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ABSTRACTS OF THE "GIORNATE DI CONIGLICOLTURA ASIC 2013"

Forlì, Italy 10-11th April, 2013.

On the 10 and 11 of April, in Forlì (Italy) it was held the 5th edition of the Italian Rabbit Days, product of the collaboration among ASIC (Italian Rabbit Scientific Association), ASPA (Animal Production Scientific Association) and the Forlì Fair. The 1st day included a round table focused on "Which future for italian rabbit faming?". During the 2nd day, there were presented 2 main lectures "Resources allocation in reproductive rabbit does: genetic strategies for a suitable performance", by Pascual J.J., Savietto D., Cervera C., Baselga M. and "Controlling the rabbit digestive ecosystem to improve digestive health and efficacy", by Combes S., Fortun-Lamothe L, Cauquil L., Gidenne T. which were previously presented at the last World Rabbit Congress. Moreover, 2 sessions of oral communications on Pathology and Zootechnics were held. Finally a Poster Session was through the 2 days. The meeting was attended by more than 80 participants, including researchers from France, Spain, and Hungary. A total of 2 main lectures, 10 oral communications and 6 posters were presented during the congress. Following are reported the abstracts of all contributions presented.

MAIN LECTURES

RESOURCE ALLOCATION IN REPRODUCTIVE RABBIT DOES: GENETIC STRATEGIES FOR A SUITABLE PERFORMANCE

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This article reviews how frequent feeding and selection programmes could be affecting resource allocation in reproductive rabbit does. The possible consequences of these changes and the central role of body condition for suitable female performance are analysed considering genetic level, health and welfare. Resources allocation between functions, and consequently body condition, must be genetically driven in reproductive rabbit does. The body condition of females changes during the reproductive cycle and throughout their reproductive life according to their genetically determined level. The problems appear when the animals are forced to diverge from this appropriate level, increasing susceptibility to disease, other stress factors and eventual failure. Negative energy balances detected during lactation do not seem to have the strength of those observed in late pregnancy. Genetic selection in rabbit for litter size at weaning has increased prolificacy, but also the ability to obtain resources without compromising the survival of rabbit females. However, it could have also increased the susceptibility of animals to the environment, focusing more on the maternal investment in the future litter rather than the current one under restricted conditions to maximise their selection success, "the number". Rabbit does selected for reproductive longevity have a greater soma, which enables them to better cope with the possible productive challenges. There is also evidence that they have greater plasticity in using their soma, making them more robust to overcome demanding situations. In addition, there seems to be evidence of a possible improvement of immune system modulation in robust animals.

CONTROLLING THE RABBIT DIGESTIVE ECOSYSTEM TO IMPROVE DIGESTIVE EFFICACY AND HEALTH

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The digestive ecosystem has several physiological roles: hydrolysis and fermentation of nutrients, immune system regulation, angiogenesis, gut development and acting as a barrier against pathogens. Understanding the digestive ecosystem and how to control its functional and specific diversity is a priority, since this could provide new strategies to improve the resistance of the young rabbit to

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digestive disorders and improve feed efficiency. This review first recalls some facts about the digestive microbiota composition in the main fermentation compartment, and its variability in rabbits with some new insights based on recent molecular approaches. The main functions of the digestive microbiota will then be explained. Finally some possible ways to control rabbit caecal microbiota will be described and a suitable timing for action will be defined.

