

Abstracts of the papers presented during the
**9TH SYMPOSIUM ON HOUSING AND DISEASES OF RABBITS,
FURBEARING ANIMALS AND FANCY PET ANIMALS.**

CELLE (Germany), 10-11 May 1995

Organized by the German Group of the WORLD RABBIT SCIENCE ASSOCIATION
in collaboration with the German Veterinary Medicine Association and the Institute of Small Animal Research
The abstracts are those produced by the Authors and pertaining to rabbit.

**Chronoendocrinology of reproduction
in the female rabbit (*Oryctolagus cuniculus*).**

HUDSON R.

*Institut für Medizinische Psychologie, Ludwig-Maximilians
Universität, Goethestr. 31, D 80336, MÜNCHEN, Germany*

The renowned reproductive capacity of the rabbit is based on the precise timing of a typical pattern of behavioural and physiological events. This not only makes it an ideal animal for the reproductive biologist but should also help in assessing the various forms of husbandry in relation to productivity.

Reproductive activity is strongly influenced by photoperiod and can be readily stimulated experimentally by long day and suppressed by all short day. These effects are most probably mediated by the pineal gland and the night-time secretion of its hormone, melatonin.

Maternal care in rabbit is limited to building a nest of grass and fur in a separate nursery burrow a few days before parturition, and to nursing the young for only 3-4 minutes once every 24 hours. To locate nipples in this time the pups depend on a pheromone on the mother's ventrum for the commencement of the characteristic nipple-search behaviour and suckling. This pheromone is also produced by non-breeding females depending on season and daylength. However, during pregnancy, pheromone emission always increases, reaching a maximum by parturition and then declining during late lactation or following early removal of the young. The effects of daylength and reproductive condition on pheromone emission can be readily simulated in ovariectomized does by the following sequence of hormone substitution: estradiol for long photoperiod and oestrus, followed by estradiol and progesterone for pregnancy, then estradiol and prolactin for lactation, and withdrawal of prolactin for weaning.

Does typically give birth during the daytime, i.e. in their resting period, and nurse regularly once each night. For the young to obtain sufficient milk it is important that they anticipate the doe's arrival by uncovering from the nest material and remaining in an aroused state. However, the doe's regular nursing pattern not only functions to ensure efficient feeding of the young, but also has a broader significance with regard to other reproductive events.

Rabbits have a strong *post partum* oestrus and so are frequently both pregnant and lactating. In non-pregnant mothers the nursing visit can be experimentally shifted to the

light phase without apparent negative consequences. However, does mated *postpartum* and allowed access to their litters only during the light phase demonstrate an unwillingness or even temporary refusal to nurse within a few days of mating. When nursing continues to be restricted to the light phase, does have severe difficulties giving birth even though the pups, when delivered by oxytocin injection appear well developed. As these effects of out-of-phase nursing can be simulated by administering oxytocin daily to non-lactating, pregnant does in the light phase, a temporal window protecting does from the effect of oxytocin surges associated with nursing must exist.

**Study on some reproductive traits
in normal hair and angora rabbit.**

EIBEN C., SUGAR L., SZENDRŐ Z., RADNAI I.,
BIRONÉ NÉMETH E., LANSZKI J.

*Pannon Agric. University, Faculty of Animal Science, H 7401
KAPOSVAR, P.O.B. 16 - Hungary*

Ovulation rate and embryonic development were investigated to compare the performance of normal hair (Pannon White meat type : N) and Angora (A) rabbits with different genotypes (buck x does : N x N, N x A, A x A and A x N ; n = 18, 15, 12 and 24). Multiparous does after half year production were slaughtered at the 12th day after artificial insemination. These traits were evaluated: rate of ovulated does and total embryo resorption, number of corpora lutea (NO), live embryos (NS), dead embryos at slaughter (ND), implantation sites (NI = NS + ND), implantation rate (IR = 100 x NI/NO), survival rate (SR = 100 x NS/NO), number of embryos dying before implantation (NSB = NO - NI) and number of embryos dying after implantation (NDA = NI - NS). Compared with the meat rabbits, a quarter of angora does did not ovulate (2.40 and 25.9%). Both normal hair and angora does had relatively high total embryo resorption (39.0 and 20.0%). The NO (11.0 and 7.49) and NS (8.05 and 3.52) were significantly greater in rabbits of N genotype. In the case of ND (1.61 and 2.10) and NDB (1.37 and 1.87) the differences were not statistically proven between does of N and A genotype. While the IR was 91.6, 79.0, 66.6 and 86.7% in the four genotypes, the SR was 87.5, 50.7, 70.3 and 78.9%, respectively. There was no significant effect of male genotype on the traits examined.

Synchronization of the oestrus in does by a PMSG stimulation : advantages and disadvantages.

MAERTENS L. *, LUZI F. **, GRILLI G. ***

* CLO-Ghent, Government Research Station for Small Stock Husbandry, MERELBEKE - Belgium

** Zootechnical Institute, Veterinary Faculty, University of MILAN - Italy

*** U.O.F.A.A., Animal Artificial Insemination Center, PAVIA - Italy

Although the rabbit is considered as a mammal with an extremely high reproductive capacity, the irregular alternation of estrous and anestrus periods is a disadvantage in view of regular synchronized reproduction rhythm. Especially with the increasing use of artificial insemination in rabbit breeding, large groups of females in the same reproductive and physiological stage are likely. However, the receptivity of the doe is largely dependent on the hormonal antagonism between prolactin and gonadotropin. In order to solve this problem, in recent years an increasing use of a pregnant mare serum gonadotropin (PMSG) treatment, 2-3 days before the insemination, has become widespread.

The authors reviewed the literature concerning the effects of a PMSG treatment in order to synchronize the oestrus. The following benefits were generally determined :

- especially in lactating non-receptive does, receptivity and fertility are significantly increased.
- an increase of the prolificacy ; total litter size : + 5 to 10%.
- positive results on does with reproductive problems.

