet with a probiotic at 0.15%; T_4 = diet with a prebiotic at 0.15%; and T_5 = diet with a probiotic and a prebiotic), with four replicates each. Each experimental unit consisted of two animals. Feed and water were offered *ad libitum*. Animals and feed were weighed at 35 and 80 days of age, when daily weight gain, daily feed intake, and feed conversion ratio were determined. There was no statistical difference ($P>0.05$) in the analyzed parameters among treatments. It was concluded that the addition of prebiotic and/or probiotic does not improve performance.

EVALUATION OF MILK PRODUCTION OF PRIMIPAROUS RABBIT DOES NURSING TWICE A DAY. SALCEDO B.R., GARCÍA P.E., AVENDAÑO J.J.G., ECHEGARAY T.J.L. *Dpt. de Preparatoria Agrícola. Univ. Autónoma Chapingo. Texcoco, Edo. de México, México. rames@correo.chapingo.mx*

The objective of the trial was the evaluation of milk production of primiparous does nursing twice a day. The experiment was carried out at the Unidad de Investigación Aplicada en Producción Cunícola, Departamento de Preparatoria Agrícola, Universidad Autónoma Chapingo, from April to July 2005. Fifty two primiparous does records were used. There were 3 doe genotypes (A, B, and C) each genotype had 25% of White New Zealand, 25% of Chinchilla, and the remaining 50% was Rex, Dwarf and Giant for A, B, and C genotypes respectively. They were artificially inseminated with Californian sires semen in three sets, when they were 4.5 months old, 11 days after delivery. Litters involved a total of 377 kits. After parturition, litters were made homogenous by size. Does and their litters were randomly divided in two groups: one of them nursed once a day (treatment 1) and the other group nursed twice a day (treatment 2), making sure does from the different weight categories were in both treatments. Starting one day after birth until day 35, every other day, milk production (MP) was computed by weighing the litter before and after nursing. Weaning was done at day 40. Kit daily weight gain (DWG) was computed

from litter weight difference. Mortality was recorded daily and cumulative mortality to day 35 was computed. Doe fertility, litter size and weight at second parity were recorded as well. Nursing frequency effect was significant, MP was lower for does nursing once a day (4052.42 ± 210.85 g) in comparison with does nursing twice a day (5113.26 ± 274.98 g) and 21 day young rabbit mean weight showed differences in favor of treatment 2: (244.34 g) vs. treatment 1 (235.14 g). There were no treatment differences for weaning weight, cumulative mortality at day 35, following insemination fecundity, and next kindling litter size and weight.

TABLE OF NUTRITIVE COMPOSITION OF CONVENTIONAL AND NON CONVENTIONAL RAW MATERIALS WITH DIGESTIBLE ENERGY ESTIMATES FOR RABBITS. MARANTE O.D.¹, DE LEÓN R.P.², SAVÓN L.² TORRES V.². ¹*Univ. Agraria de la Habana, Fac. de Medicina Veterinaria. osana@isch.edu.cu.* ²*Inst. de Ciencia Animal.*

The knowledge of the nutritive value of feed is fundamental to increase the efficiency of animal production. This is very important for the rabbit breeders to maximize the use of available conventional and non conventional feedstuffs of the territories. Feed composition tables with the digestible energy specifically for rabbits including non-conventional products are generally not available for small producers. With the objective to elaborate a table of up-to-date composition with the specific content of digestible energy particularly of non conventional feeds of tropical regions for this species, a series of investigation steps was carried out: a) Selection of the better prediction equation by feedstuff group (energy, protein and fibrous sources), starting from the validation of the equations reported by different authors and the elimination of those whose predictions were less efficient. b) Compilation of the nutritive compositions of tropical feedstuffs from the literature. c) Calculation of digestible energy values of the feedstuffs lacking it, applying the selected equations. d) Elaboration of a new nutritive composition table including more products and with digestible energy estimates for all of them. The database of the ALIMCONEJOS program was enriched with 101 new products for a total of 237. Each item includes the author reference and the equation or method of digestible energy determination. In the final table 18.6% are energy concentrated products, 37.9% are protein concentrates, 38.4% are fibrous materials and 5.1% are mineral supplements. In this table 54 fibrous materials were incorporated, of which 8 were grasses, 20 legumes and 20 belong to other species of trees with rabbit feeding potential.

THE EFFECT OF EARLY WEANING AND VEGETABLE OIL ON THE PERFORMANCE AND NUTRIENT DIGESTIBILITY OF BROILER RABBITS. ZITA L.¹, TUMOVÁ E.¹, SKØIVANOVÁ V.², MAROUNEK M.^{2,3} ¹*Cz. Univ. of Agriculture Prague, Prague, Cz. Republic.* ²*Res. Inst. of Animal Production, Prague, Cz. Republic.* ³*Inst. of Animal Physiology and Genetics, Cz. Academy of Sci., Prague, Cz. Republic.* *tumova@af.czu.cz*

In the balance experiment the effect of early weaning at the age of 21 days, vegetable oil and lipase on growth, feed consumption, carcass yield, digestibility of nutrients and parasites incidence was investigated. As vegetable oil we used Akomed R[®], commercial oil (Karlshamns, Sweden) which contains 60.8% caprylic acid, 38.7% capric acid and 0.5% lauric acid. Forty two Hyplus rabbits (average body weight 472 g) were assigned to three groups. Group 1 was fed a control feed mixture, the second group received an experimental feed mixture containing 1% of Akomed R[®] and 0.5% lipase (PES-S, Inotex, Czech Republic) from 21 to 42 days of age. The third group received the same feed as the latter group from 21 to 77 days of age. Akomed R[®] had no growth promotion effect but reduced ($P < 0.05$) daily feed intake. Carcass yield was not significantly influenced. However, the renal fat was non significantly reduced from 2.99% in the control group to 2.59% or 2.10% in the experimental groups. Fat digestibility increased ($P < 0.05$) in both experimental groups. Lower incidence of *Eimeria perforans* was detected in both experimental groups, in comparison with the control group.

THE EFFECT OF WEANING AGE ON PERFORMANCE, NUTRIENT DIGESTIBILITY AND LIPASE ACTIVITY IN BROILER RABBITS. TUMOVÁ E.¹, ZITA L.¹, MAROUNEK M.^{2,3}, SKØIVANOVÁ V.², BERLADYN A.^{3,4} ¹*Cz. Univ. of Agriculture Prague, Prague, Cz. Republic.* ²*Res. Inst. of Animal Production, Prague, Cz. Republic.* ³*Inst. of Animal Physiology and Genetics, Cz. Academy of Sci., Prague, Cz. Republic.* ⁴*Res. Inst. of Biotech. in Animal Production, Lviv National Academy of Veterinary Medicine, Lviv, Ukraine.* *tumova@af.czu.cz*

The effect of the weaning age, commercially available oil Akomed R[®] (Karlsham, Sweden) containing caprylic, capric and lauric acid, and lipase addition (Inotex, Czech Republic) on performance, digestibility of nutrients and lipolytic activity in different parts of the digestive tract of rabbits was investigated. In the 1st experiment rabbits were weaned at the age of 27 and 35 days. At each weaning age rabbits were split into 2 groups which were fed with a control and experimental feed mixture. In the 2nd experiment rabbits were weaned at 25 and 35 days

and fed with the same feed mixtures as in the experiment 1. The experimental feed mixture included 1% of Akomed R[®] and 0.5% lipase. There was no effect of Akomed R[®] and lipase addition on growth and feed consumption. Akomed R[®] did not affect digestibility of dry matter and crude protein, but crude fiber digestibility was reduced. Lipase activity in digestive segments decreased with rabbit age. Rabbits weaned at 25 days had generally higher gastric and intestinal lipolytic activity in comparison with rabbits weaned at 35 days. The lipase and oil supplement did not significantly affect the lipolytic activity of digesta.

