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The current situation of rabbit production in Hungary

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At present, slaughter rabbit production in Hungary is slightly more than half of that achieved in the peak years of 1982 and 1991. In 1998, live rabbit production amounted to a total of 13,903 tones. Very specifically to Hungary, this meat quantity is exported in its entirety; there is practically no rabbit meat on the domestic market. Previously, approx. 90 % of rabbits slaughtered were sold to Italy. At present, Italy accounts for 60-65 % of Hungarian rabbit exports and Switzerland for 20-25 %. The export of live rabbits practically ceased in 1986. In 1998, export shipments comprised 68 % whole carcasses and 32 % chopped meat products. The majority of Hungarian rabbit abattoirs are now under foreign ownership or involve foreign partners. The abattoirs work on a one-shift system at 50 % exploitation of their shift capacity. Previously, 95-98 % of rabbits for slaughter were produced on small farms with 5-15 does. Now, two abattoirs operate large-scale farms with 10,000 does, and there are approx. 40-50 medium-sized farms operating between 100 and 3,000 does.
Angora rabbit production reached its peak in 1996. With an annual output of 190 t of Angora wool, Hungary was then the largest exporter in Europe. The dramatic drop in wool prices has forced production down to a purchase level of about 1 t per year.

MEAT

Some recent French studies on rabbit carcass and meat quality

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Since the last 2-3 years, French rabbit scientists made a specific new effort to study the effects of breeding conditions on carcass quality and moreover on meat quality. The main reason of this effort is the hope of French rabbit breeders to propose to the market a great variety of types of rabbits in order to increase the number of rabbit consumers : the wider is the supply quality, the greater should be the total quantity bought. This paper summarises these efforts published in French mainly during the 2 last French Rabbit days (1998 and 1999).
The first question the French scientists tried to answer was the smallest age variation that can be detected through a sensory test. According to the different experiments presented, it is possible to detect a variation of 2 weeks (e.g. 8 *vs* 10 or 10 *vs* 12 weeks) during tripartite tests. But wider variations in age (e.g. 10 *vs* 18 weeks) were not detected with a better accuracy. The sensory criteria used to detect age differences were not consistent from one experiment to the other : external criteria such as odour, darkness or dry aspect of the cooked meat were more frequently significantly affected than juiciness or tenderness of the meat.
The affect of age on exsudation and cooking loss of loin slices was also estimated. In opposition with the "expected" result, relative exsudation during storage was smaller for 10 week-old rabbits than for 19 week-old ones; cooking loss decreased with increasing age but no correlation was established between storage exsudation and cooking loss.
Another group of investigations was devoted to examining the effect of different raising conditions on carcass or meat quality : effect of sex , feed restriction and type of housing. Females, intact and castrated males were compared at 14 weeks. Sex insignificantly modified carcass weight or proportions of cuts, cooking loss and *longissimus lumborum* (LL) chemical characteristics, even for traits relative to fatness. LL muscle of castrated males or of females was less red and less pale than that of intact males. Moreover, LL muscle tenderness (low mechanical shearing force necessary to cut the muscle) was greater for females and castrated males than for intact males. From 11 weeks onwards, NZW male rabbits were fed *ad libitum* (AL group) or received 70% of the voluntary feed intake (R group). At the same slaughter weight (2.9 kg), restricted rabbits were 3 weeks older than the AL ones (18 *vs* 15 weeks). As expected, restriction induced a reduction of fatness indexes such as perirenal fat proportion. In both of the 2 tested muscles *longissimus lumborum* (LL) and *biceps femoris* (BF), feed restriction increased water content and decreased intra-muscular fat content. Muscular fibre size was not modified. Proportion of oxidative fibres was unaffected in the BF muscle whereas it was reduced (12 *vs* 17%) in LL muscle in R rabbits compared to AL rabbits. The target of a second study on feed restriction was to determine the effect of an initial feed restriction applied during the first 2 or 3 weeks after weaning, and followed by *ad libitum* feeding until the rabbits arrived at 2.4 kg of weight. As in the previous experiment, restriction level was 70% of *ad libitum* feeding. The initial feed restriction induced a lower slaughter rate (56.2 *vs* 57.2%) and a modification of carcass composition: lower proportion fat but higher proportion of hindpart. The last experiment included in this overview of French rabbit research was devoted to caging conditions. Purebred