However, a number of disadvantages were found :

- the lack of improvement in non-lactating or receptive does
- a decrease in fertility because of antigenic properties after repeated doses
- an increase of the mortality rate at birth, probably related to the dosage used
- an increase replacement level of does and loss of natural selection on fertility
- a changed distribution of litter size frequencies : large litter (>12 young) and small litter (<5 young) are more numerous.

Based on these observations, the authors advise to use this treatment in relation to the physiological status of the doe and at a low dosage (15-20 IU). They are further concerned about the animal welfare implications.

Using intensive conservative insulin therapy in veterinary practise.

II : Effects of diabetes mellitus on the reproduction performances in artificially inseminated rabbits.

FREIHERR VON BÖLCSHÁZY G. *, BERSÉNYI A. **

* Siechhofstrasse 17, D-35576 WETZLAR, Germany

** Institute for Small Animal Research, GÖDÖLLÖ, Pf 417, H-2101, Hungary

A total number of 20 New Zealand White (NZW) rabbits were used to study the effects of the intensively

treated diabetes mellitus (DM) on the reproduction performances of artificially inseminated (AI) rabbits. DM was caused by alloxan in i.v. application (Alloxan monohydrate, Sigma Chemical Co.). Conception rate (CR), pregnancy rate and litter size (LS) were recorded. Two groups were considered : group A received intensive insulin therapy (n = 10) and control group B (n = 10) showing no DM. Similar results were noticed with the two group's parameters studied (CR = 82% ; LS = 9). Pathological signs were not recorded for the litters in group B.

Effect of frequency of semen collection on semen quality in rabbits.

TACKE S., GÖTZE S., PINGEL H.

Institute of Animal Breeding and Husbandry with Veterinary Clinic, Martin-Luther-University, HALLE-WITTENBERG, Germany.

For the trial, 15 Zika bucks were used during 11 months. Bucks were divided into three groups. Semen from bucks was collected throughout the experimental period, twice a week for group 1, three times for group 2, and seven times a week for group 3. Ejaculate volume were measured. Morphologically abnormal sperms from each buck were examined once a month. The ejaculated volume ranged from 0.65 ml to 1.09 ml in group 3 and 1 respectively. The motility of sperm fluctuated from 67% in group 1 to 48% in group 3. The spermatocrit amounted to 7.4% in group 1, 6.2% in group 2 and 5.7% in group 3. The pH-value ranged from 7.28 (group 1) to 7.49 (group 3). The number of morphologically abnormal spermatozoa in all groups showed a great variation between months. On average group 3 exhibited the highest number of morphologically abnormal spermatozoa. It was found that the twice a week collection provided the best results.

Relationships between vulva colour, concentration of serum progesterone and reproductive performance in rabbits.

BERSÉNYI A.

Institute for Small Animal Research, GÖDÖLLÖ, POB 417, H-2101, Hungary

A total of 110 New Zealand White (NZW) does were artificially inseminated on different days after parturition in order to study the relationships between vulva colour, serum progesterone concentration and reproductive performance. Birth rate (BR) and litter size (LS) were recorded. According to the colour of vulva four experimental groups were prepared : pale, purple, pink and congested red. The lowest BR (22%) and the smallest LS (5/litter) were found in pale vulva colour group (P<0.01). A higher serum progesterone level was measured in the empty does compared to conceived females (0.23 ± 0.09 ng/ml; P<0.01). The mean BR did not show extremely high rates (64.84%). Statistically important differences (P<0.05) were observed in all

parameters studied between groups according to insemination interval.

**Determination of the spermatozoa count
the rabbit semen with spectrophotometer.**

BODNÁR K.

*University of Agriculture Debrecen, Faculty of Animal
Husbandry, H-6801 HÓDMEZŐVÁSÁRHELY, POB 79, Hungary*

Semen samples were obtained (once a week) from 14 New Zealand White males, 1 year old, for a total of 127 samples. The sperm concentration was evaluated by counting with a Buerker's chamber, and light absorbance was measured by a VSU2-P (Carl Zeiss, Jena, Germany) spectrophotometer at 550 nm wavelength. Samples contaminated by urine were eliminated, and the gelatinous components were removed carefully before the evaluation. The average concentration of spermatozoa was $422.1 \cdot 10^6$ /ml (standard deviation : $382.9 \cdot 10^6$), minimum was $11.25 \cdot 10^6$ /ml and the maximum was $1725 \cdot 10^6$ /ml. The light of absorbance was highly correlated with the spermatozoa count (corr. coeff : 0.86, $P < 0.0001$). A linear regression was found in the studied ranges of values, therefore the value of light absorbance can be used to estimate the sperm concentration with a simple interpolation.

**Results of selection for improvement
of meat rabbit performance traits.**

NIEDZWIADK S., ZAJAC J., BIELANSKI P., FIJAL J.

*National Research Institute of Animal Production, Department of
Fur Animal Husbandry, 132-083 BALICE, KRAKOW, Poland.*

The experiment involved New Zealand White rabbits. Each generation comprised 200 females, 50 males and the entire offspring obtained in the yearly cycle. The females were utilized for one year in each generation. The year of utilization was counted from the first mating to 365 days after the first mating. Young rabbits were weaned at 35 days. The females were covered two days after weaning the young.

The males and females for the F_1 progeny herd were selected according to the parameters of reproductive, fattening and slaughter performance included in the breeding records. Third litter offspring in each generation was tested, and the rabbits meeting the selection criteria were qualified for the selection herd.

The selection parameters for the specialized male line of meat rabbits were the following : body weight at 90 days, daily weight gains from weaning to 90 days, feed intake per 1kg gain, and in the maternal component, number of rabbits weaned per litter.

In the experiment to create specialized meat lines of NZW rabbits, a male line population was obtained in the

third generation ; its maternal component surpassed the original generation by 0.7 rabbits, had a higher body weight at weaning by 101g, and a higher body weight at the end of the fattening by 259g, with feed conversion of 3.71kg feed per 1kg body weight gain. The parental component (excluding reproductive performance) had higher values of 107, 300 and 3.58 respectively.