THE HYPOSMOTIC SWELLING TEST IN FRESH RABBIT SPERMATOZOA. AMORIM E.A.M., TORRES C.A.A., AMORIM L.S., SANTOS L.V.L., SILVA J.F. *Dpt. of Animal Sci., Federal Univ. Viçosa, Viçosa – MG, Brazil, eamufv@yahoo.com.br*

The hypoosmotic swelling test (HOST) has been proved to be a good tool for evaluating the membrane integrity of spermatozoa of various domestic animals including cattle, horses and swine. The present study to establish the best hypoosmotic solution (HS) for testing membrane integrity in fresh rabbit semen. Sacarose solutions (SS) with the following osmolarities (mOsm/L) were used: 50 (SS1), 60 (SS2), 75 (SS3), 100 (SS4), 125 (SS5) and 150 mOsm/L (SS6). Twenty-four semen samples were collected from four mature rabbits (six collections per rabbit) at three days intervals. After macroscopic evaluation, the HOST was performed by mixing 10 μ L of each sample with 1 mL of each solution and incubated for 30 minutes at 37°C. Sequentially, 20 μ L of every sample was smeared on a microscope slide and observed with oil immersion using a phase contrast microscope. A minimum of 100 cells was observed and classified as non-coiled and coiled (coiled plus strongly coiled). The respective percentages of spermatozoa with coiled tails (coiled plus strongly coiled) in the six solutions listed above were: 49.37, 52.84, 49.65, 49.53, 37.19 and 29.44%, respectively. According to total coiling, SS2 was superior to SS6 ($P<0.01$). Results suggest that the 60 mOsm/L solution would be best for use in HOST in fresh rabbit spermatozoa.

USE OF DIFFERENT INCUBATION TIMES FOR HYPOSMOTIC TEST IN FRESH RABBIT SEMEN. AMORIM E.A.M., TORRES C.A.A., SANTOS L.V.L., AMORIM L.S., SILVA J.F. *Dpt. of Animal Sci., Federal Univ. of Viçosa, MG, Brazil, eamufv@yahoo.com.br*

The hypoosmotic test (HOST) is used in many domestic animals to test the integrity of spermatozoa

plasma membrane, characterized by the sperm tail coiling, which requires an incubation time to show this phenomenon. Twenty-four ejaculates from four rabbits (six collections per rabbit) were used to check the ideal incubation time. Six aliquots of 10 μ L of each ejaculate were diluted in 1 mL tubes of basic sucrose hypoosmotic solution (HS, 60 mOsm/L) and incubated at 37°C for six different times: 5 (T1), 30 (T2), 55 (T3), 80 (T4), 105 (T5) and 130 minutes (T6). Afterward, 20 μ L of HS diluted semen were evaluated under phase-contrast microscope at 1000X magnification, by counting 100 spermatozoa, classified as non-coiled and coiled spermatozoa (coiled plus strongly coiled). The incubation time affected the percentage of spermatozoa that showed the coiling of the tails ($P<0.01$). The positive HOST reaction were shown by the T1 (58.06 \pm 17.10) and T2 (50.56 \pm 17.15). The results of this study suggest the use of incubation time of 5 or 30 minutes for HOST consolidation in rabbits semen.

USE OF FRESH CHICORY (*Cichorium intyibum L.*) ON RABBIT FEEDING. COSSU M.E.¹, GAUNA C.², MARTINO P.³, CUMINI M.L.¹, TACCHINI F.⁴, LAZZARI G.¹ ¹*Dpt. de Prod. Animal, UBA. Bs As, Argentina.* ²*Cat. Biología General, Univ. Nac. La Pampa.* ³*Cat. Microbiología, Univ. Nac. La Plata.* ⁴*Zootecnia, Univ. Nac. de Cuyo, Mendoza. Argentina.* *mcossu@agro.uba.ar*

The effect of adding fresh chicory (*Cichorium intyibum L.*) in concentrated diets for rabbits on productive performance, carcass and meat quality were studied on 156 F1 (New Zealand \times California) rabbits of both sexes. Animals were fed *ad libitum* concentrate diets (Control) or concentrated diets plus fresh chicory (Chicory); from 33 d to 55 d of age young rabbits were fed with standard feed and from 56 to slaughtering age (78 d) the finishing diet was used. During the growing phase no statistical differences were found on the final weight, but Chicory group promoted higher weight gains ($P<0.05$). Animals did not replace concentrate intake because of the Chicory and increased the total dry matter daily intake (ns.). At slaughter age, no differences were observed on microbial counts of caecal content but Chicory group showed less *Escherichia coli* content ($P>0.05$). No differences were observed in slaughter yield, dressing percentage and meat to bone ratio but Control group was fatter ($P<0.01$). The effect of diets on physical quality traits was significant only for Control *Longissimus dorsi* muscle high tenderness ($P<0.01$). The *Longissimus dorsi* Control group meat had less water, more lipid content and higher energy concentration ($P<0.01$); moreover, it tended to have a high protein content ($P>0.05$). The hind leg of Chicory rabbits had more

protein and less lipid content ($P < 0.05$) but similar energy concentration.

EFFECT OF THE ENERGY LEVEL IN THE WEANING, AGE AT WEANING, AND STARCH LEVEL IN THE POSTWEANING DIET ON FATTY ACIDS PROFILE OF RABBIT CARCASSES.

SILVA W.R. DA², SCAPINELLO C.¹, MARIA B.G. DE³, DONIDA M.W.³, FURLAN A. C.¹, MATSUSHITA M.⁴, MICHELAN A.C.¹ ¹*Animal Sci. Dpt., UEM. cscapinello@uem.br.* ²*Masters of Sci. st., Dpt. of Animal Sci. UEM.* ³*Animal Sci. Under Graduate st. UEM.* ⁴*Chemistry Dpt. – UEM.*

In order to evaluate the fatty acids profile of the rabbit meat, 64 rabbits were slaughtered at the age of 70 days, from does fed with diets of two energy levels (2.600 or 2.800 kcal DE/kg), weaned at 28 or 35 days of age. The experimental design was a factorial scheme 2x2x2 (diets with two levels of energy (2600 and 2800 kcal DE) until weaning versus two weaning ages (28 and 35 days old) versus diets with high or low starch (16% or 21%) with or without soybean oil addition) with eight treatments and eight replications. After slaughtering, the meat of the right thigh was removed and, within each group, submitted to chemical analyses. The levels of fatty acids were not influenced by the different DE levels of the diets until weaning and weaning age rabbit, however they were influenced by the addition or not of soy oil in diets from weaning to slaughtering, when the fatty acids profile on the meat of the animals reflected the composition of the experimental diets. Thus, the addition of soybean oil to the diets after weaning reduced the levels of saturated fatty acids, making the animal meat more unsaturated and providing meat with higher amounts of polyunsaturated fatty acids and with a higher ration polyunsaturated/saturated fatty acids.