"Normand" rabbits of both sexes were reared after weaning in classical wire mesh cages (7 rabbits per cage, 16/m²) or in larger pens with an outdoor part (64 rabbits per pen, 8/m²). Raising in pens reduced growth rate, carcass adiposity and slaughter rate (e.g. live weight at 86 days was reduced by 14% (2269 *vs* 2657 g)). In a complementary experiment, meat quality of NZW x Normand rabbits raised until 92 days in pens was compared to that of commercial hybrid rabbits slaughtered at 71 days of a similar live weight. Older rabbits raised in large pens had more tender meat with higher juiciness, both for loin and hindleg cuts.
The author concludes that if producers mixed different sources of variation of meat quality, it is possible to increase the number of qualitative types of rabbits proposed to the consumers, and then to expect an extension of the rabbit meat market.

NMR spectroscopy examination of water spaces in rabbit muscle tissue samples

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In the course of this experiment, muscle samples were taken at two examination times, at birth and during the growing period, from the posterior part of the m. longissimus dorsi (m. LD.) and from the lateral part of the m. quadriceps femoris (m. QF.). In addition to the above sites, samples were also taken from the m. soleus (m. S.) of adult rabbits. NMR proton spectroscopy examinations were performed to enable the tissue water spaces to be depicted. The measurements included the recording of T1 and T2 relaxation times and the multiexponential analysis of T2 curves performed for the purposes of the quantitative examination of the water fractions. The results obtained, which should be considered to be of a preliminary nature, indicated that T1 relaxation times for the tissue samples decreased with advancing age with changes in the water content of the samples. On analysis of the T2 relaxation times, it was established that in newborn rabbits the proportions of the strongly and weakly bound components in samples taken from the m. LD. and the m. QF. were almost the same (49 % and 51 %, respectively). Subsequently, in the growing rabbits the two tissue samples were observed to differ significantly from each other in these proportions (79 % and 21 %, respectively); in adult rabbits the proportion of strongly bound components could again be regarded as identical (77 % and 76 %, respectively). Water spaces in the red muscle tissue examined (m. S.) were found to differ from those in the white muscle tissue (m. LD. and m. QF.) in areas where the proportion of the weakly bound components were significantly higher (44 % and 56 %, respectively).

NUTRITION

Effect of reduction in duration of feeding period on production in growing rabbits

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Two-hundred and eighty eight Pannon White growing rabbits (weaned at 5 weeks of age) were allotted to 4 groups. The control group (C) was fed *ad libitum*, while the feeding periods for the three experimental groups were as follows: 16 hours per day (K16); 14 hours per day (K14); 12 hours per day (K12). A medicated pelleted diet fed to the rabbits was of the following composition: DE 10.3 MJ/kg, crude protein 16.8 %, crude fibre 14.1 %, Zn-bacitracin 200 mg/kg, oxytetracycline 500 mg/kg, Diclazuril 1 mg/kg. Daily feed intake was found to decrease with reduction in duration of feeding period: C 146 g, K16 135 g, K14 135 g, K12 134 g. Mean daily weight gain, in the same order, was 46.8 g, 46.3 g, 44.6 g and 45.1 g. Feed conversion was observed to be more favourable in the experimental groups: 3.23, 3.11, 3.12, 3.10, respectively. Reduction in the duration of the feeding period exerted no influence on dressing percentage (at 61.4-61.8 %). On the basis of the results obtained in this experiment, a feeding period of 16 hours per day is recommended.