REPRODUCTION AND GENETICS

EXPLORING THE RABBIT GENOME TO IDENTIFY SINGLE NUCLEOTIDE POLYMORPHISMS USEFUL FOR ASSOCIATION STUDIES

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High throughput genotyping platforms and next generation sequencing are changing the way in which animal genomes are investigated. In this study we applied a next generation sequencing technology (Ion Torrent PGM) to identify single nucleotide polymorphisms (SNPs) in the rabbit genome. Equimolar genomic DNA from different rabbit breeds was pooled and digested with 2 restriction fragments. Two reduced representation libraries were produced and sequenced on 2 different Ion Torrent 318 chips. A total of 6343257 reads were aligned to the rabbit genome (oryCun2.0), whereas 621483 reads resulted as "unmapped". Variant calling produced a total of 65630 SNPs with a mapping quality of at least 10Q and covered by at least 4 reads in the point of the detected variation. This study represent the first one that identified a large number of SNPs in the rabbit genome. In addition, the SNPs identified will be useful to design a commercial high throughput genotyping platform that could have an important impact in the study of variability and identification of markers associated with production traits in rabbit populations.

EFFECT OF LIGHT INTENSITY ON PERFORMANCE OF RABBIT DOES

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The aim of the study was to compare the reproductive performance of rabbit does housed in 2 different light intensities. The experiment was conducted at the experimental rabbit farm of the Kaposvár University. Rabbit does (n=108) were randomly housed in 2 identical rooms which only differed in the light intensity (HL group: 150-200 lux; LL group: 10-20 lux). In both rooms 16L:8D lighting schedule was applied. Rabbit does were first inseminated at 16.5 wk of age. Forty-two d reproductive rhythm and single batch system was applied. Productive data of the first 3 consecutive reproductive cycles were evaluated. The light intensity did not influence the kindling rate and the body weight of the does at kindling. The litter size of HL group was higher compared to LL rabbits (born total: 10.69 *vs.* 9.91, NS; born alive: 10.21 *vs.* 9.29, P=0.032; litter size at 21 d: 8.66 *vs.* 8.26, P=0.028, respectively). The litter- and individual weight at 21 d, and suckling mortality did not differ in the 2 light intensities. Calculating the productivity index, the number of kits born alive per 100 artificial insemination (AI) was higher in the HL than in the LL group (769 *vs.* 712 kits, respectively), but the 2 groups did not differ for the total weight of the 21 d kits per 100 AI (HL: 229 kg; LL: 223 kg).

EFFECT OF INTENSIVE AND SEMI-INTENSIVE RHYTHM ON REPRODUCTIVE PERFORMANCE OF RABBIT DOES

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A total of 34 Pannon rabbit does were housed in commercial rabbit cages (floor area 0.32 m^2) and inseminated 2 d after kindling (18 does; 33D group) or 11 d after kindling (16 does; 42D group). A single-batch system (all of the does in the group were inseminated on the same day) was used. Duration of the experiment was 193 d. During this period number of cycles were 5 and 4 in group 33D and 42D, respectively. There were not significant difference in kindling rates (33D: 75.6%, 42D: 85.2%), in litter size (33D: 9.02 and 8.69, 42D: 9.44 and 8.58, total and alive, respectively), suckling mortality (33D: 14.5%, 42D: 15.6%), and survival of does (33D: 71%, 42D: 81%) between the 2 groups. During the experiment, the percentages of does that kindled 0, 1, 2, 3, 4, and 5 times were 0, 0, 0, 8, 69, and 23% in does of 33D group; and 0, 0, 17, 58, and 25% in does of 42D group (in this group, does had maximum 4 kindlings). Significant differences were found in kindling rate of primiparous does (33D: 50.0%, 42D: 87.5%, P<0.05) and in mortality of

suckling kits of the 3rd and 4th litter (33D: 8.6 and 3.3%, 42D: 17.2 and 19.1%, respectively). During the entire experiment (193 d), the numbers of rabbits born alive per doe were 32.8 and 29.4 in groups 33D and 42D, respectively, so that the annual productivity of 33D does was 17% higher than that of the 42D does.