**The effect of inbreeding on fertility and growth
parameters of New Zealand White rabbits.**

BIENIEK J., KANIA J., JAGUSIAK W.

*Department of Genetics and Animal Breeding Academy of
Agriculture in KRAKOW, Poland.*

The purpose of this investigation was to observe the effect of relationship and inbreeding in a closed flock of New Zealand White rabbits and the interrelations of these indexes with reproductive qualities of does and with obtained final results.

The research was based on documentation of the Genetic Department and Animal Breeding Research Station of the Academy of Agriculture in Kraków.

The research included 2433 rabbits from 438 litters, from 9 year period. To evaluate relationship and inbreeding the data was calculated using SAS, d-Base, and our own Departmental Program.

Research results were the following :

- the litter size at birth has a significant effect on the majority of parameters characterizing reproductive ability of does such as : length of pregnancy, litter size in later growth stages, mortality rate, litter weight of individual rabbits, and daily weight gain.

- the degree of inbreeding has a negative influence on litter weight at birth ($b = -0.014$); however its positive effect on litter weight is observed at later growth stages (42 days : $b = 0.156$; 56 days : $b = 0.216$; 76 days : $b = 0.438$; 86 days : $b = 0.797$.)

Beginning from day 14 of growth there is a slight (but significant) positive effect of inbreeding on daily weight gain of litter.

Up to 65 days inbreeding did not have significant influence on litter size and mortality rate. Positive effect of inbreeding degree on litter size was observed, however, at the age of 70 and 84 days, and its negative correlation with rabbit mortality between the age of 56 and 84 days. During the period between 28 to 84 days of growth, the highest body gains were observed among rabbits in 2 inbred classes ($F_x > 0.0$ to 12.5%) slightly lower in case of rabbits with the highest degree of inbreeding ($F_x > 12.5\%$) and the lowest for non-inbred rabbits. Daily weight gains were distributed similarly.

Simultaneously, with successive litters, body weight of progeny, and also birth-to-weaning weight gains increased.

The performance of Pannon White, Danish White rabbits and their crosses.

SZENDRÓ Z.* , JENSEN J.F.** , JENSEN N.E.** ,
KENESSEY A.* , BIRO-NEMETH E.* , RADNAI I.*

* Pannon Agricultural University, H-7401, KAPOSVAR, POB 16, Hungary

** National Institute of Animal Science, DK-8830, pob 39, TJELE, Denmark.

Twenty Pannon White (H) and 19 Danish White (D) does were inseminated with bucks of the same and the other breed. Twenty-three HxH, 41 DxH, 22 HxD and 23 DxD crossings were studied. The conception rates were 87.0, 58.5, 72.7 and 52.2% respectively. The number of total young per litter averaged 8.30, 8.83, 7.56 and 6.92, litter size at 21 days of age 7.18, 7.43, 6.70 and 6.12, litter weight at 21 days 2175, 2499, 2136 and 2196g. The rabbit were weaned at 42 days of age. For 67 HxH, 124 DxH, 24 HxD and 32 DxD rabbits, body weight of the young averaged 1046, 1173, 1273 and 1189g at 42 days, and 1947, 2224, 2270 and 2344g at 70 days, and the daily weight gain between 6 and 10 weeks of age was 32.2, 37.7, 35.9 and 41.2g respectively. It was concluded that the Pannon White does gave the best production and Danish White young rabbits gave the best growth performance.

The effect of teat number on rearing effectiveness of does.

HILBIG S.* , PINGEL H.** , SCHNEIDER K.H.*

* Department of Animal Breeding, University of LEIPZIG, Germany

** Department of Animal Science, University of HALLE-WITTENBERG, Germany

The aim of the investigation was to find out interrelationships between the number of teats and the performance of reproduction in does as a new basis for the selection in rabbit breeding.

The investigations were conducted within the rabbit population of the Pannonian Agricultural University, Kaposvar (Hungary). In the experimental station of this University, the genotypes New Zealand White, White Pannonian and New Zealand x Californian have been selected over many years on meat performance. The study involved the data of 1584 litters from does with known teat numbers (8, 9 and 10). To minimize the influence of age, only the first 5 litters of each doe were considered. By synchronization of litter, the litter compensation could be realized. During the suckling period (42 days) the does had free access to their litter in the nest box. Statistical evaluation of the data was achieved by analysis of variance according to SAS. Differences between the treatments (groups) were tested for significance by applying the Newman-Keuls test.

Results : suckling rabbits are not fixed on any one teat. Because of this fact does are able to rear a larger number of offspring in comparison with the number of teats. But in this case the mortality risk within the litter during the rearing

period is higher. Despite this, the 10-teat-does showed a significantly higher rearing rate, especially within the largest litters. Litter sizes of more than 10 animals have a lower mortality when reared by does with 10 teats than by does with 9 or 8 teats. Average number of reared per litter is, in the group of 10-teat-does, 0.44 times greater than in the group of 8-teat-does and 2.49 times greater than in the group of 9-teat-does. Consequently, for the 10-teat-does it can be calculated that during a median useful life of does of 1.5 year and with insemination 3 weeks *post partum* there is an increase of the number of slaughter rabbits per doe in the order of 5-6 animals. The expenditure to count the teats is very low, because it is possible to couple this with the handling of first litter control, immediately after birth. In a large number of analysed aspects the group of 9-teat-does was defeated, not only by the group 10-teat-does but also by the group of 8-teat-does. Suckling mortality up to 42 days *post partum* shows nearly the same tendencies as up to 21 days. That's why the survival rate during the rearing period depends primarily on the level of early mortality. The litter weight at 21 days p.p. was not significantly affected by the number of teats. Against it the average "weight of individuals" at this age was, in the group of 10-teat-does significantly lower, because of the significantly larger number of animals which was reared by these does.