The effect of feeding intensity on the development of growing rabbits

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A total of 26 six-week-old growing female NZW rabbits were divided into two groups according to feeding intensity. Half of the animals were fed *ad libitum* (group 1), while their siblings (in group 2) were fed a restricted diet of 70 % *ad libitum* (i.e., pair feeding). The trial period was from 6 to 18 weeks of age. Mean body weight at 18 weeks of age was found to be higher in group 1 (3.71 ± 0.31 kg vs. 3.14 ± 0.24 kg). Water consumption was three times dry matter intake (335.71 ± 93.70 ml) in group 2 and 1.9 times dry matter intake (267.81 ± 51.16 ml) in group 1.
The two groups showed similar nutrient digestibility, with the exception that crude protein, which proved more favourable ($P<0.001$) in group 1 (76.53 ± 1.37 % vs. 73.01 ± 2.72 %). Feed restriction did not influence the health status of the animals. Reduced body weight gain and improved feed conversion (5.29 and 4.73 for group 1 and group 2 respectively) results suggest that feed restriction is suitable for application in growing rabbits.

The effect of feeding intensity on endocrine and genital development in female rabbits during puberty

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The relation between feeding intensity (restricted to 70 % or *ad libitum*) and endocrine and gonad development during prepuberal and puberal age was studied in NZW rabbits. To control the adenohypophyseal and ovarian function, responsiveness to hCG (50 IU per doe) and GnRH (0.8 μg per doe) treatments was investigated in two-week intervals during puberty. The receptivity of does was checked by exposure to male rabbits 2 and 5 days after hormone treatment. This was accompanied by observation of clinical symptoms of heat. At the ages of 12-13 weeks and 14-15 weeks, the *ad libitum* group showed clearer clinical signs of heat (75 % vs. 40 %). However, the GnRH and hCG treatments used to induce LH secretion and/or ovulation were not effective in either group. At the age of 16 weeks, the *ad libitum* group showed high sexual activity (92 %). In 25 % of cases, spontaneous heat with well-expressed clinical symptoms, receptivity, successfully induced ovulation, active corpora lutea and embryonic development or pseudopregnancy were observed as features of sexual development. In the group fed a restricted diet, 69 % of the does showed sexual activity with weakly expressed symptoms of heat. This tendency was also seen at the age of 17-18 weeks; however, improved ovarian activity and responsiveness to hormone treatment in the group fed a restricted diet proved significantly lower.

Effect of different levels of feed restriction during rearing on performance in rabbit does

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Ad libitum fed ten-week-old littermate female rabbits of NZW lines were divided into four groups (n=4x50) on the basis of body weight and genotype as follows: a control group with *ad libitum* feeding (C); access to a restricted 130 g daily feed per rabbit up to the age of 17 weeks, followed by 140 g per day until first breeding (130R); one-day (24 hours) starving every week (1D); 9-hour daily access to the diet (9H). When the young given restricted feed reached 75 to 80 % of their adult weight (3.4 to 3.5 kg) they were given an extra feed supply (flushing) for 4 days before first breeding. The does were re-inseminated 9-11 days *post partum*. It was expected that they would deliver three times. In 130R and 1D, the doe culling rate was 7 to 10 % lower and more does delivered three times, resulting in an insignificantly higher number of kindlings per doe (1.81 and 1.94, respectively) than in group C (1.77). The groups subjected to restricted feeding of various levels showed insignificant improvements in conception rate, between 5 and 9 % in comparison with the does of group C (62 %). Litter size and litter weight at birth, at 21 days of age and at weaning were higher in group 130R (8.5 and 514 g, 7.6 and 2726 g, 7.3 and 6296 g) and in group 9H (8.6 and 499 g, 7.7 and 2624 g, 7.7 and 6542 g) than in group C (8.4 and 461 g, 7.1 and 2444 g, 6.9 and 6029 g); however, these data showed no significant differences. The does of group 130R lost less weight at kindling and showed the best body condition during the lactation period. In comparison with group C, in larger litters of group 130R no decrease in the individual weight of progeny at birth or at 21 days was observed; this suggests that good body condition in does could be accompanied by improved intrauterine rearing ability and milk production.
In summary, it was concluded that when does were reared on a restricted 130 g per day diet ration or were given only 9 hours' access to the diet each day their subsequent performance showed no significant decrease.