NUTRITION AND PHYSIOLOGY

EFFECT OF FEED RESTRICTION LEVEL AND PERIOD ON PERFORMANCE AND HEALTH OF GROWING RABBITS

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The present study aimed to evaluate the effect of the level (100, 90 and 80% of *ad libitum*) and period (2 and 3 wk) of post-weaning feed restriction on growth performance and health status of 246 growing rabbits controlled from weaning until commercial slaughter (33-75 d of age). Despite significant effects of restriction program during the restriction period itself and soon after, the differences in final live weights of non-restricted and restricted rabbits were not significant, whereas rabbits submitted to the strongest restriction (80%) still tended to be lighter compared to R90 rabbits (P=0.06). Therefore, daily weight gain from 33 to 75 d of age was lower in R80 compared to R90 rabbits (P=0.04); feed intake was lower in restricted *vs*. not restricted rabbits and in R80 *vs*. R90 rabbits. Feed conversion was lower (P=0.04) in restricted rabbits without differences between the 2 restriction levels (R90 *vs*. R80). The restriction program, level and period did not affect rabbit health in the entire trial.

EFFECT OF DIETARY SUPPLEMENTATION OF FRESH RED CHICORY (*CHICORIUM INTYBUS FOLIOSUM*) ON GASTRO-INTESTINAL TRACT AND CAECAL FERMENTATION OF RABBIT BEFORE WEANING

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The aim of the study was to evaluate the effect of the administration of red fresh chicory (*Chicorium intybus foliosum*) to kits before the weaning. Immediately after kindling 16 New Zealand White multiparous rabbit does were homogenised for litter size (n=8) and at 16 d, when the nest was opened, they were divided in 2 groups: control group, in which young rabbits fed control diet; chicory group, in which young rabbits were fed control diet and fresh chicory, separately. The chicory leaves were roughly cut and administrated on the top of the nest from 16 d of lactation until weaning (30 d), when 10 young rabbits/group were weighted and killed by cervical dislocation. The dietary administration of red fresh chicory to young rabbits before weaning increased the caecum weight (P<0.05) for a high water (94%) of leaves and improved biochemical traits of caecum content: the increased volatile fatty acids (P<0.05) content indicated a higher fermentation of gut microflora. In conclusion these results can imply that red chicory could be considered an additive rather than a feed.

PRELIMINARY STUDY ON THE EVALUATION OF THE NUTRITIONAL POTENTIAL OF MIXTURES OF HATCHERY BY-PRODUCTS AND CASSAVA PEEL MEAL IN CROSS-BRED GROWING RABBITS DIET

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This study was designed to evaluate the synergistic effects of combining hatchery waste/cassava peel meal (HWCPM) on the performance and relative organ weights of growing rabbits in an 9-wk feeding trial. Twenty eight crossbred growing rabbits of between 451.8 and 459.6 g initial body weight were used for the study. The hatchery wastes consisting of candled out egg and dead in embryo which were cooked for 1 h at 100°C and sun dried before mixing with sun dried cassava peels in ratio 3:2 (w/w). Four experimental diets were formulated. Diet 1 (control) was a maize-groundnut cake diet formulated to meet the nutrient requirements of growing rabbits; mixture of HW/CPM was included at 5, 10, and 15% for diets 2, 3 and 4 respectively. The rabbits were randomly divided into 4 groups of 7 rabbit each. Each rabbit serves as a replicate in a complete randomized design experiment. Rabbits fed control diet had lower final weight (1208 g) if compared with those fed 5% (1452 g), 10% (1596 g) and 15% (1350 g) inclusion levels of HWCPM. Feed intake increased linearly with increasing levels of HWCPM. The relative organ weights showed that the liver, heart, kidney and spleen were not affected (P>0.05) by dietary treatments. It was concluded that HWCPM can be added to growing rabbits' diets without any adverse effect on the performance of rabbits.