DIGESTIBILITY OF SODIUM HYDROXIDE TREATED SUGAR CANE BAGASSE IN GROWING RABBIT DIETS.

PEREIRA R.A.N., FERREIRA W.M., SOUZA J.C. DE, DUARTE M.R., GARCIA. S.K., BERTECHINI A.G., PEREIRA. M.N. *Lavras – MG, Brazil. renata_apocalypse@yahoo.com.br*

Sodium Hydroxide (NaOH) treated (TB) and untreated (UB) sugar cane bagasses were evaluated for growing rabbits. TB and UB nutrient digestibility coefficients (DC) were determined on a completely randomized design, with five treatments (basic ration and rations with 40% bagasse treated with 0, 2, 4 and 6% NaOH) and four replicates. The basal diet isometric substitution method was adopted to obtain exclusively bagasse digestibility values and not total diet values. Bagasse NaOH addition did not improve ($P > 0.05$) dry matter, crude protein, neutral detergent

fiber, crude fiber and energy DC. However it lowered ($P = 0.0023$) acid detergent fiber DC ($y = 20.042 - 2.7615x$, $R^2 = 0.984$). In conclusion, sugar cane bagasse NaOH treatment did not show practical advantages for DC values that justified its use, since the adoption of this technique increases labor and feed cost.

CARCASS TRAITS AND INTESTINAL PH OF GROWING RABBITS SUBMITTED TO DIETS CONTAINING A PREBIOTIC AND/OR A PROBIOTIC.

LUI J.F.¹, ZANATO J.A.F.¹, OLIVEIRA M.C.², CAVALCANTE NETO A.¹, JUNQUEIRA O.M.¹, SCAPINELLO C.³, MALHEIROS E.B.¹, COLONI R.D.¹ ¹*Dpt. of Animal Sci., São Paulo State Univ. SP, Brazil jeffrey@fcav.unesp.br.* ²*Dpt. of Animal Sci., Univ. of Rio Verde. Rio Verde, GO, Brazil.* ³*Dpt. of Animal Sci., State Univ. of Maringá, Maringá, PR, Brazil.*

This study aimed at evaluating carcass traits and intestinal pH of growing rabbits fed diets containing a prebiotic and/or a probiotic. Forty New Zealand White rabbits, weaned at 35 days of age, were distributed in a completely randomized experimental design into five treatments (T_1 = negative control diet with no probiotic, a probiotic, or an antibiotic; T_2 = positive control diet with 0.05% Zinc Bacitracin; T_3 = diet with a probiotic at 0.15%; T_4 = diet with a prebiotic at 0.15%; and T_5 = diet with a probiotic and a prebiotic), with four replicates each. Rabbits were slaughtered at 80 days of age, after being submitted to water fasting for six hours. Carcass yield was obtained using the hot carcass, with no feet or edible viscera. Kidneys, liver, heart, lungs, head, front and hind legs, and hide were weighed. At slaughter, duodenum, jejunum, ileum, and caecum of two animals per treatment were weighed, and pH was measured. As to carcass traits, there were significant differences ($P < 0.05$) only in heart weight, whereas for pH measurement, significant differences were observed only in the duodenum. It is concluded that the use of prebiotic and/or probiotic did not cause changes in the studied carcass traits, except for heart weight, and changed the pH only at the duodenum.

EFFECT OF ORAL ADMINISTRATION OF PROPOLIS ALCOHOLIC EXTRACT ON THE CARCASS OF GROWING RABBITS.

LUI J.F.¹, COLONI R.D.¹, SANTOS E.¹, OLIVEIRA M.C.², CAVALCANTE NETO A.¹, MALHEIROS, E.B.¹, PAHOR FILHO E. ¹*Animal Sci. Dpt., São Paulo State Univ. SP, Brazil.* ²*Animal Sci. Dpt., Univ. of Rio Verde, Rio Verde, GO, Brazil. jeffrey@fcav.unesp.br*

The objective of this experiment was to evaluate the effect of levels of propolis alcoholic extract (PAE) on carcass characteristics of growing rabbits. Twenty

White New Zealand rabbits, both sexes, weaned at 34 days of age were distributed in a randomized blocks design with four treatments and five repetitions. The rabbits were allocated individually in wire cages containing a nipple drinker and a semi-automatic feeder. The treatments were: T1 = control, T2 = 1 ml of alcohol, T3 = 0.8 ml of PAE and T4 = 1.5 ml of PAE. The commercial ration and water were provided *ad libitum* to the animals and the treatments with alcohol of cereals and PAE was administered via oral using a 1 ml syringe. When the animals reached 84 days of age, they were weighed and then slaughtered. Their hot and eviscerated carcasses were also weighed as well the edible viscera, skin, head, lungs, stomach and cecum. The carcass and part yields were determined considering the weight of the live animals. There was no effect ($P>0.05$) due the treatments on body weight, carcass and edible viscera yields, skin, head, lungs, stomach, legs and cecum relative weights. It was concluded that the administration of PAE did not affect in a positive way the carcass characteristics of growing rabbits.

REPRODUCTIVE TRAITS AND GROWTH PERFORMANCE OF NEW ZEALAND WHITE AND CALIFORNIAN RABBITS IN NORTHEAST BRAZIL. ESPÍNDOLA G.B.¹, CABRAL G.H.², GUERREIRO M.E.F.¹, DOS SANTOS M.S.V.³, OLIVEIRA S.M.P.¹, VIEIRA M.M.M.⁴ ¹Prof. do Dpt. de Zootecnia - UFC, Fortaleza-CE, marietammv@yahoo.com.br. ²Prof.^a do Dpt. de Zootecnia - UFRR, Boa Vista-RR. ³Dra. em Zootecnia - UFC, Fortaleza-CE. ⁴Zootecnista - UFC, Fortaleza-CE.