Effect of dietary energy level and probiotics on fryer performance in rabbits

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Two feed energy levels (HE 10.28 MJ/kg, LE 9.66 MJ/kg) associated with three different probiotics were tested. The following were compared with the control group (PC) without probiotic: sporulated bacteria bacillus Toyo, 1.5 x 10^6 spores per g (PT); mixture of microencapsulated bacteria and yeast (PL); sporulated bacteria bacillus CIP 5832, 1 x 10^6 spores per g (PP).
With respect to mortality, no difference between the probiotic treatments was ascertained (PT 8.3 %, PL 4.2 %, PP 6.2 %, PC 5.2 %), nor did the various dietary energy levels produce significant difference (HE 5.2 %, LE 6.8 %). Feed consumption proved lower with the PT treatment (118. g/day) than with the other treatments (between 122 and 124 g/day), and was also lower in the HE diet group (118 g/day) than in the LE diet group (126 g/day). Growth rate was not affected by the probiotic treatment but was higher in the HE group (33.7 g/day) than in the LE group (31.3 g/day). Feed conversion was observed not to be affected by the probiotic treatment applied, but was affected by the energy level of the diet (HE 3.51, LE 4.07).

HOUSING

The effect of environmental temperature and restricted feeding on production in rabbit does

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Thirty lactating NZW rabbit does were divided into 6 groups according to environmental temperature (5, 15, 23 and 30 °C) and feed intake (*ad libitum* (A) and restricted (R)). The does were kept at 20 °C during pregnancy, and at kindling they were transferred to climatic chambers maintained at the respective temperatures. A proportion of the does were fed *ad libitum* (groups 5A, 15A, 23A and 30A); the remainder were all kept at 15 °C and fed the same (restricted) volume of pellets as the intake of the does fed ad libitum which were kept at 23 °C or 30 °C (15/23R and 15/30R, respectively). Litter size was adjusted to 7 kits. The body weight, milk production and feed and water intakes of does were recorded daily. Milk samples were collected on days 3, 7, 14, 21, 24 and 27, and pooled milk samples were subjected to chemical analysis. Heat stress was found to reduce daily milk yield (159, 161, 161 and 114 g), daily feed intake (289, 278, 261 and 185 g) and daily water intake (505, 521, 536 and 435 g) but increased the water/feed ratio (1.91, 2.02, 1.99 and 2.53) in the groups of does kept at 5 , 15, 23 and 30 °C, respectively. In comparing the data for the groups kept at 23 °C and 30 °C and fed *ad libitum* (23A and 30A) and those for the corresponding groups 15/23R and 15/30R it was observed that daily milk yield increased by 7.8 % and 5.1 %, daily water intake by 8.4 % and 13.3 %, and the feed/water ratio by 0.18 and 0.18, respectively.
The DM content of the milk samples from groups 5A, 15A, 23A, 30A, 15/23R and 15/30R was determined at 30.2, 29.9, 31.3, 28.9, 31.7 and 30.0 %, respectively. The respective CP content values were 14.4, 14.2, 14.6, 14.1, 14.5 and 14.1 %. The respective CF content values were 12.2, 11.9, 12.6, 11.7, 11.9 and 13.2%. The respective ash content values were 2.25, 2.35, 2.30, 2.30, 2.33 and 2.27 %. The effect of temperature and feed restriction on milk composition was found to be negligible.

