

15 - PEETERS J.E., GEEROMS R., CHOW T.T.

Pathogenicity of 6 strains of *Eimeria magna*, *media* and *perforans* in weanling rabbits and anticoccidial effect of 1 ppm of diclazuril

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 99-104.

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The influence of 3 *Eimeria* species on zootechnical performance was evaluated. Simultaneously, the anticoccidial effect of diclazuril was tested. Rabbits infected with 10^5 oocysts of *E. perforans* or *E. media* or with 5×10^4 oocysts of *E. magna* showed a weight gain reduction of 15%, 41% or 38%, whereas FCR was altered by 8%, 33% or 27% three weeks afterwards ($p < 0.05$). There was no significant difference in pathology between different isolates of the same species. A mixed infection with the 3 species exerted a stronger effect ($p < 0.05$). Low mortality was detected after infection with *E. media* or *E. magna* or after mixed infection. Oocyst output reached 62, 163, 139 and 160×10^6 oocysts after infection with *E. perforans*, *E. media*, *E. magna* or after a mixed infection. Incorporation of 1 ppm of diclazuril in the feed prevented mortality and reduced oocyst output of *E. magna*, *E. media* and *E. perforans* by 94%, 71% or 56% ($P < 0.05$). Weight loss was only partially prevented. After a mixed infection including the 3 species, weight gain was significantly improved by 35% in comparison with infected unmedicated controls, whereas no noticeable improvement of average daily gain reduction was noticed in comparison with non infected controls. Oocyst output was reduced by 71%. In case of *E. magna*, a distinct difference in anticoccidial effect was established according to the isolates tested: oocyst output of strain U93/298 was reduced by 88.5% against 99.95% in case of infection with strain U93/407. In case of the former strain the drug had no influence on zootechnical performance, whereas treatment after infection with the latter strain resulted in a significant improvement of weight gain and FCR. Performance was comparable to that of uninfected unmedicated controls.

16 - PEETERS J.E., ORSENIGO R., MAERTENS L.*, COLIN M.**
Promoting effect of dietary beet pulp on iota-enterotoxaemia (*C. spiroforme*) in rabbits at weaning

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 105-112.

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A total of 60 rabbits, weaned at 28 days of age, were fed one of two iso-energetic (10.2 MJ ADE/kg) and iso-proteic (175 g/kg) diets *ad libitum*. The diets differed in the main fiber source; 240 g/kg beet pulp were incorporated in diet P and 54 g/kg flax chaf and 300 g/kg alfalfa meal in diet F. As a result, diets P and F contained 142 and 163 g/kg crude fiber, 102 and 138 g/kg indigestible fiber, 343 and 311 g/kg NDF, 170 and 181 g/kg ADF and 46 and 66 g/kg ADL, respectively. Rabbits were inoculated orally with *Clostridium spiroforme* strain NCTC 11493. Utilization of diet P was followed by a significant 30% increase of caecal weight and a 22% increase in total volatile fatty acid (VFA) production, whereas caecal pH decreased by 0.27 units in comparison with diet F. NH_3 -levels were unaffected. None of the diets significantly favoured proliferation of saprophytic

faecal *E. coli*. Diet P promoted iota-enterotoxaemia with reduced weight gain (-29%) and impaired feed conversion (+40%). Faecal *C. spiroforme* scores remained elevated during 24 days post-infection ($P < 0.05$), two out of 10 rabbits died of enterotoxaemia and two more rabbits showed liquid diarrhoea. Experimental infection of rabbits fed diet F on the contrary was not associated with clinical signs.

17 - RIDEAUD P., COUDERT P.*

Identification of *Pasteurella multocida* pathogenic strains for rabbits.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 113-120.

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Previous results, formerly obtained, indicated a positive correlation between *in vitro* culture diameter of colony of different strains of *P. multocida* and their pathogenicity for the rabbit. This work, using 52 strains isolated from a "complexe cunicole", confirm the previous results. Furthermore it appears clearly that the strains forming small colonies are also deprived of ornithine decarboxylase (ODC-). The strains without ODC have a weak pathogenicity if any and it does not depend of the diameter of the colony. This criteria ODC+ or - is proposed in addition of the diameter of the colony to presume the pathogenicity of the strains of *P. multocida*. The classification of the species *multocida* among the genus *Pasteurella* is also discussed.

