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A PROTOTYPE OF COLONY CAGE FOR IMPROVING THE WELFARE OF RABBIT DOES: PRELIMINARY RESULTS

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The aim of the work was to ascertain if a collective cage matched the ethological needs of the doe and to define a reproductive management model for colony-breeding. Performance of animals was also evaluated. The colony cage dimension was 76W x 150L x 60H cm and it was equipped with four nest boxes (38 x 25 x 35 cm) at two heads of the cage. Twenty pluriparous New Zealand White does were artificially inseminated and the pregnant ones were transferred to colony cages (4 for each cage) or to single standard cages (38W x 60L x 34H cm). The housing system strongly affected the behaviour of animals. Does kept in colony cage performed the most of their

natural repertoire, while those of the control group some stereotypes, which substituted for normal behaviour. Reproductive performance was not affected by the type of cage. In both groups the sexual receptivity of does was satisfactory as well as the number and the weight of weaned pups. The cage prototype seemed to satisfy ethological and physiological needs of animals, also allowing good performance.

Key words: rabbit doe welfare, colony cage.

SOCIOMETRIC INVESTIGATIONS IN GROUPS OF WILD AND DOMESTIC RABBITS WITH ONE BUCK AND TWO OR THREE DOES

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Four groups with one buck and two or three does both in wild and domestic rabbits

were kept in two enclosures measuring 50m² each with 4 artificial nestboxes. The aggressive behaviour (aggressive attacks, biting, fighting) was continuously registered once a week during one hour before and one hour after dusk and dawn (total: 194 hours of observation). Data of wins and defeats were transformed into a winner-looser matrix and the sociometric parameters h, K, DC, matrix total as well as the percentages of unknown, one-way and two-way relationships were calculated. The results of the agonistic interactions and the calculation of sociometric parameters show a linear dominance hierarchy in groups of one buck and two or three does both in wild and domestic rabbits. With the exception of domestic rabbit group 1, 3, Landau's linearity index h and Kendall's coefficient of linearity K were very similar reaching values between 0.625 and 0.75. The sociometric parameter DC indicates a nearly or total complete unidirectionality (DC = 0.95 up to 1). This is in accordance with the result that the percentage of two-way relationships was zero in 3 of 4 groups. Although the social groups were relatively small between 33.3 and 50.0 % of all dyadic relationships were unknown relationships because the individuals did not fight against each other.

Key words: Wild rabbits, domestic rabbits, aggressive behaviour, sociometric measures.

EVALUATION OF THE USE OF STRAW AS AN ENTERTAINMENT IN *GIGANTE DE ESPAÑA* RABBIT CAGES: THE EFFECT OF THE PLACING OF THE STRAW IN CAGE ON THE BEHAVIOUR

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The instantaneous behaviour (direct, discontinuous recording every 5 minutes, 3 hours a day) of two groups of 13 adult females that received straw daily was evaluated. The straw was placed in between lateral walls of each two contiguous cages (group A) or in a metallic container fixed on the floor of the cage (group B). More than 70% of the does were occupied with the straw immediately after its distribution, but the frequency decreased up to 10% after the first hour of straw being made available to them. The dynamics of the resting behaviour was opposed to that of the occupation with the straw. The does spent more of their time resting to which followed the interaction with the straw and the self-grooming behaviour. There were no significant differences between groups in the interaction with the straw, but in other behavioural patterns (resting, self-grooming, feeding, movement, polishing, playing). The rabbits of group A have used more of their time on resting and less in the other activities than group B. The average intake of straw was 2 g per doe day (10 a.m.-6 p.m.).

Key words: rabbit does, straw, behaviour.

GROUPHOUSING OF BROILER RABBITS:
PERFORMANCES IN ENRICHED VS
BARREN PENS

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With the intention to have a distinct difference in stress conditions, broiler rabbits were housed in enriched pens at low stocking density or in barren pens at high density. In total 12 pens of 1.9 x 1.0 m were used for the experiment. Half of them were enriched with a plastic platform (92 x 40 cm), a hiding box (50 x 40 x 35 cm) and gnawing material. In these “welfare friendly” pens, rabbits were stocked at low density (17/pen or 8.95/m²). No enrichment was used in the barren pens and rabbits were stocked at double density (34/pen). Performances of the 306 rabbits were determined bi-weekly between day 29 and slaughter age. During the first 2 weeks, daily feed intake ($P<0.05$) and daily weight gain ($P<0.05$) were higher in the enriched pens: 97.0 and 46.3 g/rabbit and 91.4 and 43.9 g/rabbit, respectively for enriched and barren pens. In the following weeks, performances between enriched and barren pens were comparable. Clear signs of aggressiveness scored as injuries were not observed in any of the pens. Average weight gain during the overall fattening period, was somewhat favourable in the enriched pens (44.6 vs 43.5 g/rabbit/d, not significant).