The experiment was carried out for 12 months in the Rabbit Unit of the Departamento de Zootecnia (Department of Animal Science) at the Universidade Federal do Ceará. Its aim was to compare reproductive performance and development of pups from the New Zealand White (NZ) and Californian (CA), breeds in Northeastern Brazil. Animals were fed a commercial feed for rabbit reproduction containing 2500 kcal DE/kg. Thirty female rabbits (50% from each breed) were distributed at random in the experimental cages, one per cage. Data were analyzed using an analyses of variance and F-test, with $\mu=5\%$. Does were selected by weight and age, being included in the experiment with approximately 3.0 kg and 4.5 months of age. The male/female ratio was 1:10. Pregnancy check was done by palpation 15 days after mating. Reproductive management adopted was mating 10 days after delivery and weaning at 30 days (semi-intensive). Productivity in maternity was similar ($P>0.05$) between breeds. General numeric productivity for both breeds was 31.3 rabbits weaned/cage/year. Californian does showed maternal ability than NZ does, expressed by heavier offspring at birth ($P>0.05$) and at weaning ($P<0.05$).

NUTRITIONAL VALUE OF CASSAVA ROOT SILAGE WITH INCLUSION OF WHOLE SOYBEANS AND AMYLOLYTIC INOCULANT FOR GROWING RABBITS. FURLAN A.C., DA SILVA M.A.A., SCAPINELLO C., MOREIRA I., OTUTUMI L.K., MICHELAN A.C. *Dpt. of Animal Sci. State Univ. of Maringá. Maringá - PR - Brazil. acfurlan@uem.br.*

Forty male New Zealand White rabbits aging 45 days were used on a digestibility assay. The aim of experiment was to determine the nutritional value of the cassava root silage (CA), cassava root with amylolytic inoculant silage (CI), cassava root with inclusion of whole soybeans silage (CS) and cassava root with inclusion of whole soybeans and amylolytic inoculant silage (CSI). The rabbits were randomly allocated to five treatments with eight replications each, being one control diet and four test diets. In the elaboration of test diets, the evaluated ingredients replaced 20% of the dry matter of the reference diet, containing 16.30% raw protein, 13.14% crude fiber and 2.548 Kcal of digestible energy. The digestibility coefficients of dry matter, whole energy, crude protein and organic matter were respectively 90.95%, 91.23%, 69.01% and 85.71% for CA, 91.23%, 95.11%, 64.57% and 87.27% for CI, 89.37%, 88.07%, 86.21% and 84.03% for CS and 93.89%, 90.41%, 87.77% and 88.89% for CSI. The values of digestible dry matter, digestible energy, digestible protein and digestible organic matter, on an *as fed* basis, were respectively, 40.22%, 1,638 kcal/kg, 1.14% and 37.15% for CA, 39.09%, 1,681 kcal/kg, 1.07% and 36.69% for CI, 39.19%, 1,704 kcal/kg, 3.58% and 35.95% for CS and of 39.91%, 1,672 kcal/kg, 3.57% e 36.89% for CSI. It can be concluded that the cassava root silage had good nutritional values and can be used in diets for growing rabbits.

PERFORMANCE OF GROWING RABBITS FED CASSAVA ROOT SILAGE WITH INCLUSION OF WHOLE SOYBEANS. SILVA M.A.A., FURLAN A.C., SCAPINELLO C., MARTINS E.N., SCHERER C. *Dpt. of Animal Sci. State Univ. of Maringá. Maringá, PR, Brazil. acfurlan@uem.br.*

The experiment was carried out to verify the performance of growing rabbits fed a diet containing corn (CD), and two diets with total replacement of corn for the cassava root silage (CA) and cassava root with inclusion of whole soybeans silage (CS). Forty-eight 35 days old White New Zealand rabbits, 24 males and 24 females, 35 days old were allotted to one of the three groups in a completely randomized design, with 16 replications each. The experimental unit consisted of one animal. Differences were observed in the performance traits among treatments. The daily average feed intake (DAFI) was higher for

animals fed diets containing CS and the worst result was found for those fed MA. The rabbits fed CD and CA diets exhibited better feed: gain ratio (F:G). The daily average weight gain (DAWG) did not differ between CS and CD, however, both were better than the CA treatment. It can be concluded that the cassava root silage with whole soybeans inclusion may replace corn in the diet of growing rabbits, improving performance and carcass weight.

DIGESTIBLE FIBRE TO ADF RATIO AND PROTEIN CONCENTRATION IN DIETS FOR EARLY-WEANED RABBITS. XICCATO G., TROCINO A., CARRARO L., FRAGKIADAKIS M. *Dpt. of Animal Sci. Univ. of Padova. Legnaro, Padova - Italy.* gerolamo.xiccato@unipd.it

To evaluate the effects of three ratios of digestible fibre (DF = hemicelluloses and pectins) to ADF (1.1, 1.3 and 1.5) and two levels of crude protein (CP, 16% and 17%) on digestive efficiency, growth performance, health status, and meat quality, from early-weaning (26 d of age) to slaughter (74 d) 246 rabbits were given *ad libitum* access to six diets according to a 3x2 factorial arrangement. Increasing DF/ADF linearly increased DM, fibre fraction and energy (59.9 vs. 62.3 vs. 65.9%, $P < 0.01$) digestibility and daily weight gain (42.4 vs. 43.2 vs. 45.2 g/d; $P = 0.02$) and improved feed conversion ($P < 0.01$), without affecting slaughter results, carcass and meat quality. Total caecal VFA concentration increased (51.3 vs. 66.9 and 66.0 mmol/l; $P < 0.01$) as DF/ADF raised from 1.1 to 1.3 and 1.5. Increasing dietary protein improved DM and nutrient digestibility and feed conversion ($P < 0.01$), as well as slaughter dressing percentage (61.2 vs. 61.8%, $P = 0.03$). Dietary protein concentration did not modify caecal content characteristics or carcass and meat quality. A higher mortality ($P = 0.05$) was measured in rabbits fed diets at 1.1 DF/ADF (27.1%) in comparison with rabbits fed diets at 1.3 (14.3%) and 1.5 (17.1%). However, feeding the highest DF/ADF diets, mortality raised up to 23.9% with the 16% CP diet, while was only 11.4% with the 17% CP diet.

AGE AND SEX INFLUENCE IN THE RESISTANCE OF RABBIT SKINS. OLIVEIRA A.C., SOUZA M.L.R., HOCH A.L.V., GODOY L.C., GASPARINO E., SCAPINELLO C., DOMINGUES M.C. *Animal Sci. Dpt., Maringá State Univ. (UEM). Maringá - PR, Brazil.* mlrsouza@uem.br