REPRODUCTION

18 - P. ARVEUX P., TROISLOUCHES G.

Effect of a lighting programme 8 h/4 h (L/D) on rabbit does reproduction.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 121-126.

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Nulliparous does from a strain selected for litter size, were divided in 2 equivalent groups of 18 each: Control group was submitted to lighting during 16 hours consecutively per 24 hours, experimental group was submitted to lighting during 2 periods of 8 hours each, separated with 4 hours darkness.

The trial stopped at the end of the 6th litter of the does (dead or culled does were not replaced during the trial).

Experimental group does performance was:

* Lower mortality and culling rate (42.9 versus 71.4%)

* Better response to mating (interval between kindling and successful mating of 19.2 days versus 24.2) and increased fertility (82.6% versus 67.6%).

* Does weight gain between kindling and weaning was higher; feed intake was also higher (479 versus 446 g per day for litter plus multiparous doe from kindling to weaning).

* Increased productivity (58.9 weaned rabbits per doe and per year versus 52.8)

However, averaged weaning weight and litter size at birth and weaning were not modified.

19 - BOLET G.

Effect of the crowding of the uterine horn and of litter size at birth on young rabbits weight from birth to eleven weeks, after crossfostering of litters.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 127-135.

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The effect of the number of fetuses during pregnancy and of litter size at birth on young weight at birth and up to 11 weeks was studied. 246 does from the A129 strain were bred in artificial insemination. Half of them were unilaterally ovariectomized before puberty to allow a double crowding of the uterine horn corresponding to the remaining ovary. The number of implanted fetuses was counted by endoscopy. There was a negative relationship between the number of implanted embryos and fetal survival on one hand, and average weight of young alive at birth on the other. The unfavourable effect of overcrowding of one horn on these two parameters was significant, but weaker. In the 2nd parity, litters were standardized at 6 young after birth. They were weighted every week up to weaning (28 d.), and at 7 and 11 weeks. The negative effect of litter size at birth remained significant whatever the age of young. The unfavourable effect of overcrowding was weaker and less significant as the age of young increased. It is concluded that the decrease of weight of young from large litters, which remains after birth and even after weaning, was mainly due to a nutritional deficit and not to a physical competition due to overcrowding of uterine horns. So improvement of prolificacy must be accompanied by a better response to nutritional needs of pregnant does.

20 - GHIERICATO G.M., BOITI C.*, CANALI C.*, RIZZI C., ROSTELLATO V.

Age and temperature effects on Hormonal profile of rabbit

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The effects of age and environmental temperature on plasma hormonal concentrations of testosterone (T), dihydrotestosterone (DHT), cortisol (C), triiodothyronine (T3) and thyroxine (T4) were evaluated in 46 male White New Zealand rabbits divided into two groups reared at 20 °C (TNT=Thermic Neutrality Temperature) or at 27 °C (HT=High Temperature). The animals were fed "ad libitum". Blood samples were collected from each animal at 71 and 85 days of age. The older rabbits had significantly higher ($P<0.01$) final body weight (2680 vs 2221 g.), daily intake (124 vs 112 g) and feed conversion ratio (3.56 vs 3.23 g/g). With age increasing T (1.98 vs 1.35 ng/ml, $P<0.05$), DHT (1.18 vs 0.70 ng/ml, $P<0.05$) and C (2.81 vs 1.81 µg/dl, $P<0.01$) decreased, whereas T+DHT, T/DHT, T3, T4 and T4/T3 ratio did not change. With regard to the effect of temperature, the HT animals had a lower ($P<0.01$) final body weight (2332 vs 2568 g), daily gain (31.6 vs 38.0 g) and feed intake (106 vs

130 g/d). HT treatment significantly ($P<0.05$) decreased plasma levels of T (1.37 vs 1.96 ng/ml) and T+DHT (1.80 vs 3.02 ng/ml), but not DHT and T/DHT ratio. The concentrations of C, T3 and T4 were unchanged between HT and TNT groups. HT animals had higher ($P<0.01$) T4/T3 ratio (36.2 vs 30.7).