Conclusion : the exploitation of the significant interactions between teat number of does and number of remaining young rabbits in regard to mortality and litter size up to 21 days p.p. presents a new possibility to improve rearing effectiveness in rabbits by selection. Therefore teat number can be seen as an important selection criterion in rabbit breeding.

Effects of crossbreeding on some reproductive traits of rabbits.

NOFAL R.Y., TOTH S., VIRAG GY.

Institute for Small Animal Research, GÖDÖLLÖ, POB 417, H-2101, Hungary

Some reproductive traits of does of New Zealand White (NZW) and Californian (CA) breeds of rabbits were compared with that of the two reciprocal crosses, NZW x CA and CA x NZW (buck:doe). Estimates of heterosis percent in conception rate, gestation period, litter size at birth, litter size born alive, litter size at 6 weeks of age and preweaning mortality were 6.56, 1.12, 24.35, 39.31, 32.47, -11.87 respectively. Highly significant differences among genetic groups ($P \leq 0.01$) in all traits were found except gestation period. Both types of crossbred doe showed a better reproductive performance than the purebred breeds in litter size at birth, litter size born alive, litter size at weaning and viability at weaning.

It could be concluded that crossing of CA x NZW has an advantage in improving litter size and born alive at birth and viability of young until weaning. From this type of crossing the Hungarian rabbit keepers may have about 46% more progeny at weaning and may expect lower preweaning mortality (about 18%) compared to the best purebred NZW.

Energy and nutrient requirements of does and their young.

MAERTENS L.

CLO-Ghent, Government Research Station for Small Stock Husbandry, MERELBEKE, Belgium.

The energy requirements of highly productive does are calculated at various phases of the reproduction cycle, using the factorial method. Total daily requirement, when the does are simultaneously pregnant and lactating, is about 5.0 MJ ME at top lactation. Expressed in terms of feed intake, this means a daily intake of 500g of a concentrated diet, (10 MJ ME/kg). This quantity is not attainable especially for primiparous does. As a consequence does lose weight and mobilise body tissue. An increase of the dietary energy content reduces only partly the energy deficit because it has been shown that specifically the use of dietary lipids increases milk production. A selection towards a large intake capacity is suggested as a way to reduce the energy deficit.

Although protein demand is high during lactation, the protein status of does is adequate when providing a dietary ratio of 12.5g dig. protein/MJ ME. Does require a higher dietary lysine level (0.9%) than fatteners. Low phosphorus levels (0.5%) may be used without deterioration of performance in order to reduce the output into the environment.

Young rabbits have an immature pancreatic enzyme system. High starch-containing diets provoke a starch overload in the caecum and promote enterotoxemia in the young rabbit. Based on these observations, it is necessary to put a starch constraint (<13.5%) in feed formulation for rabbits between 3 and 6 weeks of age. Many experiments have shown the favourable effect on mortality of a high content of cell-wall constituents in the early weaning stage. Recently the importance of the dietary ADL level has been demonstrated.

Because of the different requirements of does and young, a problem occurs when the young start to take in solid feed. Separate feeding or a change to a "weaning" diet at 21 days *post partum* is suggested. When does are submitted to a 42 day reproduction cycle, consequences on the condition of the doe seem to be negligible.

Effect of soybean and rapeseed oil in rabbit diet on reproduction traits of does.

CHRIST B. *, LANGE K. **, JEROCH H. *

* Institut für Tierernährung und Vorratshaltung der Martin-Luther-Universität Halle-Wittenberg, Emil-Abderhaldenstr. 25b, 06108 HALLE/SALLE, Germany.

** Hessische Landesanstalt für Tierzucht Neu-Ulrichstein, 35315 HOMBERG/OHM, Germany.

Nearly 90% of rabbit fetal growth takes place during the last week of pregnancy. However, the increasing fetal mass limits the feed intake capacity of the doe, especially during the last third of pregnancy. That's why the doe can't eat more

feed to compensate the increasing demand of energy if she is carrying many kits. On that account the doe has to mobilize her own energy reserve.

By means of addition of fats it is possible to raise the energy content of the diet and moreover the digestibility and the palatability of the feed and also the absorption of fatty soluble vitamins.

This study examined to what extent dietary oils influence fertility and rearing ability of does.

Fourty eight hybrid does were divided into four feeding groups. The control group got pelleted feed for rabbits without addition of oil. The other three groups got feed with different oils (4.5% soybean oil, 4.5 and 9.0% rapeseed oil). During 7 insemination periods, by artificial insemination in a 33-day-rhythm, the results of reproduction and the rearing ability were recorded.

Results : no does died during the feeding time. With the addition of dietary oil the feed intake decreased. The conception rate increased by addition of fat, with the exception of the group with added 4.5% rapeseed oil. The number of newborn rabbits was higher in the dietary oil groups. On that account the feed conversion efficiency regarding reared young rabbits was improved.

Considering all these results it can be said that soybean or rapeseed oils can be used in doe's nutrition.

Comparison of reproduction performance of does fed restrictive and *ad libitum* during the rearing period.

HARTMANN J., PETERSEN J.

Institut für Tierzuchtwissenschaft, Abt. Kleintierzucht und -haltung, Endenicher Allee 15, 53115 BONN, Germany

The present study was designed to evaluate the effects on reproductive performance of either a restrictive or an *ad libitum* feeding during the rearing period of does.

The data were recorded on 360 ZIKA hybrid does, which were randomly assigned to the two feeding regimens. The feed restriction was limited to 80% of the feed intake under *ad libitum* conditions.

The first insemination in the *ad libitum* group took place at the age of 94, 108 and 122 days. The restricted fed does were inseminated at the 108th, 122nd and 136th day. In order to obtain standard conditions the litter size was equalized. Does, which littered the first time, had to rear 8 and in the following litters 9 young.

In most of the presented results, does were taken into consideration which conceived after the first, the second and the third insemination. From the second litter on it was observed that the restrictive feeding had a positive influence on the reproductive performance. Considering only the second litter, a superiority of the restricted group was expressed by a higher litter size of 1.4 rabbits. Comparing both feeding groups in order to compare the body weights at the first three inseminations, it was remarkable, that the does of the restricted group were heavier. Moreover, it was observed that the body weight had increased.