This assignment aimed to evaluate the age and sex influence of slaughtered rabbits in the resistance (traction, elongation and the progressive tearing) of the tanned skins without fur (leather). Twenty six

rabbits were used, from 70 to 400 days of age. The skins were submitted to tanning. The steps were the soaking, fleshing, liming (4% of lime and sodium sulphide), alkaline products removal, purge, degrease, pickling, tanning (6% of chrome salts), neutralization, retanning (4% of chrome salts), dyeing, grease (6% of surfactant oils), and dryness. After tanning them, the body-of-test was pulled away in both longitudinal and transversal directions, according to the length of the rabbit. A 2x2x2 factorial treatment with both sexes (M= male and F= female), two ages (I1= 70 days; I2= 400 days) and two directions of leather (S1 = longitudinal; S2 = transversal) were used, according to the length of the leather. The leather was considered the experimental unit. The 400-day-old male leather (10.34 N/mm²) was significantly more resistant considering traction. When the elasticity in the way of the leather was analyzed, the transversal one was significantly superior (71.09%). Analyzing the age, the 70-day-old rabbits also showed more elasticity in the transversal direction, independently of the sex. The maximum strength used in the tear for the traction and stretching test was ($P < 0.05$) superior in the 400-day-old animal leather (M=196.33N and F=87.33N). The maximum strength also used was superior in the 400-day-old males when compared to the females of the same age. For the 400-day-old animals, the male leather showed a higher resistance to the progressive tearing (25.75 N/mm) compared to the female leather (17.65 N/mm). When the age in each sex was analyzed, the 400-day-old male leather also showed a higher resistance to tearing. The 70 and 400-day-old animal skins were processed together and this might have influenced a lot in the results once it probably weakened the skins of the younger animals because they are thinner. Perhaps the concentration and time of liming have been too much for the skins of these young animals. All the results lead to the conclusion that the skins must be processed separately due to their thickness, influenced by the age of the animals. It is checked that the skins of the young animals (70 days) must be processed separately and changes in the tanning technique are necessary. The skins that had a higher resistance were the 400-day-old male animals, however due to their extreme thickness they are difficult to handle in clothing manufacturing. They are ideal for leather goods, though.

INFLUENCE OF TANNING PROCESSING TIME IN THE QUALITY OF RABBIT SKINS. DOMINGUES M.C., SOUZA M.L.R., OLIVEIRA A.C., HOCH, A.L.V., PRADO M., GASPARINO E., SCAPINELLO C. *Animal Sci. Dpt., UEM, Maringá- PR, Brazil.* mlrsouza@uem.br

This assignment aim to verify the quality of the rabbit skins submitted to different times of processing. The rabbits were slaughtered with 70 days of age and

twenty skins were used. The steps of the tanning process were soaking, fleshing, liming (3% of sodium sulphide and 4% of lime), alkaline products removal, purge, degrease, pickling, tanning (6% of chrome salts), neutralization, retanning (4% of chrome salts), dyeing, grease (6% of sulfacant oils), dryness and softening. The skins were separated in two groups by process. It was used a 2x4 factorial treatment, being two times of processing (T1= continuous time, 10 h 10 min and T2= regular time, 49 h 10 min) and four different cuts of the skin (P1=fore longitudinal and P2=fore transversal; P3=hind longitudinal and P4=hind transversal). The body-of-test was pulled away in the fore and hind regions in the longitudinal and transversal directions in relation to the length of the body of the rabbit. The thickness of the rabbit skins was significantly higher ($P<0.05$) when the continuous time technique was used. The continuous time tanning offered significantly ($P<0.05$) a less resistant skin to traction (9.75 N/mm²) and progressive tearing (25.03 N/mm) compared to the regular time tanning (12.8 N/mm² and 31.43 N/mm, respectively). The technique used in the continuous time tanning offered a higher elasticity (95.85%) to the rabbit skin in relation to the regular time (67.60%). The hind region regardless if it is a longitudinal direction (34.50 N/mm) or transversal one (30.33 N/mm), showed a higher resistance to tearing compared to the fore region (longitudinal =25.80 N/mm and transversal=27.60 N/mm). Therefore, it is advisable to take extra care with the hind region of the skin if used in clothing manufacturing because it is less resistant. Although the less resistance is shown in the tanned skins in continuous time, the rabbit skins showed enough resistance to be used in clothing manufacturing without taking into account a fast (continuous) or regular tanning. The skins submitted to the continuous time tanning may be indicated due to not affect the quality of resistance, mainly by the optimization of the equipment, therefore the production of skins in tanning factories.

SEX INFLUENCE IN THE PROCESSING OF RABBIT SKINS: AREA, YIELD AND RESISTANCE.

HOCH A.L.V., SOUZA M.L.R., OLIVEIRA A.C., PRADO M., MACHADO A.C., GASPARINO E., AGUILAR-VALDEZ M.C. *Animal Sci. Dpt., UEM, Maringá - PR, Brazil. mlrsouza@uem.br.*

The aim of this assignment was to evaluate the sex influence in rabbit skins, *tanned without fur, concerning the resistance characteristics*. The rabbits were slaughtered at the age of 70 days, weighed individually and separated in groups according to their sexes. The steps of the tanning process were the soaking, fleshing, liming (3% of lime and sodium sulphide), alkaline products removal, purge, degrease,

pickling, tanning (6% of chrome salts), neutralization, retanning (4% of vegetable tannin), dyeing, grease (6% of sulfacant oils), dryness and softening. Two factorial treatments (T1=male and T2=female) for the characteristics of weight, area and yield of the skin were used. For the skin resistance tests, a 2x2 factorial treatment was used, being two sexes and two directions in the leather (S1=longitudinal and S2=transversal), with ten repetitions. The same analysis was used for the regions (R1=fore and R2=hind). The tanned skin was considered the experimental unit. There was no significant difference for the weight and yield (T1= 248.40 g; 11.40% and T2=237.8 g, 11.01%). There was no significant difference for the thickness of the rabbit leather when the regions and directions were analyzed. However, when these characteristics considering sex were analyzed, the male leather showed a higher thickness (1.06 mm), compared to the female leather (0.82 mm), independently the directions and regions of the leather. The traction test did not show difference between the longitudinal (8.56 N/mm²) and transversal (8.39 N/mm²) directions, when both sexes were analyzed. When the fore region concerning the sex was analyzed, those ones from the male animals showed more resistance when compared to the region for the females. There was no difference for the progressive tearing and concerning the sex and the direction of the leather. When the regions of the leather independently of the sex were analyzed, the fore region showed a resistance to tearing (22.20 N/mm) significantly superior to the hind region (14.70 N/mm) and there was no difference between the sexes for this characteristic. Elongation the transversal one (60.45%) showed a significant higher value than the longitudinal one (46.30%), independently of the sex. The elongation was inferior in the hind region of the female skins (42.90%), while there was no difference in the male skins ($P>0.05$). The tanning technique used in these rabbit skins offered leather with inferior resistance to that one recommended for clothing manufacturing, despite showing resistance to tearing into the recommended values. Special care must be taken when using the female leather, about the hind region, once it did not show great elasticity, being easily torn.

QUALITY OF RABBIT SKINS RESISTANCE SUBMITTED TO DIFFERENTE RETANNING TECHNIQUES.