Key words: rabbits, group housing, fattening, enrichment, performances.

THE FREE CHOICE OF RABBITS AMONG
IDENTICALLY AND DIFFERENTLY SIZED
CAGES

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The aim of this experiment was to obtain information on the free choice of early (at 3 weeks of age) weaned rabbits among different cages, depending on their age. In the first experiment the size of the cages in one cage block with 4 cages was identical (500 x 750 mm), while in the second the cages were differently sized (500 x 300, 500 x 600, 500 x 900 or 500 x 1200 mm). During the first trial 18, 24 or 30 rabbits (12, 16 and 20 rabbits/m²) were placed into one cage block; in the second one 8, 16 or 24 rabbits (5.33, 10.66 and 16 rabbits/m²) were applied. Rabbits were allowed to move freely among the cages of the block, through swing doors. 24-hour video recordings were taken weekly; the number of rabbits in the different cages was counted once every half hour. The mean of the 48 daily counts was handled as the result for the presence of rabbits in the different cages. In the first experiment, one week after the weaning some 68-77% of all rabbits were counted in a flock in one preferred cage (33-61 rabbits/m²); in the less preferred cages only 1-3% of the rabbits were counted. During the second week, the difference was still large between the most highly (32-46%) and the less preferred (9-17%) cages, but rabbits crowded in an other cage. According to the progress of the age (at the age of 9.5 weeks) the proportion of the rabbits in the largest group decreased to 37, 35 and 32%

(18, 22 and 26 rabbits/m²) and the number of animals in the smallest group increased to 12, 15 and 18%, according to the setting of 18, 24 or 30 rabbits in one cage block. The difference between the most and least preferred cages showed a continuously decreasing tendency; the cage choice tended to be equalized, although the difference was significant in the whole trial period. In the second trial most of the rabbits huddled in one of the two smallest cages, where the density was found to be 18, 70 and 40 rabbits/m² (8, 16 or 24 rabbits in one block). In the two larger cages the rabbit density ranged between 1 and 14 kits/m². This difference decreased up to the 2nd and 3rd weeks, though the number of rabbits was still significantly higher in the smallest cage. At the age of 6.5 weeks the difference in the cage choice tended to equalize, though the difference was significant in the whole trial period. The results prove that early weaned rabbits like to huddle together; this means that more (up to twice) than the conventional number (16 rabbits/m²) of rabbits can be fattened in one cage in younger age. It was also found that rabbits prefer to be in one smaller cage instead of a large one.

Key words: rabbits, behaviour, free choice, stocking density.

LOCATION AND SOCIAL BEHAVIOUR OF YOUNG RABBIT BUCKS

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Three 16 weeks old rabbit bucks were lodged in a set of three contiguous two-floor cages, projected to increase the floor surface

and to improve the welfare of the animals. They had the opportunity of looking at each other or not, and this chance was considered. The rabbits were firstly introduced in the upper floor and their behaviour was video-recorded each 12 minutes for 13 days. The trial had four replications to a total of 12 subjects. Since it was observed an initial explorative activity performed mainly during the second day, but with peculiar behavioural differences among subjects, this aspect was later studied in a second trial, by continuous video-recording of 3 rabbits. After a few days, the rabbits chose to lay preferentially in the lower floor (80.7% of the time; $P < 0.01$). The trend was already clear at the 3rd day (lower floor 74.1%; $P < 0.01$), while, during the second day, the explorative activity equalized the percentage of presences (50.9% lower floor vs 49.1% upper floor; $P = n.s.$). When rabbits had the chance of looking at each other they did it mostly. On the 2nd day this behaviour was slightly reduced as an effect of the explorative activity. From the 4th day rabbits located in the external cages were looking toward the subject nearby in the central cage 76.2% of the observed occurrences ($P < 0.01$). The general trends could be observed as a mean notwithstanding rabbits showed individually specific behaviours. The results of the second trial showed that rabbits have different latency periods, in a range of 20 to 47 hours, before beginning the explorative activity.