Nutrient economic, energetic and ecological aspects of rabbit meat production.

SEMISH J.* , LANGE K.** , FLACHOWSKI G.*

* *Institut für Ernährung und Umwelt der Friedrich-Schiller-Universität, JENA, Germany.*

** *Hessische Landesanstalt für Tierzucht Neu-Ulrichstein, 35315 HOMBERG/OHM, Germany.*

Besides relevant aspects of animal welfare, ecological criteria of animal food production are discussed more and more critically. Closely connected to that are questions concerning nutrient economy and amount of energy necessary for feed production and animal housing.

Based on data of several fattening trials with allmash feed at the Hessian Institut of animal production, Neu-Ulrichstein, the rabbit meat production was compared to other farm animal meat production with regard to the above mentioned aspects. The following parameters were investigated : the nutrient economic parameters of necessary levels of gross energy and crude protein in feed and the excreted amount of phosphate and nitrogen as possibly being harmful to the environment.

Furthermore the amount of technical foreign energy needed for production was determined. The present investigation contained only the fattening period of young rabbits without taking into account the portion for their parents.

Nutrient economy : Concerning expense of feed gross energy per kg eatable meat protein the rabbit ranges between pig and cattle, depending on fattening method and feed used it shows more similarity to the one or the other. The amount of crude protein in feed per kg eatable meat protein is comparably high, similar to that of beef production.

The rabbit needs 2 to 3 times more feed energy and feed protein per kg eatable protein than the broiler. On the other hand, concerning the kind of feed ingredients being used, the broiler is a bigger food competitor of the human being than the rabbit.

Ecology and environmental pollution : Nitrogen and phosphate which are excreted by meat animals can become environmental pollution depending on regional circumstances.

The amount of excreted nitrogen and phosphate in fattening rabbits is high, relative to the amount of produced protein. Especially the amount of excreted phosphate is higher than in cattle, pig and chicken.

Quantity of foreign energy : the quantity of technical foreign energy per kg of produced eatable protein is the same for rabbit and pig. This is caused by the similarity of housing conditions and feed combinations. Anyway, there are still possibilities of energy reduction for the feed combination and the technology of feed production.

The result of the present investigation can be summarized as follows : the rabbit as a fattening animal does

not show any special advantages nor disadvantages compared to other meat producing animals concerning nutrient economy, energy and ecology.

The effect of extrusion in diets with different starch levels on the performance and digestibility in young rabbits.

MAERTENS L.* , LUZI F.**

* *CLO-Ghent, Government Research Station for Small Stock Husbandry, MERELBEKE, Belgium.*

** *Zootechnical Institute, Veterinay Faculty, University of MILAN, Italy.*

Before 5-6 weeks of age, the amylase activity of rabbits is limited. Literature data have shown an important ileal starch flow especially in maize based diets. A caecal overload in rapidly fermentable carbohydrates has been suggested as a cause of enteritis in young rabbits. Extrusion, which destroys the physical structure of starch could improve its digestibility and overcome digestive disorders.

Two isoenergetic diets with different starch content : 120 (N diet) and 216g/kg DM (H diet) respectively, were either extruded or pelleted. They were administered to 4 x 16 litters, with 7-9 young rabbits, before weaning (28 days of age) and also during the early fattening period (0-3 weeks post weaning). After weaning, the young rabbits received the same diets, but each litter was separated and one half of the litter received the extruded form while the other half was fed the pellets. The digestibility of both diets, pelleted and extruded as well, was determined at 4-5 weeks and 7-8 weeks of age.

Before weaning, feed intake of does and kits was not significantly influenced by the thermo-physical treatment or the dietary composition. Weaning weight was 620g and 625g for extruded and pelleted diets, respectively.

After weaning, although overall mortality was limited to 3.5%, a significant higher ($P<0.05$) mortality rate was observed with the H diet. However, the extrusion did not reduce the mortality rate of the high starch containing diet. The extrusion reduced significantly ($P<0.01$) daily weight gain and feed intake. This effect was most pronounced in the first week after weaning in the group which changed from a pelleted diet before weaning to an extruded diet after weaning.

Starch digestibility differed markedly ($P<0.01$) between both diets : 92.3 and 98.0% for diet H and N respectively. However, the extrusion did not improve the faecal starch digestibility. At 8 weeks of age starch digestibility tended to be higher in H diet. This was in contrast with the digestibilities of the other nutrients, which decreased significantly ($P<0.01$) compared to the digestibilities in 4 week-old rabbits.

In conclusion, the application of extrusion did not reach the intended objectives.

Influence of soya oil added to feed on pH values in gastrointestinal tract of growing rabbits.

KERMAUNER A., STRUKLEC M.

University of Ljubljana, Biotechnical Faculty, Zootechnical Department, Institute of Nutrition, DOMZALE, Slovenia.

Weaned New Zealand White rabbits were used to study the influence of added soya oil on growth, carcass weight, dressing percentage and pH values in gastrointestinal (GI) tract of rabbits. Trial feed (TF) contained 4% soya oil replacing dried sugar beet pulp in the control. The content of digestible energy (DE) was higher in TF than in control feed (CONT), (TF : 10.35 Mj DE/kg, CONT : 9.03 Mj DE/kg), crude protein (CP) and crude fibre (CF) contents were lower in TF (CP : TF 144g/kg ; CONT 147g/kg. CF : TF 141g/kg ; CONT 147g/kg). The contents of minerals and vitamins did not differ.