PRADO M., SOUZA M.L.R., MACHADO A.C., HOCH A.L.V., OLIVEIRA A.C., GASPARINO E., SCAPINELLO C. *Animal Sci. Dpt., UEM, Maringá - PR, Brazil. mlrsouza@uem.br*

This experiment aimed to determine the leather resistance after the use of different retanning techniques. Forty rabbit skins of New Zealand White

breed were used. The steps were soaking, fleshing, liming (3% of lime and sodium sulphide), alkaline products remotion, purging, degreasing, pickling, tanning (6% of chrome salts), neutralization, retanning, dyeing, grease (6% of oils), dryness and softening. After tanning, the leather was removed from the body-of-test in order to determined test the resistance to traction and elongation and the progressive tearing. It was used a 4x2x2 factorial treatment, with four techniques of retanning (T₁=4% chrome salts, SC; T₂=4% vegetable tannin, TV; T₃=4% synthetic tannin, TS; T₄=2% vegetable tannin + 2% synthetic tannin, TS+TV) and two directions (longitudinal; transversal) and two regions of the leather (fore; hind), with 10 repetitions. The experimental unit was the leather. The retanned leather with vegetable tannin (1.35 mm) showed a higher thickness ($P<0.05$) in relation to the other treatments. The retanned leather with chrome salts (10.93 N/mm²) and synthetic tannin (12.13 N/mm²) showed higher resistance to traction. Also, in the elongation test this leather showed a higher elasticity (SC=63.55% and TS= 60.60%), despite not having differed significantly from the others. The leather in the fore region (near the head of the animal) showed higher resistance (10.90 N/mm² and 19.86 N/mm) in relation to the hind region. It is concluded that the rabbit leather tanned with chrome salts and retanned with different tannins may be used in leather goods in general. However, for clothing manufacturing this is possible when it is retanned with synthetic tannin or chrome salts, using carefully the fore region of the leather considering that it is more fragile.

UTILIZATION OF THE PRODUCT SL491* CONTAINING PROPOLIS AS A BASE, ON THE PERFORMANCE AND CHARACTERISTICS OF RABBIT CARCASS. PONTARA L.P.M., SCAPINELLO C., SILVA A.A., FRANCO S.L., NAKANO A.S., LOBO JUNIOR A.R., PRADO O.P.P., BETT V., NOVELLO C.R., ALVAREZ R. *Animal Sci. Dpt., UEM, Maringá - PR, Brazil.* lucimar_pontara@yahoo.com.br

Aiming to evaluate the development and characteristics of growing white New Zealand rabbit carcass, it was used five different levels of the product SL491, containing propolis as a base, as an alternative to the development and increasing of the productivity of the Cuniculture section, suitable to a product considered apotherapeutic, since that food without chemical products are worldwide spread tendency. The experiment was conducted in the Cuniculture Section of the Experimental Farm of Iguatemi (UEM), using 20 male and 40 female, 35 days of white New Zealand rabbit strain, individually allocated in cages with automatic bottle and a semi automatic feeder in a randomized sketch. It was formulated a control diet

according to growing rabbits' requirements, and with five level of SL491* containing propolis as a base. As follows, dry pelleted and offered freely as Treatment 1: without addition of product SL491*, with robenidine, bacitracin zinc; Treatment 2: without robenidine and bacitracin zinc and 100 g SL491*/100 kg of ration; Treatment 3: without robenidine and bacitracin zinc and 150 g SL491*/100 kg of ration; Treatment 4: without robenidine, bacitracin zinc, with 200 g SL491*/100 kg of ration and Treatment 5: without robenidine and bacitracin zinc 250 g SL491*/100 kg of ration. There was no significant difference between the treatments to the analyzed parameters, not affecting the performance and carcass characteristics, evidencing the utilization of SL491* containing propolis as a base in rabbits' food, offering meat of excellent quality to human consume, and agreeing with the international exigency in the area of zootecnic production. (RPI -1851/PI - 0506393 0)*.

PHYSICAL AND MECHANICAL TESTS OF WHITE NEW ZEALAND RABBITS' LEATHER SUBMITTED TO DIFFERENT RETANNING TECHNIQUES. SOUZA M.L.R., TOZZI M., ZEFERINO C.P., FRANCO N.P., HISANO L.K., CAMIN A.M., PONTARA L.P.M., SCAPINELLO C., GIOVANELI R.A., GASPARINO E. *Animal Sci. Dpt., UEM, Maringá-PR, Brazil.* mlrsouza@uem.br

To process rabbits' skin without fur is an additional alternative to its use. The aim of this work was to evaluate the resistance (traction, elongation and progressive tearing) of rabbits' leather submitted to different techniques of retanning. Sixty rabbits' skins were submitted to a tanning process using chrome salts and a retanning process with different techniques. The skins were submitted to delineation in factorial 4x2, being four techniques of retanning (T1= chrome salts; T2= synthetic tannins; T3= s tannins e T4 = synthetic and vegetable tannins) and two directions of the leather (S1= longitudinal and S2= transversal), making fifteen repetitions. After the tanning procedure, it bodies-of-test were extracted the analyzed sampling in the EMIC dynamometer. The retanning and the direction of the leather did not influence the traction test, but influenced the elongation test. The retanning with chrome (65.88%) and vegetable tannin (43.88%) provided ($P<0.01$) bigger and smaller elongation, respectively. The leather in the longitudinal direction (58.56%) presented bigger elongation ($P<0.01$). Despite the fact, the direction did not influence the progressive tearing. The technique of retanning provided more resistant leathers to tearing when used chrome salts (16.37 N/mm) and smaller with vegetable tannin combined with synthetics (11.79 N/mm). These leathers may be used to application in artifacts in general, and it must not

be used to clothing manufacturing due to its low resistance to traction and tearing. Despite of it, the technique applied in these skins must be submitted to some changes, in the reduction of products of liming and duration of this step.

INFLUENCE OF UTILIZATION OF THE PRODUCT SL491* CONTAINING PROPOLIS AS A BASE, ON CHARACTERISTICS OF RESISTANCE RABBITS' SKIN.

SOUZA M.L.R., PONTARA L.P.M., SCAPINELLO C., FRANCO S.L., SILVA A.A., AGUILLAR-VALDEZ M.C., LOBO JUNIOR A.R., GASPARINO E., OLIVEIRA A.C., NOVELLO C.R., ALVAREZ R. *Animal Sci. Dpt. Maringá State Univ. (UEM). Maringá – Paraná/Brazil. mlrsouza@uem.br.*

Aiming to evaluate the characteristics of resistance of white New Zealand rabbits skin, it was used five different levels of the product SL491*, containing propolis as a base. Using 60 rabbits, with 35 days strain, individually allocated in cages, with automatic bottle, and a semi automatic feeder in a randomized sketch. It was made five diets, dry pelleted and offered freely as follows: Treatment 1, control without addition of SL491*, with robenidine and bacitracin zinc; Treatment 2, without robenidine and bacitracin, with a level 1 of 100 g SL491*/100 kg of ration; Treatment 3 without robenidine and bacitracin zinc, with level 2 of 150 g SL491*/100 kg of ration; Treatment 4 without robenidine, bacitracin zinc and with a level 3 of 200 g/SL491*/100 kg of ration; and Treatment 5 without robenidine and bacitracin zinc, with a level 4 of 250 g SL491*/100 kg of ration. The rabbits were slaughtered with 70 days and skins submitted to tanning. The steps were the soaking, fleshing, liming (3% of lime and Sodium Sulphide), alkaline products remotion, purge, degrease, pickling, tanning (6% of chrome salts), neutralization, retanning (4% of tannin vegetable), dying, greasing (6% of surfactant oils), and dryness. After skin tanning it was removed the body-of-test in order to determine the resistance to traction and elongation and progressive tearing. To the tests of resistance it was used an EMIC dynamometer. It was used a delineation completely randomized in factorial 5x2, being five level of SL491*(T1= 0 g; T2= 100 g; T3= 150 g; T4 =200 g and T5=250 g SL491*/100 kg of ration) and two directions of leather (S1= longitudinal and S2= transversal), with ten repetitions. The leather was considered the experimental unit. The animals which received 100 g of SL491*/100 kg of ration (T2), presented a significantly higher thickness of the leather (1.65 mm) and differ in the leather thickness T5 (1.38 mm).The leather thickness showed in this experiment implies that high quantities of propolis may be negative as a consequence. When the thickness of the leather was analyzed in the longitudinal (1.51 mm) and transversal (1.58 mm) directions, a