21 - DAVOUST C., SALEIL G.*, THEAU-CLEMENT M.*, ROUSTAN A.*

Influence of the PMSG-hCG association on the numeric productivity of lactating does managed as a single group inseminated artificially every 35 days.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 145-152.

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274 Hyplus does were managed as a single group and inseminated every 35 days during one year. A total of 2517 inseminations were analysed. The efficiency of three forms of treatment for increasing reproduction performance of lactating does was investigated. Hormonal subcutaneous injections were carried out 48h before insemination. Treatment 1 contained: 1,8 ml fish autolysate and 16 iu PMSG + 8 iu hCG; treatment 2: 0.9 ml fish autolysate and 8 iu PMSG + 4 iu hCG; and treatment 3: 1,9 ml fish autolysate and 8 iu PMSG + 4 iu hCG. Non-lactating does were not injected and were used as a control. The fertility of non treated (non-lactating) does was greater (87,7%). Fertility of treated does did not vary with the doses. Prolificacy was lower under treatments 1 and 3 (10.1 vs 9.7 total young born and 9.7 vs 9.0 alive, respectively). It seems that injecting 0.9 ml fish autolysate and 8 iu PMSG + 4 iu hCG significantly increased fertility and litter size. As treatments 2 and 3 were not run synchronously, the experimentation phase has to be extended before full conclusions can be drawn. In addition, both, fertility and prolificacy were lower in first parity.

22 - DEPRES E., THEAU-CLEMENT M.*, LORVELEC O.

Effect of genotype, lighting duration, season and physiological stage on the reproductive performance of rabbit does reared in Guadeloupe (F.W.I.).

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 153-162.

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The aim of this study was to compare, in terms of reproductive performance, 2 genotypes of rabbit does reared in tropical area under different conditions. The does belonged to two genotypes (NZ vs NZxCAL). Two lighting durations (16h/day vs natural light i.e. 11-13 h/day), two seasons (hot and wet vs cold and dry) and two physiological stages (lactating or non lactating before mating) were studied. 272 observations were analysed in this experiment. Fertility was not influenced by the different treatments. The NZxCAL does exhibited a litter size higher than NZ does (8.2 vs 7.1; $P<0.05$). A significant interaction was found between genotype and physiological stage for the average weaning weight ($P<0.01$) and

between genotype and birth season for the litter size ($P < 0.05$). The additional lighting (up to 16 h/day) increased the litter size at birth (8.4 vs 6.9; $P < 0.001$) and at weaning (6.6 vs 5.5; $P < 0.05$). On the other hand, this study shows significant interactions between light duration and birth season for litter size at weaning. The hot and wet season (May-November) decreased the litter size at birth and weaning (7.1 vs 8.2; $P < 0.05$ and 5.5 vs 6.6; $P < 0.05$). The authors found a significant effect of physiological stage on average weight at weaning, stillbirth rate and mortality between birth and weaning ($P < 0.05$). It was concluded that the genotype and the exposure of female rabbits to 16 h light/day may serve as useful management tool at improving does productivity during the cold and dry season under tropical climate. However, the hot and wet season was especially unfavorable and decreased the positive effect of genotype and photoperiod control.

23 - EL SHERBINY A.M.*, AMIN S.O.*, HERNANDEZ C., CARREAU S.

On the existence of two leydig cell populations in the immature rabbit testis.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 163-168.

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In the immature rabbit testis (78 days), after a collagenase treatment (0.05%) and centrifugation on a Percoll gradient, we demonstrated the presence of two enriched Leydig cell populations (CLI: 47% and CLII: 76%) which viability is higher than 95%. In basal conditions (Ham F12/DME medium, 5h at 32°C), Leydig cells of CLI synthesize 3 fold more testosterone than Leydig cells of CLII; in addition, the cells of CLI are twice more sensitive to hCG than these of CLII.

24 - MIRABITO L., GALLIOT P., SOUCHET C.

Effect of a PMSG treatment and of a modification of the photoperiod on the reproductive performance of artificially inseminated rabbit does.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 169-177.