After two weeks of trial TF group had decreased live weight of rabbits ($P \leq 0.05$) (TF : 1335g, CONT 1463g), but the growth curve in the TF group was optimal. Carcass weight and dressing percentage were influenced by oil addition only in 37 day-old rabbits, where the TF group had worse results (carcass weight : TF 467g, CONT 520g, $P \leq 0.05$; dressing percentage : TF 54.62%, CONT 57.37%, $P \leq 0.10$). pH values were measured in stomach, duodenum, small intestine, caecum, large intestine and in appendix of caecum. Added soya oil influenced pH values only in 43 day-old rabbits ; at the age of 50 days these differences were no longer significant. Oil addition decreased ($P \leq 0.05$) pH in stomach (TF 1.20 ; CONT 1.69) and increased pH caecum (TF 6.08, CONT 5.78). Sex of trial animals influenced some parameters : carcass weight, dressing percentage and pH value in stomach. At the age of 37 days, female animals had lower carcass weight (♀ 480g, ♂ 507g, $P \leq 0.05$) and after one week trial (43 days) they had higher carcass weight (♀ 648g, ♂ 525g, $P \leq 0.05$). Dressing percentage was better in female animals at 43 days of age as well (♀ 59.29%, ♂ 55.26%, $P \leq 0.10$). Forty-three day-old female animals had a lower pH value in stomach (♀ 1.16, ♂ 1.73, $P \leq 0.05$).

The methionine + cystine level in diets for adult and growing meat rabbits.

JENSEN N.E.

National Institute of Animal Science, DK-8830, P.O.B. 39, TJELE, Denmark.

The compound pellets for meat rabbits in Research Centre Foulum include 9.4 MJ ME per kg pellets, 17% crude protein and 0.6% Methionine + Cystine. The content of M + C was increased by supplementing 0.2 and 0.4% Di-methionine, so that the three mixtures contained 0.6, 0.8 and 1% M + C or 3.4, 4.1 and 5.1g M + C per 16g N.

The fastest growth was obtained in groups with females fed pellets containing 0.8% M + C from a week before mating and until weaning of the litter, and with young rabbits receiving the same pellets from weaning to slaughter. If the does were fed pellets with 0.6% M + C, the growth

rate did not increase if the young received pellets with 0.8 M + C.

The growth rate decreased if the does as well as the young were fed pellets with 1.0% M + C. If the does were fed these pellets and the young received the 0.6% pellets, the growth rate was at the same level as when mothers and growing rabbits were fed the 0.6% mixture.

The young's average daily feed intake was reduced 5.4% when they were fed the 1.0% pellets instead of the two other levels.

Observations of behaviour of does and young reared on slatted floors with different gaps.

SCHLENDER-BÖBBIS I., PETERSEN J.

Institut für Tierzuchtwissenschaft, Abt. Klieintierzucht und -haltung, Endenicher Allee 15, 53115 BONN, Germany

In the rabbit production of today the animals were often kept in cages with wire grid floors. This means that especially does are often affected with ulcerative pododermatitis, the so called "sore hocks".

The aim of this work is to develop a slatted plastic floor, which satisfies the needs of the animals as well as the demands of the breeders. Therefore observations of behaviour took place on slatted floors with different gaps, does as well as young were observed. First results of the doe observations showed that neither the age of the animals nor the time of the day had an effect upon the behaviour. Even gravidity or raising of the young did not influence behaviour. Significant influences on the doe's behaviour were seen by the cage's position in the stable and by the width of the gap. It could be seen that the young showed safe movements with highest frequency on those floors with the narrowest gaps.

Determination of effective size of population in closed herd of rabbits.

JAGUSIAK W., BIENIEK J., STALINSKI Z.

Department of Genetics and Animal Breeding, Academy of Agriculture, KRAKOW, Poland.

Three breeds of rabbits were investigated (New Zealand White : NZW ; Popielno White : POP ; Black Tan : BT) grouped in three different closed herds in the Department of Genetics and Animal Breeding, Experimental Station, Kraków.

Observations on NZW, POP and BT breeds were conducted at the age of 5, 6, 9 and years. Average numbers of bucks and does for particular herds and analyzed periods of time were calculated and are shown below :

NZW : ♂ = 14.22 (σ = 1.79)	♀ = 51.89 (σ = 8.59)
POP : ♂ = 8.86 (σ = 3.44)	♀ = 16.86 (σ = 6.84)
BT : ♂ = 13.00 (σ = 5.57)	♀ = 27.60 (σ = 11.41)

In closed herds there is a higher risk of excessive inbreeding, and significant decrease of effective size of population.

The objective of this research was to evaluate the effective size of populations in following years of use and to

determine to what extent this size differs from the actual number and what is the relationship between effective size, actual number and degree of inbreeding.

Calculations were performed according to Hill's method (1972) using the following formula :

$$\frac{1}{N_e} = \frac{1}{16M} \left[2 + \sigma_{mm}^2 + \frac{2M}{F} \text{cov}(mm, mf) + \left(\frac{M}{F} \right)^2 \sigma_{mf}^2 \right] + \frac{1}{16F} \left[2 + \left(\frac{F}{M} \right)^2 \sigma_{fm}^2 + \frac{2F}{M} \text{cov}(fm, ff) + \sigma_{ff}^2 \right]$$

N_e :	effective size of population
M :	number of males
F :	number of females
σ_{mm}^2 :	from males parents, the variance in the number of male progeny
σ_{mf}^2 :	from male parent, the variance in the number of female progeny
$\text{cov}(mm, mf)$:	from male parents, the covariance of numbers of male and female progeny
σ_{fm}^2 :	from female parents, the variance in the number of male progeny
σ_{ff}^2 :	from female parent, the variance in the number of female progeny
$\text{cov}(fm, ff)$:	from female parents, the covariance of numbers of male and female progeny

Reproduction ability and housing systems in breeding of the brown hare (*Lepus europaeus*) in captivity.

PETERSEN A.

National Institute of Animal Science, DK-8830, P.O.B. 39, TJELE, Denmark.

Four years of investigation of reproduction of the brown hare (*Lepus europaeus*) kept in captivity showed that reproduction started earlier and ended later year by year. In 1990, the breeding season lasted 267 days which is 40 days more than in 1988, prolonging the season by the length of a gestation period. This resulted in an increase of the average number of litters per female per year from 3.4 to 5.0.