WELFARE, MANAGEMENT AND MEAT QUALITY

GROWTH DURING THE FIRST TEN MONTHS OF AGE IN CAGE-BRED WILD RABBITS

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The aim of this study was to evaluate growth of cage-bred wild rabbits of the *Oryctolagus cuniculus* algirus subspecies under game farming conditions. Eighteen wild rabbits born and reared in cages, fed with a commercial feed, were weighed from birth to 10 mo of age. No differences ($P>0.05$) were found between sexes in live weight during this period. A Gompertz equation fitted for growth was $Y=893.803\times[0.098 \exp (0.496 \exp (X/30))]$, where X: age (d), Y: live weight (g). Growth of cage-bred wild rabbits of the *Oryctolagus cuniculus* algirus differed to that described in the literature for rabbits in the wild, with captive rabbits reaching lower weight at maturity.

EFFECT OF FLOOR TYPE ON PRODUCTIVE, CARCASS AND MEAT QUALITY TRAITS OF GROWING RABBITS

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The aim of the experiment was to compare the production, carcass and meat quality traits of growing rabbits (maternal line) housed on different floor types. At the age of 35 d, the rabbits (n=126) were randomly sorted to 3 groups and were housed in pens with a basic area of 1.27 m^2. The floor type of the different pens was plastic mesh (PM), deep litter (DL) or wire mesh (WM). Body weight, feed intake, mortality, carcass and its parts, pH and colour of meat were measured. The 7 and 10 week-old PM and WM rabbits' body weight was significantly higher compared to the DL group. At the age of 11 wk significant differences were only found between the PM and DL groups. Twelve week-old rabbits showed no significant differences among the groups. No significant differences were found for mortality, feed consumption and feed conversion ratio Significant differences were recorded between the PM and DL groups for the average daily gain, dressing out percentage, b* value and ratio of the hind part related to the reference carcass. It could be concluded that housing the growing rabbits on wire or plastic mesh floors had no substantial differences, while housing rabbits on deep litter negatively affected certain traits, but the alterations were smaller compared to the results of the relevant literature.

PERFORMANCE OF GROWING RABBITS IN BICELLULAR CAGES AND COLLECTIVE PENS

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The study aimed at evaluating whether housing growing rabbits in pairs in bicellular cages (18 animals/m^2) or in group of 20 to 54 animals kept in small (1.40×1.20 m) or large pens (1.40×2.40 m) with wooden floor at low (12 animals/m^2) or high stocking density (16 animals/m^2) might influence growth performance and slaughter traits. The rabbits kept in bicellular cages showed higher final live weight (2839 *vs.* 2655 g; $P<0.01$), daily weight gain (+10%; $P<0.01$), and feed intake (+11%; $P<0.001$), without differences for feed conversion ratio, compared with the rabbits housed in collective pens. At slaughter, the former rabbits also displayed higher dressing percentage (60.5 *vs.* 59.6%), dissectible fat proportion (3.0 *vs.* 2.1% reference carcass) and hind leg muscle-to-bone ratio (7.53 *vs.* 6.63) ($P<0.001$) compared with the group-housed rabbits. Within the collective pens, the increase in the stocking density from 12 to 16 rabbits/m^2 increased only the slaughter dressing percentage (59.4 *vs.* 59.8%; $P=0.05$), whereas no significant effect of pen size was measured. In conclusion, rearing rabbits in collective pens impaired growth performance and slaughter results compared to rabbits kept in bicellular cages, regardless of stocking density or pen size.

SODIUM REDUCTION IN MARINATED RABBIT MEAT

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This study aimed to evaluate the effect of sodium chloride (NaCl) replacement up to 50% with potassium chloride (KCl) on marination performance and some quality traits of marinated rabbit meat. A total of 100 *L. lumborum* samples

were marinated in 2 separated replicates using solutions with different NaCl:KCl ratios (100:0, 80:20, 70:30, 60:40 and 50:50) to assess marination performance (uptake, purge loss, cook loss and total yield) and meat quality traits (pH, colour and shear force). Overall, only some minor changes were observed among different levels of sodium replacement. Purge loss was significantly higher in 40% KCl-marinated loins in respect to 20% KCl treatment. Moreover, pH and redness (a*) of cooked meat were higher in meat marinated with 40 and 50% KCl if compared with control group. These results demonstrated that it is possible to replace sodium chloride up to 50% with potassium chloride in marinated rabbit meat without impairing main technological properties (processing yields, appearance and texture).