Effects of summer heat stress on male rabbit reproductive performance : preliminary results

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The influence of high environmental temperature on male rabbit production during the summer months of July and August was studied. Three groups of adult NZW bucks were kept at 25 °C and fed *ad libitum* (n=6), at 25 °C on a restricted diet (n=6), and at an ambient temperature over 30 °C and fed *ad libitum* (n=12). A 16-hour lighting programme was used.
GnRH test was performed and base testosterone levels were also determined. Base testosterone concentration proved the lowest in the group kept at 25 °C and fed *ad libitum* (1.98 ± 1.75 ng/l) and the highest in the group housed at 25 °C and fed a restricted diet (10.28 ± 2.21 ng/l). With the exception of one sampling date, there was no significant difference between the groups. Ninety minutes after the administration of GnRH, a difference ($P<0.05$) in testosterone concentration was observed between the group kept at the higher ambient temperature (15.05 ± 1.45 ng/l) and between the group housed in an air-conditioned room and fed *ad libitum* (8.77 ± 2.02 ng/l).

REPRODUCTION-REARING

The effect of birth weight and litter size at suckling age on performance in does as adults

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Pannon White rabbits of low (39-43 g) and high (63-70 g) birth weight were reared in litters of 6 and 10, respectively, while those of intermediate (53-56 g) birth weight were reared in litters of 8 (n=394). The does' birth weight had a significant effect on the number of inseminations necessary for the first kindling. Later on, however, birth weight no longer affected the conception rate. With heavier birth weight, significantly improved doe performance could be expected. Litter size at birth was 12.4 % (9.52 vs. 8.34; $P<0.01$) higher, litter size at 21 days was 9.4 % (7.64 vs. 6.92; $P<0.01$) higher and litter weight at 21 days was 4.5 % (2.70 vs. 2.58; $P<0.05$) greater when the doe was born with a heavier weight. Total litter loss was 21.0 % and 8.2 % ($P<0.01$) for the two groups, respectively. The size of the litter in which the doe had been raised (6, 8 or 10) did not influence subsequent performance.

Some factors influencing the effectiveness of *post partum* artificial insemination

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Production performance of Pannon White does inseminated *post partum* (PP) was evaluated in a one-year experiment. In addition to insemination, does were treated with a single 1.5 μg GnRH analogue injection, but PMSG was not supplied and no biostimulation was performed. Of the 1305 inseminations, 663 PPs were carried out, the resulting conception rate (CR) being 46.8 per cent and the total litter size (LS total) being 7.7. The CR of does not conceiving at the first attempt (i.e., resting further) was 71.8 %; LS total in these was 8.85. The results obtained for the PP group were influenced by several factors. Young does inseminated after the first and second parturitions conceived at significantly lower rates (CR of 36.1 % and 30.8 %, respectively) than older does producing CR values between 47.9 % and 52.4 %. LS total proved the lowest in first litters (6.73); the fourth litter gave the highest value (8.26); no significant difference was observed in the other litters for this trait (the LS total values falling between 7.64 and 7.76). The most favourable CR, values between 50.0 and 56.8, was achieved during the period from February to July, while the poorest level was recorded in October and November (CR 24.7 %, $P<0.05$). The greatest LS resulted from insemination between February and May, the lowest when the does were inseminated between October and January (LS total 8.46 to 8.66 and 6.19 to 6.21, respectively; $P<0.05$). CR was influenced significantly by the size of the previous litter as recorded on the 21st day of age of the litter. Does which had lost their first litter (subsequent CR being 33.3 %) and those does which had previously produced a litter of 10 or more kits (subsequent CR 29.3 %) conceived less successfully. In contrast, CR values between 48.1 % and 53.3 % were recorded among does previously producing litters between 1 and 9 young. LS total proved not to be dependent upon the size of the previous litter. In the PP group, the interval between parturition and the following insemination was between 0 and 3 days. The most favourable results were achieved when inseminations were performed on day 0 (CR 58.8 % and LS total 7.06; $P<0.05$).