Key words: rabbit, behaviour, welfare.

FREE CHOICE OF GROWING RABBITS
BETWEEN DEEP LITTER AND WIRE NET
FLOOR IN PENS

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The free choice of rabbits between deep litter and wire net floor was investigated. The floor of a 2.89 m² pen was divided into two parts; one part was made of wire net, while the other one was covered with deep litter. Twenty-three, 35 or 46 rabbits, weaned at the age of 5 weeks were placed into one pen (8, 12 and 16 rabbits/m², resp.). A 24-hour video recording was performed every week; the number of rabbits on the deep litter or on the wire net was counted every half-hour. During the whole experimental period (between 5 and 10 weeks of age) 18, 14 and 14% of all rabbits was found on the deep litter, depending on the number of rabbits in one pen (23, 35 or 46, resp.). The feed intake was lower from the feeders placed to deep litter (28, 18 and 16% of the whole feed intake, respectively). According to the results, at normal temperature (16-18°C) rabbits prefer wire net floor, compared to deep litter.

Key words: rabbits, deep litter, wire net, free choice.

VOCALIZATION OF RABBIT PUPS IN
THE MOTHER-YOUNG RELATIONSHIP

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The vocalization of rabbit pups, within the first two weeks of life, from nine litters kept under various conditions was investigated. A sound recording was made using a condenser microphone with a frequency range from 40 to 20 000 Hz. Additionally all doe-pup contacts were recorded using infrared video technology. In litters with an average of 6.6 pups the mean number of vocalizations was 165 in 24 hours (n = 15 x 24 h). Rabbit pups vocalised in a frequency range from 374 Hz up to 667 Hz with a mean duration of 67 ms. The distribution of the vocalizations in the course of day showed maximum values during the night. During intervals when nursing occurred the mean number of sounds was much higher than in intervals without nursing. The investigation showed a strong rise in the number of sounds during the hourly interval prior to nursing. This implies a connection between the vocalization and the time of nursing. In 6 cases, in which the doe nursed her pups a 2nd time in 24 hours a rise in the sounds could not be determined, prior to the 2nd nursing. During the nursing, no difference in the number of sounds could be determined between the pups which were nursed once or twice a day. It can be concluded that the vocalization cannot be the only stimulus for time of nursing.

Key words: Vocalization, mother-young relationship, communication, nursing.

THE BEHAVIOUR OF FARM RABBITS IN THE DAY OF PARTURITION

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A total of 7 multiparous pregnant rabbit does were observed around parturition in order to study the pattern of behaviour and to try to establish some common pattern of their activities under farm conditions. A video covering the complete day when parturition of each doe took place was recorded, using an infrared lamp during the night and subsequently digitalised. Starting and ending time were registered for different female activities: feeding, caecotrophy, chewing, resting, grooming and nesting. For the analyse of frequency and time spent on each activity, a model considering the hour in relation to parturition (12 hours pre and post-partum), the light presence (day or night) and their interaction was used. As it was expected, a general tendency to decrease main activities recorded around parturition was observed, with the exception of time spent in the nest. Taking into account the relevance of the light presence on the rabbit behaviour, lighting level at parturition increased the variability between the animals, being required its inclusion in the model and conditioning the number of animals required for this type of experiments. Feeding time was about 9% of the total time (126 min per day), and it took place mainly during the night, showing some distortion and increasing after parturition independently of the light. Conversely, 78% of the time spent in caecotrophy practice was recorded during the day in a somehow irregular pattern. The frequency of grooming was more linked to the hour in relation to

parturition than to the light presence, and the time spent in the nest was steadily low before parturition increasing afterwards, but no significant differences were detected. The frequency of chewing, much higher during the night, decreased after -4 hour to the levels observed during the day, and this pattern had as a consequence the significant interaction found between the hour and light in the analysis. The results confirmed the general idea that rabbit does largely prefer the night for most activities even around parturition, and conversely resting time was higher during the day.

Key words: behaviour, parturition, rabbit does.