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A total of 362 does were divided into three groups and studied during 13 consecutive artificial inseminations (every 42 days). The first group was the control group. The lactating females of the second group received an injection of PMSG (30 UI) 48 hours before artificial insemination (AI). The non lactating does of this group were not treated. These two groups were bred under 16L/8D artificial lighting. The lighting treatment of the third group was as follows : 8L/16D during four weeks and 16L/8D during the week before the AI. In the following week, the duration of lighting period decreased slowly down to 8L/16D.

In the lactating does, mating acceptance rate was significantly greater in the 2 experimental groups (85.7% for group 2 and 77.7 for group 3) than in control group (67.4%). However, only the lighting treatment induced an amelioration of the fertility (62.2% vs 53.4% for the PMSG group and 53.2% for the control group). On the other hand, PMSG increased the prolificity in term of number of rabbits

born alive by litter (10.7 vs 9.9 for the lighting treatment and 9.7 for the control group). Not one of these treatments had an influence on the number of rabbits by litter at weaning but the weight of litter was significantly decreased by the modification of the photoperiod : (5385g vs 5653 for the PMSG group and 5614 for the control group).

25 - THEAU-CLEMENT M., MICHEL N., POUJARDIEU B., BOLET G., ESPARBIE J.

Effects of artificial photoperiods on sexual behaviour and sperm output in the rabbit

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 179-186.

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Male rabbits aged from 4 to 4.5 months were subjected to a 8L:16D photoperiod for 4 weeks and were then distributed into two groups. One group of 13 males was maintained at 8L:16D (group 8). The other group included 16 males and was submitted to 16L:8D (group 16). Two successive ejaculates were collected and analysed once a week for 6 months. Animals from group 8 were sexually more active and ejaculated significantly larger volumes of semen than those from group 16. Performance of males from group 16 was better for all other parameters, whether these were qualitative (motility, percentage of live spermatozoa) or quantitative. Averages for the total number of spermatozoa and number of live spermatozoa per ejaculate were significantly greater in males submitted to 16L:8D (509 and 408 vs 452 and 344 10^6 spermatozoa, respectively). Under the experimental conditions, the average sperm output of bucks exposed to 16 h of artificial lighting was greater than that of bucks exposed to 8 hours.

26 - THEAU-CLEMENT M., POUJARDIEU B.

Influence of mode of reproduction, receptivity and physiological stage on litter size components in rabbit does.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 187-194.

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33 or 42 days after a previous natural mount (NM) or artificial insemination (AI), 170 New Zealand multiparous does were submitted to an other natural mating (82 does) or artificial insemination (88 does). According to the result of the previous fertilization attempt, 3 subgroups of does were taken in consideration : non lactating, *post partum* lactating and 11 days after kindling lactating does. Male acceptance was systematically recorded in both NM and AI groups. In the NM group, non-receptive does were subjected to force mating. The does were slaughtered a fortnight after mating or insemination in order to analyse how litter size components were affected by mode of reproduction, receptivity and physiological stage. Ovulation was more frequent under AI (87.8 vs 55.9%, $P < 0.001$), implantation and survival defects for a constant number of corpora lutea were higher after natural service (0.7 vs 1.1 and 0.5 vs 1.1, $P < 0.05$). The number of embryos still alive after 14 days of gestation was independent of the mode of reproduction. Receptivity significantly improved all recorded parameters: frequency and intensity of ovulation (85.6 vs 58.1% and 11.0 vs 8.7 corpora lutea), fertility (74.8 vs

33.2%), the number of embryos still alive after a fortnight of gestation (8.3 vs 5.9) and implantation and survival defects calculated for a constant number of corpora lutea (-1 vs -1.4 and -1 vs -1.5). Receptive does produced three times as many live embryos at mid-term as non receptive does did (6.2 vs 2.1). The physiological stage affected the ovulation frequency, *post partum* lactating does ovulated less frequently (55.7 %) than non-lactating does or 11-days *post partum* lactating does (83.5 and 76.5 %, respectively). The physiological stage also affected to a lesser extent the number of corpora lutea (9.1, 10.4 and 10.1, respectively in the same order). The number of live embryos per doe at mid-term was higher among non lactating does (5.3) than among lactating does (*post partum* : 3.6; 11 days : 4.0). This study confirms that lactation and reproduction are partly antagonistic, as demonstrated here on frequency and intensity of ovulation.