The average number of leverets per female was also increased from 9.0 to 12.0. The female hares were in average between 255 and 299 days old at the first conception, while the youngest were only 130 days old.

During the years, 10 makes of cage were tested. The main purpose of the test was to study constructional advantages and disadvantages of the cages in the breeding of hares.

With added modifications according to the test results, it was concluded that all makes -except one- could be characterized as suitable for hare breeding.

Standardization of carcass quality : a condition for a rabbit production in line with market conditions.

SCHLOLHAUT W.

Neu-Ulrichstein, 85918 HOMBERG (Ohm)

Contrary to the situation with other farm animals, no quality grading of rabbit carcasses exists. At sampling, the existing differences in nutritive and sensory parameters of rabbit carcasses, depending of age and feeding intensity, are demonstrated.

In view of the large variation of production intensity, especially in export countries, these differences will confuse the consumers.

Furthermore it handicaps the market potential of rabbit. Therefore the necessity of a grading system for rabbit carcasses is stressed.

Quality of carcass and meat depending on genotype of rabbits.

BIENIEK J., PTAK E., KANIA J.

Department of Genetics and Animal Breeding, Academy of Agriculture, KRAKOW, Poland.

Objectives of investigations were as follows :

- determine the effect of crossbreeding of rabbits raised in half-intensive conditions to be used for meat and to possibly determine the presence of heterosis.
- evaluation of the effect of some environmental conditions effecting meat quality of rabbits in a systematic way.

The experiment was performed using two breeds of rabbits: New Zealand White (NZW) and Black Tan (BT). Three series of different age groups of rabbits were investigated. To determine the effect of crossbreeding between races the following methods of mating were applied:

- purebreds (as control) : reciprocal crossbreeding of purebreds (F1)
- recurrent crossbreeding (R1) considering sexes (purebred males, females ; crossbreds F1 males and females)

Twelve genetic groups were obtained among the 10 experimental crossbreds with different proportions of genes of NZW and BT breeds. From factors other than genetic, the effect of sex, age at weaning, and litter size were evaluated.

The experiment comprised 327 animals from 171 litters.

In respect to meat quality, significant differences were noted between bucks and does in the percentage of protein, fat, water and also in meat colour.

In respect to carcass quality, weight of carcass, weight of meat and bones in the carcass and their percentage, significant differences between sexes were observed in not all experimental series.

Comparison of 10 groups of crossbreds with different shares of genotypes of NZW and BT breeds shows that the

best results are obtained in combinations in which there is high share of genes of NZW breed (mating of F1 does with NZW bucks or does of NZW with F1 bucks). Higher quality of meat was observed in F1 crossbreds than in R1 expressed by higher protein content in meat, slight differences in fat content, lower water absorption ability and thermal leakage.

Maturing time and maturing conditions of rabbit meat.

JENSEN J.A.

National Institute of Animal Science, DK-8830, pob 39, TJELE, Denmark.

The purpose of this investigation was to examine whether the ripening period and the packing method had any influence on the consistency of rabbit meat.

110 rabbits of the breed Danish White, weighing 2.6-2.9kg at a slaughter age between 80 and 100 days, were used.

Two ripening methods were used: 1 - Unpacked carcass, 2 - Cut up and vacuum packed carcass.

Meat from both methods was kept at 5°C in a cold store. Ten samples from each method were taken every day for 5 days.

Furthermore it was examined whether the length of the carcass could be increased to improve the consistency of the meat. The carcass was hung for 12 hours by the hind legs and 12 hours by the forelegs at 5°C in a cold store. The length was increased by 0.6% compared to method 1 with hanging of the carcass for 24 hours in the hind legs. The method had no influence on the consistency.

The vacuum packing had no influence on the consistency of the meat, but did however prevent a considerable cooling loss : Unpacked 2.6% loss/day ; vacuum pack 0.8% loss/day.

The age of the rabbits at slaughtering had an important influence on the tenderness of the meat. Rabbits older than 90 days had significantly tougher meat than rabbits younger than 90 days at slaughtering. <90 days = 20.8 Nm, >90 days = 22.6 Nm.

Estimation of dressing percentage of young rabbits by computer tomography in different live weight categories.

ROMVARI R., MILISITS G., SZENDRŐ Z.

Pannon Agricultural University, Faculty of Animal Science, KAPOSVAR, Hungary

In our previous works we have found close connections between computer tomography (CT) parameters and the dressing percentage, where we have measured the rabbits at the same live weight (2800 ± 50g). In this experiment we have scanned 165 Pannon White rabbits at live weight interval of 2400-3200g by CT. The pictures were taken between the 2nd and 3rd and 4th and 5th lumbar vertebrae. The average surface of musculus *longissimus dorsi* (L value) was measured. Six groups were formed on the basis of body weight. After the scanning procedure the animals were slaughtered by the international method of BLASCO *et al.* (1990).

Results : we have found a high correlation ($r = 0.7$) between "L-value" and dressing percentage and also between the "L value" and the weight of meat in the intermediate part. We have determined the average surface of musculus *longissimus dorsi* in all groups and we have described the changes of the middle part as a proportion of the live weight, in connection with the "L value".

The carcass, the middle part and the weight of meat of the intermediate part increased by 34-39% within the examined live weight interval. For the dressing percentage and the middle part weight relative to the live weight or carcass weight, the best slaughter weight is within 2700-2800g. It was found that the carcass traits can be predicted well on the basis of the "L value". Now the scanning method is an important part of the selection method of Pannon White rabbits and results in improvement of carcass traits (slaughter value).

In vivo measurements of body composition of dwarf and normal rabbit.

FEKETE S., KÓSA E., ANDRÁSOF SZKY, HULLÁR I.

Department of Animal Nutrition, University of Veterinary Science, POB 2, H-1400 BUDAPEST, Hungary.