PATHOLOGY

CONTRIBUTION TO EPIDEMIOLOGIC KNOWLEDGE ON RABBIT DERMATOMYCOSIS IN NORTHERN ITALY

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The study has examined the data coming from 40 rabbit farms in Northern Italy to determine the damaging health effects that dermatomycosis may cause to the rabbit farms hit by it, and estimate the zoonotic risks for those working in this field. The purpose of this study was to investigate the roles of *Trichopyton mentagrophytes* and of *Microsporum canis* as causative agents, to quantify the pathology in the farms hit by them, and to determine the concentration of dermatophyte spores in the air. During inspections, data on the farms and on the animals was collected to determine the potential risk factors. A single etiological agent, *T. mentagrophytes*, was isolated. Lesions were limited in 17.5% of the farms (<1% of rabbits affected), moderate in 37.5% (1-10% of rabbits affected), high in 30% (10-50% of rabbits affected) and very high in 15% of the farms (>50% of rabbits affected). The worst-hit by this infection were the fattening units. Farms showed a correlation between air spore concentration and the rate of clinical lesions (P=0.002). Spore concentration was nil in 7.5% of the farms, low in 27.5% (1-50 CFU/m^3), high in 42.5% (51-500 CFU/m^3), and very high in 22.5% (>500 CFU/m^3). As highlighted by the study, the severity of dermatomycosis is associated to the type of ventilation and to the farm's hygiene standards. As this study shows, the entity of this phenomenon in tandem with high counts of fungal spores in the air represent a zoonotic risk that compromises animal welfare, implying direct and indirect costs for the farms affected, and calling for more rigorous prophylactic measures.

MOLECULAR DIAGNOSIS OF MYXOMAVIRUS AND CHARACTERIZATION OF STRAINS DETECTED IN ITALY DURING 2010-2011

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Myxomatosis, a lethal systemic disease of European rabbits (*Oryctolagus cuniculus*), is caused by myxoma virus (MV). The entire genome of the MV has been sequenced, allowing a systemic survey of the functions of a large number of putative pathogenic factors. The data present in literature have shown that MV is characterized by a high degree of genetic stability. Aim of this study was to identify molecular markers, on MV genome, for characterizing the isolates circulating in Italy during epidemiological studies. As a first step a PCR-based assay was established to rapidly diagnose the presence of MV in biological samples isolated from naturally infected rabbits. Twelve isolates collected during 2010-2011 from different Italian regions (wide ranging geographic locations), were then partially sequenced. Based on the sequence analysis we found nucleotides substitutions, deletions and insertions randomly present on the MV genome. We identified at least 6 different strains circulating in Italy during that time. In particular, one strain was identified in 5 samples (Cluster 1), another one in 3 samples (Cluster 2) and the remaining strains in single samples. Since 3 point mutations common to Cluster 1 can be identified with PCR-RFLPs analysis, these markers could be easily used to perform epidemiologic studies. Interestingly, one strain from Sicily region (South Italy) has shown 100% nt identity with the Borghi vaccine strain, with a region of the genome suggesting a possible *in vivo* recombination between a circulating wild virus and a Borghi vaccine strain

EVALUATION OF BIOFILM FORMATION BY RABBIT *ESCHERICHIA COLI* BIOTYPES

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Evaluation of biofilm formation by rabbit *Escherichia coli* biotypes. Diarrhoea caused by enteropathogenic