The effect of doe-litter separation on production performance in does and their kits

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Pannon White does were artificially inseminated on days 9-11 after kindling (n = 931). Alongside the control group (group C, n = 236), the does of the three experimental groups were prevented from suckling on the day prior to insemination (doe-litter separation : DLS). On the following day, some of the does were inseminated two hours before suckling (B-2, n = 229), some immediately after suckling (B-0, n = 234), and some two hours after suckling (B+2, n = 232). The effect of biostimulation led to only slight, non-significant improvements in receptivity (0-7 %) and fertility rate (1-5 %). Litter sizes were 0.74 and 0.70 greater in groups B-2 and B-0, respectively, but no increase was observed in group B+2. The most substantial effect of MLS was recorded after the first kindling subsequent to separation. On the day after the omission of suckling, the quantity of milk produced by the does increased by 22 %. For three consecutive days, milk secretion in these does lagged behind that of control does by 33 %, 15 % and 6 %, respectively. Also, two days after the omission of suckling, as a symptom of the drying up of milk flow, the milk secreted contained higher levels of dry matter (by 4.2 %), fat (by 1.7 %), protein (by 2.6 %) and ash (by 0.53 %). However, these values later returned to levels approaching the original values. Due to the omission of only one suckling, the weight of kits declined by 20-34 g, no compensatory growth being observed either before or after weaning.

Doe-litter relations in the European rabbit: physiological and behavioural locks and keys

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In any mammalian species a proper understanding of the natural, co-evolved doe-litter system is of major importance if productivity is to be optimised under conditions compatible with the animals' welfare. The European rabbit (*Oryctolagus cuniculus*) is of particular interest in this respect, given its unusually limited and stereotyped pattern of maternal care and the equally stereotyped set of corresponding specialised characteristics in the young. For each of five key topics (the nest, parturition, nursing, suckling and weaning) the behaviour of the mother and that of the young is described, followed by consideration of the possible application of this information in the improvement of management practices.

The possibility of double feeding suckling rabbits

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In this experiment, the performance of two rabbit groups was compared, as follows: one group suckled once a day, as is the norm (S, n=120); the other group suckled twice a day, morning and evening, once from each of two does (D, n=128). The individual daily milk intake of the group S rabbits was 25.7 g from birth to the 23rd day, and 24.0 g from days 24 to 35. Mean milk intake in the rabbits of group D was 22.7 g and 21.1 g in the morning and 24.3 g and 20.6 g in the evening for the two periods, respectively. The group D rabbits ingested 83 % and 74 % more milk in the respective periods than the rabbits of group S. The body weight of the group S rabbits was found to be substantially lower at both 3 weeks and 10 weeks of age (0.32 kg *vs.* 0.55 kg and 2.49 kg *vs.* 2.91 kg). The rabbits of group S started eating the solid diet (pellet) earlier; their daily intake in the 4th and 5th weeks (respectively) being 14 g and 55g. Daily intake in the group D rabbits in the same two weeks was 5 g and 37 g, respectively. A very rapid increase in feed consumption was observed in the rabbits of group D after weaning. Between weeks 6 and 10 mean daily feed consumption was 137 g in group S and 158 g in group D. Group D rabbits reached 2.5 kg body weight earlier by 9 days than those of group S; their total feed consumption was also lower between the 21st day of life and the point at which they reached 2.5 kg body weight (S 5.3 kg, D 4.5 kg). Low mortality rates from birth to 70 days of age were recorded in both groups (9.2 % in group S and 4.4 % in group D). Non-significant differences were observed between the groups with respect to dressing percentage (S 61.0 %, D 61.1 %) and the ratio of the fore, intermediate and hind parts of the carcass. The total quantity of perirenal + scapular fat was found to increase considerably by the effect of twice-daily suckling.(S 28.9 g, D 42.2 g).

The effect of litter size and sex on weight gain in Pannon White rabbits

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One thousand, one hundred and thirteen Pannon White rabbits were examined. No difference in daily weight gain in relation to litter size was ascertained. Individual weight at 70 days of age was significantly lower in litters of 11 than in litters of 6 or fewer. Both individual weight at 70 days of age and daily weight gain between 42 and 70 days proved significantly higher in the males than in the females.