significant difference was not observed. However, all analyzed variable of resistance presented results significantly superior in the transversal direction. The direction of the leather interferes in the resistance, maybe due to the distribution, orientation and arrange of the collagen fibers and indeed, there are evidences the thickness may affect this resistance because of it is determined by the quantity of collagen fibers distributed in the dermis. (RPI-1851/PI- 0506393 0)*¹

GENOTYPE x ENVIRONMENT INTERACTION FOR WEIGHT GAIN IN WHITE NEW ZEALAND RABBITS.

SANTOS A.L., SCAPINELLO C., MARTINS E.N., HIDALGO A.M. *Dpt. of Animal Sci. State Univ. of Maringá. Maringá - PR- Brazil. leseur@30gigs.com*

New White Zealand male rabbits were submitted to a performance test in two ways, to verify the presence of genotype x environment interaction. In the first way (A1), at 47 days old, rabbits of same litters were located jointly in the same cage. In the second way (B1), the rabbits were located in separated cages. The weight gains were evaluated from 50 to 70 days old. Using mixed models on these data the rabbits genetic breeding values (EBV) were obtained in each environment and 5% of animals in each of genetic levels were selected: low, medium and high. Full and half-sibs, obtained from the selected male, were submitted to a performance test in the first way (A2) and using these data the EBVs for the selected males were obtained. For the fathers of the selected males, EBVs based alternatively on data of theirs son or grandsons. Spearman's correlations between EBVs ranking of grandfathers obtained alternatively from A1, A2 and B1 data set were 0.82 (A1B1), -0.031 (A1A2) and 0.017 (B1A2). For selected males Spearman's correlations were 0.053 (A1A2) and 0.190 (B1A2). Heritability estimated from A1, A2 and B1 data sets were 0.33, 0.44 and 0.47, respectively. The results conflicted. Thus, it is not possible to conclude about the presence of genotype x environment interaction due to the way of the performance test. Probably the season conditions where the tests were conducted is to be the responsible for the conflicting results.

EFFECT OF THE SUBSTITUTION OF STARCH SOURCES OR WHEAT STRAW WITH APPLE PULP ON GROWTH PERFORMANCE, MORTALITY AND CARCASS YIELD, UNDER FIELD CONDITIONS.

MARGUENDA I.¹, CARABAÑO R.², GARCÍA-REBOLLAR P.², DE BLAS C.², GARCÍA-RUIZ A.I.¹ ¹NUTRECO Poultry & Rabbit Res. Center, Toledo, Spain. ²Dpt. de Producción Animal, E.T.S.I. Agrónomos, Univ. Politécnica de Madrid, Madrid, Spain. rosa.carabano@upm.es

The aim of this work was to evaluate the effect of the substitution of starch sources or wheat straw with apple pulp on growth performance, mortality and carcass dressing percentage in fattener rabbits under field conditions. Two isofibrous (31% NDF, 3.8% ADL) and isonitrogenous (15% CP) diets (C2 and C3) were formulated in order to maximize growth and health condition in the post weaning period. Diet C2 contains traditional sources of fiber (Alfalfa, and Wheat straw) and diet C3 was enriched in soluble fiber by substituting wheat straw with beet pulp. Diet C1 was formulated to meet or exceed the actual recommendations for whole of fattening period (36% NDF, 5.9% ADL and 16% CP) but substituting partially the starch (barley and wheat bran) by soluble fiber (beet pulp). A growth trial was performed in four farms with different sanitary conditions and management to study the interaction with the experimental diets. A total of 2520 rabbits, housed in collective cages were controlled from weaning (35 days of age) to slaughter (63 days of age) in the growth trial. Eighty four rabbits (slaughter at 63 days of age) were used to study the effect of diet in the carcass yield and weight of digestive tract. The farm had a significant effect on all traits studied. An interaction between farm and diet was observed for mortality, and feed efficiency. Diets with beet pulp inclusion (C1 and C3) reduce the mortality with respect to other diets in two farms. No effect of the diet was observed in the other farms. However, the inclusion of beet pulp, in diets with high content of NDF (diet C1), reduced feed efficiency and carcass yield.

HISTOLOGY OF THE SKIN OF THE RABBIT.

SOUZA M.L.R., TOZZI M., DOURADO D.M., PONTARA L.P.M., SCAPINELLO C. FRANCO N.P., FRANCO S.L., MACHADO A.C. *Animal Sci. Dpt. Maringá State Univ. (UEM). Maringá – Paraná/Brazil, mlrsouza@uem.br*

The morphology of the skin of the rabbit is provided. Five 70-day-old rabbits were slaughtered and samples of skin were collected for analysis under light microscopy. Samples of skin from the mid-dorsal region were collected and fixed in formaldehyde 10% during 24h. Samples were put in paraffin, cut in 5 mm thick and colored with hematoxylin-eosin (HE). Rabbit skin presents an epidermis and a dermis. The latter is divided into two (papillary and reticular) layers. The papillary layer is constituted by loose connective fabric, immediately below the epidermis; the thicker reticular layer is composed of a dense connective fabric. Hair and glands of skin may be observed in the latter. The dermis is composed of collagen fibers in the papillary layer, which are thinner and short; on the other hand, thicker, wavy and longer fibers may be found in the reticular layer. These layers lack any patterned order and disposition of collagen

fibers. Rabbit skin may be transformed into tough hide which depends on species and tanning techniques. When compared to the skin of other animals, rabbit skin has a lower resistance owing to its distribution, orientation and disposition of the collagen fibers. They are extremely irregular and lack a defined pattern that would give them a better intertwining and thus a perfect texture of the fibrous structure.