GENETICS

27 - BRUN J.M., LEBAS F.*

Preliminary study on the interactions of sire and feed composition on the reproductive performance of breeding does

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 195-202.

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The breeding performance of 215 rabbit does obtained from 15 males of the 2066 line mated with line 1077 does, were measured during one year. These does were fed isoenergetic diets containing 14.9% (B) or 21.6% (H) crude protein on dry matter basis. The aim of the authors was to determine if the diet's protein level influence the classification of the 15 males according to their daughter's breeding performance and/or the magnitude of the differences between males. The diet did not influence significantly the number of young per litter at birth or at weaning. With diet H, the individual weaning weight (at 29 d.) was increased by 8.2%, the litter weaning weight by 6.5%, and the interval between 2 litters was 3 days shorter. But in one year of production, 438 litters were weaned with diet B and only 354 with diet H for the same initial number of does. A sire significant effect was observed on all of the measured parameters. A significant interaction with the diet's protein level was also observed. Particularly, the dispersion of the sire means was wider with diet H than with diet B, for all parameters but the individual weaning weight. The sire part of the variance of the doe performance was near zero with diet B but 5.6 to 10% of the total variance, according to the trait, with diet H.

28 - BRUN J.M., SALEIL G.

On-farm estimation of heterosis on reproductive performances between INRA A2066 and A1077 rabbit strains

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 203-210.

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Since 1974, the "Station d'Amélioration Génétique des Animaux" has been selecting two rabbit strains, the A2066 (from Californian breed) and A1077 (from New-Zealand breed) on their litter size. These strains are used in crossbreeding to produce the 1067 female which is distributed in commercial production farms. We have studied the reproductive performance of four genotypes (A2066, A1077, A1067 and A1076), in six farms. There was a significant favourable influence of female genotypes A1067 and A1076 on litter sizes : for total number of young rabbits born, number of young rabbits born alive, and number of young rabbits weaned, heterosis was 1.3, 1.5 and 0.5 rabbits respectively what was 15.2 %, 20.1 % and 6.7% of the parental mean. The A2066 females were significantly different for fertility (+ 0.08 mating/needed/kindling) and also for percentage of stillbirths (+ 6 %). This study evidenced that there is a positive heterosis effect in crossbred females in farms as it was demonstrated in laboratory conditions.

29 - FAYOS L., CLIMENT A., SANTACREU M.A., GALLEGRO M., MOLINA I., BLASCO A.

Fertilisation rate and embryo development in two rabbit lines divergently selected on uterine efficiency.

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 211-215.

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40 females from three groups of rabbit does were used in the experiment. The groups were two lines selected to increase (EU+ = 15) and decrease (EU- = 9) litter size on unilaterally ovariectomized does. A group of intact does (I = 16) served as control. All the does were slaughtered 30 hours after mating. The number of oocytes (OR) and embryos (ER) and the number of blastomere of the embryos were recorded. Ovulation rate (TO) was estimated by counting the corpora lutea. The total amount of oocytes and embryos recovered (RT=OR+ER), the recovering ratio (TR= RT/TO x 100) and the fertility ratio (TF= ER/TR x 100) were calculated. The average number of cells of the embryos of the same litter (M) and their standard deviation (S) were also calculated. Least square means for the three groups were calculated on a model with group, parity and level of haemorrhagic follicles effects. It seems that the lines EU have a lower recovering ratio than the control TR(EU+, EU-, I)=(0.91, 0.84, 1). The recovering is affected by the presence of haemorrhagic follicles. The fécondation rate is very high TF(EU+, EU-, I)=(0.995, 0.998, 1). It seems that all the groups have the same number of blastomere M(EU+, EU-, I)=(3.75, 3.97, 4.05) and that the EU+ does have a more uniform embryo development S(EU+, EU-, I)=(0.42, 0.68, 0.62).

30 - GOMEZ E.A, BASELGA M., CIFRE J.

The influence of maternal effects in selection for litter size in rabbits

6èmes Journées de la Recherche Cunicole en France, INRA-ITAVI, La Rochelle 6-7 déc. 1994, 217-224.

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The selection for litter size at weaning was simulated for ten generations. Maternal effects has been considered in the simulation model. Twelve cases of genetic parameters were considered. The