Escherichia (E.) coli is considered one of the major problems for rabbit breeding. These strains cause a high mortality rate and substantial economical losses. Various are the typing methods applied to the isolates, both phenotypic and genotypic. In one commonly-used biotyping scheme, *E. coli* isolates are assigned to different biotypes, depending on the fermentation of 5 sugars. The most frequently identified biotypes in Italian farms are the rhamnose negative, B12 and B14, and the rhamnose positive B28 and B30. Furthermore, the rhamnose negative *E. coli* strains seem to be more virulent. In addition, not all the pathogenetic mechanisms of *E. coli* are known. Recently, different authors have pointed out the role of the biofilm formation as a virulent tract in *E. coli* strains. Various cell surface structures such as curli fimbriae, cellulose, flagellin have been implicated in biofilm formation in *E. coli*, conferring an increased resistance to environmental stresses. One hundred and twelve strains belonging to different biotypes (B12, B14, B30, B31, B23, B19), isolated from rabbits with enteritis were tested for their ability to form biofilm and components as curli and cellulose, contributing to its formation. The results showed that no strains have expressed the biofilm. Cellulose assay was positive in 29/112 (25.9%) strains. Curli fimbriae were not expressed in all the studied strains.

FULL DIAGNOSTIC APPROACH AIMED TO ERADICATE MYXOMATOSIS FROM AN INDUSTRIAL FARM

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An integrated approach was used in a rabbit commercial farm during a case of Myxomatosis. The collaborative activity of various actors, was finalised to eradicate the disease accomplishing those rational sanitary measures provided by the law but without stopping the production. Myxomatosis was definitively eradicated, thanks to repeated sampling of sera and naso-conjunctival swabs to detect respectively antibodies by cELISA and viral antigen by using PCR. This work emphasizes that, in association with early diagnosis performed with sensitive and specific methods, cooperation, application of strict hygienic and biosecurity measures and vaccination programs are essential to recover from Myxomatosis. Indeed, there is the urgent need to define new and updated standard measures applicable for an effective control of this disease, endemic in Italy since 1955.

A TWO-YEAR (2010-2011) SURVEY ON PRODUCTIVE PERFORMANCES AND MORTALITY RATES OF FARMED GAME HARES (*LEPUS EUROPEAUS*)

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The present survey measured the performance and the mortality rates of the biggest game hare farm in Veneto Region (318 hare pairs) during 2 yr (2010-2011). The performances were similar during the 2 yr: the yearly number of alive kits was 10.5 per reproductive present pairs and 11.4 per reproductive fertile pair; the fertile reproductive pairs kindled on average 4.9 times/yr, weaned 8.4 kits at 25 d, and produced 7.0 growing hares (60 d of age). Sterility, *i.e.* the proportion of hare does which never kindled averaged 8.5% of the total number of present does. The culling rate of hare does significantly decreased from 81.1% in 2010 to 69.2% in 2011. The mortality rates of kits varied from 22.9%, during lactation (3-25 d of age) to 9.7% during growth (26-60 d of age). Despite the total mortality of the born hares was not significantly different (on av. 38.7%), losses were significantly higher in newborn and lactating kits and lower in growing and sub-adult hares during 2010 compared to 2011.

A TWO-YEAR (2010-2011) SURVEY ON THE CAUSES OF MORTALITY IN FARMED GAME HARES (*LEPUS EUROPEAUS*)

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In this study, the biggest game hare farm in Veneto Region (Venice province) was monitored for 2 yr (2010-2011) in order to investigate on the causes of mortality. To this aim, all dead hares with a good condition score were necropsied. Data on mortality were recorded on the basis of the following categories: newborn kits, suckling kits, growing hares, sub-adult and reproducing hares. Total mortality of born hares was not significantly different

(on av. 38.7%) between the 2 yr. Mortality was highest in kits during lactation (on av. 22.9%), followed by hares during growth (on av. 9.7%). The major cause of mortality in younger hares was enteric diseases, whereas the older hares were affected mainly by respiratory diseases and traumas. In reproducing hares, respiratory diseases and ulcerative pododermatitis were the most frequently detected pathological conditions.