Thirteen 6-9 days and fifteen 12-17 days-old suckling dwarf (DW) and 4 adult (11 month) and 4 weaned (40-days-old) New Zealand White (NZW) rabbits were measured *in vivo*, using a rodent and infant TOBEC machine. Direct chemical analysis was used for the validation. The fat content of the suckling dwarf rabbits increases parallel to the age. The type of feeding altered the body composition of the NZW rabbits, both growing and in adult group. The creation of specific predictive equations according to the weight classes improves the precision of the total body electrical conductivity of the dwarf, but not for the growing and adult NZW rabbits.

Staphylococcosis in rabbits and fur animals.

MATTHES S.

Institut für Kleintierforschung, Dörnbergstrasse 25-27, D-29223 CELLE, Germany.

Staphylococcosis is a commonly occurring disease in domestic rabbits and fur animals. The disease is characterized by fatal septicemia or suppurative inflammation in nearly any organ or site. *Staphylococcus aureus* were most frequently isolated from affected rabbits while *Staph. intermedius* and *Staph. lentus* were found in fur animals, particularly in minks.

An overview of clinical signs and control measures is presented. The symptomatology of *Staphylococcus (Staph. aureus)* in rabbits may be described as follows :

Pathology : main clinical signs

-Septicemia : apathy, anorexia ; 1-2 days duration of illness ; high mortality (predominantly in young rabbits).

- Pustular dermatitis : pustular formation in hair follicles (solitary or confluent) ; pruritus, restlessness, nibbling at the affected skin.
- Purulent lymphadenitis : swelling and suppurative inflammation of the lymph nodes (neck, head, breast, body, hind leg) ; sometimes fistular formation, occasional abscess formation in the subcutis.
- Purulent conjunctivitis-blepharitis : redness and swelling of eyelid and conjunctiva ; purulent conjunctiva secretion ; sometimes pustular formation.

Isolated organ infection

- Mastitis :
 - acute form, gangrenous mastitis ("blue breast") : painful swelling of the mammary glands ; serosanguineous secretion ; apathy ; high mortality.
 - chronic form : abscess type mastitis : nodular swelling in single gland segments ; purulent secretion.
- Purulent endometritis : mucopurulent vaginal discharge ; early embryo death.
- Purulent arthritis : thickening of joints (knee, hip etc...); formation of pus in the joint cavity ; limitation of movement.
- Purulent rhinitis/sinusitis : sneezing ; mucopurulent nasal discharge.
- Parodontitis/purulent otitis : disturbing of feed intake, salivation; swelling of the jawbone, sometimes fistular formation ; occasional fracture of the jaw after bone tissue cavitation.
- Otitis media : head shaking, incoordination.

Staphylococcus aureus infections in rabbits and the transmission of the pathogens with the sperma.

ROSSI G. *, STANZEL C. **, WITTE W. ***

* Institut für Molekularbiologie und Biochemie, FU, BERLIN

** Institut für Mikrobiologie, FB Veterinärmedizin, FU, BERLIN

*** Robert Koch-Institut WERNIGERODE

During the year 1994 a rapid propagation of *Staphylococcus aureus* infections in rabbit farms in a central region of Germany was noted. Since it appeared as a disease of mother and new born rabbits it caused enormous economic losses. Clinical and pathological findings were predominated by vascular lesions. The heavy outbreak of the disease in a colony of females from a *Staphylococcus*-free farm after their fecundation with sperma from an infected colony induced us to regularly examine sperma probes. *S. aureus* was isolated from the sperma of some of the males, even more than once. We collected *S. aureus* isolates from several farms, including farms in other regions of Germany for the typing and characterization of their cytotoxins. All the *S. aureus* isolates reacted with phage 3C and showed identical lysis patterns (3c, 55, 71). This corresponds to the fragment pattern of human *S. aureus* strains which react with phage 3C. They differ from the human strains by production of hemolysin B, a sphingomyelinase with

cytotoxic effects. Apparently, the clonal expansion of an *S. aureus* strain adapted on rabbits took place. It seems that the strain was brought into the different regions at different times, at least this is indicated by the history of diseases of the single farm as well as by the different antibiotic resistance.

Pododermatitis in the rabbit

DRESHER B., SCHLENDER-BÖBBIS I.

Universität Hohenheim Institut 460, 70593 STUTTGART, Germany.

In conventional rabbit husbandry - single cage rabbits on wired floor - male breeding ZIKA rabbits have been investigated clinically as well as after slaughtering pathologic-anatomically and pathologic-histologically especially regarding their paws.

Under clinical conditions age, body weight, number of inseminations and litters as well as the continuity of bearing have been documented. In regard to the paws, attention was paid to yellowish paws, alopecia, claw and skin lesions with respect to the exact location.

As there exists no detailed investigations about the pathogenesis of pododermatitis in the rabbit, we classified the pathologic-anatomical findings. All in all we considered the following stages :

Stage 0 : without findings

Stage 1 : pododermatitis hyperaemica acuta

Stage 2 : pododermatitis fibrosa chronica = callosities

Stage 3 : pododermatitis hyperkeratotica crustosa

Stage 4 : pododermatitis hyperkeratotica et exsudativa

Stage 5 : pododermatitis hyperkeratotica et haemorrhagica

Stage 6 : pododermatitis hyperkeratotica et ulcerosa

By means of the pathologic-histological investigations the extent of the alterations have been studied, especially in regard to the deepness of the histological findings as well as the tissues involved : skin, subcutis, muscle and tendon.

Dysautonomia in rabbits

VAN DER HAGE M., DORRESTEIN G.M.

Department of Veterinary Pathology, Section of Laboratory and Special Animals, Utrecht University, YALELAAN 1, 3584 CL UTRECHT, The Netherlands.

In rabbits a disease has been noted that is characterised by caecal impaction, dilatation of the bladder, aspiration pneumonia and high mortality. No etiologic agent can be isolated. Histological changes can be present in the neurons of parasympathic and sympathetic ganglia and also in the central nervous system. The lesions are similar to the lesions found in other animals (horse, dog, cat and hare) suffering from dysautonomia.

Acknowledgements : Thanks to Bob McCROSKEY (Canada) for the English revision)