GROUP HOUSING OF GROWING RABBITS: EFFECT OF STOCKING DENSITY AND CAGE FLOOR ON PERFORMANCE, WELFARE, AND MEAT QUALITY

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Three hundred twenty rabbits weaned at 29 d (LW: 618 ± 65 g) were housed in group to evaluate the effect of stocking density and type of cage floor on behaviour, health status, growth performance, carcass and meat quality. Rabbits were put in groups of 8 in 40 cages of two sizes (110 x 60 cm and 100 x 50 cm) allowing two stocking densities (D12, 12.1 rabbits/m² vs D16, 16.0 rabbits/m²). Within density, two types of cage floor were compared (wire net vs slat) according to a 2 x 2 factorial arrangement with ten replications (cages). The rabbits were fed one single diet (CP: 17.6% DM, ADL: 5.7% DM, DE: 10.7 MJ/kg DM). No antibiotic was added to feed or water. Rabbit reactivity was

controlled by tonic immobility and open-field tests at 51 and 66 d of age. Rabbit behaviour was video-recorded at 57 and 68 d of age for 24 h. Rabbits were slaughtered at 71 d to evaluate carcass and meat quality. The dimensions and the resistance to fracture of femur and tibia were measured. Sanitary status and growth performance were highly satisfying in all treatments. Mortality was 1.6% during the trial. Daily growth rate averaged 48.5 g/d and live weight at 71 d 2655 g, with a feed efficiency of 0.327. Carcass and meat quality, and bone fracture resistance were unaffected by housing system. The highest stocking density stimulated daily weight gain during the first two weeks of trial (51.4 vs 52.9 g/d in D12 and D16 rabbits; $P<0.05$) but tended to reduce feed intake in the last two weeks (185 vs 179 g/d, $P=0.06$). Video recording, however, showed no difference in behaviour between stocking densities. Although stocking density had no overall effect on final weight or feed intake, feed efficiency was higher in D16 rabbits ($P=0.05$). During the open field test, the D16 rabbits spent more time moving than the D12 rabbits ($P=0.04$), whereas no difference in rabbit reactivity was observed during the immobility test. The effect of the type of cage floor was weak and limited to a slight reduction in feed intake during the last two weeks of trial, and therefore an improvement in feed efficiency throughout the study ($P=0.01$), by rabbits reared on the wire net floor in comparison with rabbits reared on the slatted floor (179 vs 185 g/d; $P=0.08$). During the open field test, rabbits reared in cages with wire net floor showed higher exploration activity ($P<0.01$) without any difference in reactivity during the immobility test.

Key words: stocking density, cage floor, welfare, growth performance, meat quality.

EFFECT OF HOUSING AND ENVIRONMENTAL ENRICHMENT ON PERFORMANCE AND BEHAVIOUR IN FATTENING RABBITS

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Aim of this research was to test the effect of housing and environmental enrichment (presence of a wood stick inside the cage) on the performance and behaviour of fattening rabbits. The trial was carried out in a commercial farm, in the North-West of Italy (Lombardia region, Bergamo province). 72 rabbits were housed after the weaning period, at 35 days of age, in standard fattening cages at 2, 3, 4 animals per cage, (density: 1045 cm², 697 cm² and 522 cm² respectively). Half cages were enriched using a wood stick (*robinia pseudoacacia*) hanging from the ceiling of the cage. The animals were fed *ad libitum* a commercial feed, and were weighted at 35, 55 and 75 days of age and slaughtered at 75 days of age under commercial conditions. Behaviour was video recorded at the beginning (1st period of observation) and at the end of the fattening period (2nd period of observation), 24 hours for each period. Thus each cage was observed 48 hours in total (288 scans per cage). No significant differences were found in any selected productive parameter (live weight, daily weight gain) among treatment groups. In detail, the live weight at slaughtering (75 days of age) was: 2626, 2540g for animals housed without and with environmental enrichment respectively; 2597, 2562 and

2592g for animals housed at 2-3-4 subjects per cage respectively. The animals' housing significantly affected the rabbits' behaviour. In fact, animals housed 2 per cage showed a higher variety of natural behaviours. The environmental enrichment affected the behaviour and not the performance. In fact, it decreases both oral stereotypies such as gnawing the bars of the cage, and alert, aggressive behaviour and self-grooming. This might indicate a better satisfaction of

the behavioural needs for the enriched caged rabbits, while the other ones may spend more time inactive and/or performing abnormal behaviours and consequently may show higher stress levels due to the frustration in a hypo-stimulating environment.

Key words: fatteners, housing, environmental enrichment, performance, behaviour.