GENETICS-PHYSIOLOGY

Polymorphism of the rabbit kappa casein gene and its influence on performance traits

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The rabbit κ-casein encoding gene has previously been shown to possess two alleles. These two alleles do not differ from each other in their coding region or in mRNA accumulation levels. However, they differ greatly with respect to their intronic regions. Rearranged regions in the first and fourth introns were found to be more frequent in various European breeds. The correlation between the κ-casein genotype and breeding capacity was examined in a New Zealand White population. There was significant different between the three genotypes (AA, AB, BB) in litter size (alive): 7.22, 8.91 and 7.75, respectively.

Effects of various environmental factors on the activity of glutathione peroxidase in rabbit blood

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Glutathione peroxidase is a part of the antioxidant defense system in animals. It is responsible for the elimination of reactive hydroperoxide radicals produced in either physiological or pathological processes taking place in the body. This enzyme is subject to the influence of several environmental factors. In this experiment, the authors studied the activity of the enzyme in various environmental conditions: glutation depletion, pro-oxidant effect, peroxide load and additive selenium supply. The activity of the enzyme was measured in blood serum and erythrocytes. A significant decrease in the activity of the enzyme was observed in the serum samples in glutathione-depleted conditions, while the same treatment did not result in the same decrease in activity in the erythrocytes. The provision of additive selenium resulted in elevated activity of the enzyme; this is in accordance with the selenium-dependent character of glutathione peroxidase. When a diet of high peroxide content was fed for 5 weeks, contrasting changes were observed in the serum and in the erythrocytes resulting from the difference between the physiological stability of the two systems. Pro-oxidant treatment led to surprising changes

in the activity of the enzyme, which may have been the result of post-translation control of glutathione peroxidase enzyme synthesis. On the basis of these findings, it can be stated that the treatments applied may constitute good models for the study of free radical initiator characteristics of different environmental factors and the effects of these factors on the glutathione peroxidase enzyme.

The effect of exogenous GnRH on the testicular tissues in rabbits

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The effect of exogenous GnRH on the testicular tissues in Pannon White bucks was studied. Two μg of GnRH was administered to 10 males, the other 10 were not treated. The testis and the epididymis were removed from each animal on the 42nd day of the experiment. In the untreated group, the histological structure of the testis and the epididymis was normal in every male. In the treated group, the following changes were observed: increased connective tissue, narrow seminiferous tubules, plicate wall of the epididymal duct, and less sperm in the duct.

The effect of melatonin treatment on hair follicle activity in Angora rabbits

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Angora rabbits (n=76) kept under natural photoperiod conditions, were either treated in May with 36 mg exogenous melatonin administered subcutaneously (M groups) or left untreated (control: C groups). Experimental subjects included rabbits producing wool at 200-210 days of age, rabbits at the 3rd wool harvesting, and non-pregnant multiparous does. The interval between shearings or pluckings was 98 days. The experiments and groups were designated as follows: first experiment (M1 and C1), defleeced wool-producing females; second experiment (M2 and C2), sheared wool-producing females; third experiment (M3 and C3), sheared non-pregnant multiparous does; fourth experiment (M4 and C4), sheared wool-producing males.
The values recorded for number of hairs per follicle group at the beginning of the experiment were the following: C1 5.5, M1 4.4 (n.s.); C2 33.6, M2 43.5 (n.s.); C3 30.1, M3 33.0 (n.s.); C4 39.2, M4 42.2 (n.s.). The corresponding values recorded at the end of the experiment (in the 14th week) were: C1 27.2, M1 40.4 ($P<0.01$); C2 37.0, M2 44.7 (n.s.); C3 29.9, M3 40.3 ($P<0.01$); C4 39.4, M4 51.3 ($P<0.05$). In the melatonin-treated group (M1), telogen hairs were observed in the hair follicle group at the end of the experiment, whereas only anagen hairs were found in the control group (C1). The melatonin treatment was observed to exert the most significant positive effect in defleeced females (M1) and in sheared males (M4). These results verify the differences in wool production among groups recorded (C1 163, M1 229 g; C2 193, M2 217g; C3 195, M3 230 g; C4 148, M4 200 g).