HISTOLOGY OF WHITE NEW ZEALAND RABBIT SKIN. SOUZA M.L.R.¹, NAKAGH L.S.O.², PACHECO M.R.², SCAPINELLO C.¹, PONTARA L.M.¹, OLIVEIRA A.C.³, DOMINGUES M.C.³, DOURADO D.M.⁴, FRANCO N. P.³, GASPARINO E.¹ ¹*Animal Sci. Dpt., UEM. Maringá PR Brazil. mlrsouza@uem.br.* ²*Morphology and Animal Physiology Dpt. -FCAV/UNESP-Jaboticabal/SP.* ³*Student of Post-Graduation in Animal Sci. (UEM).* ⁴*Ciências Biológicas, Agrárias e da Saúde da Univ. para o desenvolvimento do Estado e da Região do Pantanal (UNIDERP).*

Current research provides the histological aspects of the skin of 70-day-old rabbits with an aim at collecting data for future zootechnical research on leather quality. Samples of mid-dorsal skin from male and female white New Zealand rabbits were collected. After routine histological processing with inclusion in paraffin, 5 µm cuts and staining with Hematoxylin-eosin and Masson Trichrome Stain, histological laminae were analyzed and photomicrographed. Rabbit's skin is composed of three tissue layers: epidermis, dermis and hypodermis. In rabbits the epidermis is thin and consists of epithelial, covering, layered, keratinized tissue formed by basal or germinative, thorny, granulous sub-chambers, and by the cornea. The dermis, which is the skin's thickest section, is divided into papillary (loose connective tissue) and reticular (non-patterned dense connective tissue, with many collagen fibers) dermis. Transversal and tangential cross sections of the hair follicles in the dermis, associated or not to the erector muscle of the hairs (smooth muscle), and few sebaceous glands may be observed. Rabbit's hair follicles may be seen in the transversal cross section, grouped in characteristic arrangements. Different thicknesses in hair follicles are reported with their respective hairs. While the transversal cross section shows repartitions of the air chamber in the hairs, the blood vessels and sensorial nerve terminals may also be observed. The hypodermis or the loose connective tissue lies below the skin (epidermis and dermis) and links the skin to deep structures. A high amount of adipose tissue may be seen in this layer. No morphological differences between the male and female skins could be noted. Other studies must be undertaken with rabbits of different ages to see whether it is possible to

distinguish differences between male and female rabbits by means of the development of the dermal tissue.

SCANNING ELECTRON MICROSCOPY OF THE RABBIT SKIN. SOUZA M.L.R.¹, NAKAGHI L.S.O.², PACHECO M.R.², SCAPINELLO C.¹, PONTARA L.M.¹, OLIVEIRA A.C.³, DOMINGUES M.C.³, FRANCO N.P.³, GASPARINO E.¹ ¹*Animal Sci. Dpt., State Univ. of Maringá (UEM), Maringá PR Brazil. mlrsouza@uem.br.* ²*Morphology and Animal Physiology Dpt. -FCAV/UNESP - Jaboticabal.* ³*Student of Post-Graduation in Animal Scie. (UEM).*

The morphology of the white New Zealand rabbits' skin, used for tanning, is described. Ten samples were collected from the male and female rabbit skin's mid-dorsal region for scanning by electron microscopy (SEM). Samples were fixed in buffered glutaraldehyde 2.5% and post-fixed in osmium tetroxide 1%, during 2 hours, for scanning electronic microscopy analysis. They were then washed in phosphate buffer, dehydrated in ethanol and dried to critical point with CO₂. Specimens were metalized with gold-palladium ions and electron micrographed with JEOL-JSM 5410. Rabbit skins have three distinct layers: a thin epidermis, a thick dermis and thick hypodermis. The dermis has collagen fibers of irregular distribution, without any standard disposition and orientation of the collagen fibers. Whereas differentiation occurs in the distribution of collagen fibers in skin thickness, fibers are thinner and more joined when close to the epidermis and the subcutaneous tissue. The fibers in the intermediate layers are thicker and more distant. The thick hypodermis varies according to the region of the skin. Hairy follicles and their inclination coupled to hair distribution were also reported. Hairs were in tufts; one was thicker and the others thinner. They may be classified according to thickness and distribution within the animal's fur. Conductor, guard, clutch and support hairs are larger and thicker, albeit fewer, and are easily noted in the animal's fur. True hairs or hairs properly so called are more numerous, normally and proportionally more visible in the fur, or rather, they are colored and determine the color of the rabbit's fur. Down hairs are the shortest and thinnest in the fur, colorless or only slightly colored.

COMPARING RABBIT AND FISH (NILE TILAPIA) SKINS: MORPHOLOGY AND RESISTANCE TESTS. SOUZA M.L.R., ZEFERINO C.P., HOCH A.L.V., FRANCO N.P., SCAPINELLO C., ZANETTI K., KAZUMI C., SARTORI C.R., PONTARA L.P.M., GIOVANELI R.A.

Animal Sci. Dpt., State Univ. of Maringá (UEM), Maringá PR Brazil. mlrsouza@uem.br

Current experiment compared resistance of tanned rabbit and fish skins and their morphological structures by light and scanning electron microscopy. Skins of forty 70-day-old White New Zealand rabbits, weighing 1.980 g, were used together with the skins of sixty fish (Nile tilapia, *Oreochromis niloticus*) skins, weighing 500 g. Samples of skins from the dorsal region were collected and fixed in bouin, for 24 h. After routine histological processing with inclusion in paraffin, they were cut in 5 µm thickness and colored by Masson's trichrome stain (TM). Samples were analyzed under light microscopy. The best laminas were photomicrographed by photomicroscope AXIOSKOP-ZEISS. Samples were collected from rabbit skin's dorsal region for scanning by electron microscopy (SEM). Samples were fixed in buffered glutaraldehyde, 2.5% and post-fixed in osmium tetroxide 1%, for 2 hours. They were then washed in phosphate buffer, dehydrated in a graded series of ethanol and dried to critical point with CO₂. Specimens were metalized with gold-palladium ions and electron-micrographed with JEOL-JSM 5410. Skins were then frozen and tanned through a series of steps. According to Hoinacki (1989) and Souza (2004), the skins undergo soaking, fleshing, liming (3% of lime and sodium sulfide), alkaline products removal, purge, degrease, pickling, tanning (6% of chrome salts), neutralization, greasing, retanning (4% vegetable and synthetic tannin), dyeing, fixing and drying. Rabbit and fish skins had a mean thickness of 0.49 mm and 0.44 mm, respectively. There was a significant difference between rabbit and fish (Nile tilapia) skins with regard to traction, elongation and tearing force. Fish skins had a higher resistance rate than the rabbits' with regard to analyzed variables (traction -13.91 and 20.93 N/mm²; elongation 30.90 and 45.70%; progressive tearing 17.36 and 34.04 N/mm). The dermis of the skin consists of layers of differentiated collagen fibers. The rabbit's dermis lacks a dermal layer with a distribution, orientation and disposition pattern of the collagen fibers. However, fish dermis is made up of overlaid layers of collagen fibers placed horizontally and perpendicularly to the surface. This fact gives tightness to the fibers and therefore a greater resistance to the leather. Higher resistance of fish leather is thus confirmed. Tanning technique gave excellent results in resistance. Since the flower-like design in the rabbit's skin is highly delicate giving it a characteristic touch in softness and beauty, it may be used in all types of details in the finishing product without any damage to the quality of the leather. The two types of leather are excellent for their application in the manufacture of clothes.