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INFLUENCE OF TYPE OF REARING, SLAUGHTER AGE AND SEX ON FATTENING RABBIT: I. PRODUCTIVE PERFORMANCE

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iNFLUENCE OF TYPE OF REARING, SLAUGHTER AGE AND SEX ON FATTENING RABBIT: i. PRODUCTIVE PERFORMANCE

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ABSTRACT

The effects of type of rearing, slaughtering age and sex on performance of fattening rabbits were analysed over a four months period (September-December 1998). Four productive cycles were studied according to the following experimental treatments: 80 animals, living in open-air colony cages, slaughtered at 90 and 120 days; 80 animals, living inside in bicellular cages, also slaughtered at 90 and 120 days. Body, carcass and slaughtering measurements were recorded. The effect of slaughtering age and type of housing showed obviously better values for older (mainly slaughtering weight - SW, daily weight gain - DWG and carcass cold weight CCW, $P \leq 0.01$) and living indoor animals (mainly SW and DWG, $P \leq 0.01$), while very few differences were pointed out according to sex. Considering the interaction between slaughtering age and type of housing the higher CCW (1951 g) was found in the indoor living animals slaughtered at 120 days, but the better carcass dressing percentage - CDP was found for the outdoor living animals slaughtered at 120 days of age (57.42 %). These results evidenced better conditions (body and muscular improvement) of the outdoor living animals than indoor ones.

INTRODUCTION

In intensive rabbit rearing systems, the breeders' demands and animals’ welfare are taken into consideration. Previous research shows that surface, cages' material and density can directly affect animal comfort and productivity (Drescher, 1992; Rommers and Meijerhof, 1996). It is also well known that rabbits bred in open-air systems during the weaning-fattening period, could have the same productive performance as in traditional rearing systems (Crimella *et al*., 1996). Moreover, this kind of breeding system allows low management costs and better environmental conditions (Di Lella *et al.*, 1996; Paci *et al.*, 1999). Therefore, it can be foreseen that breeders, especially for the fattening period, could choose systems which allow better environmental conditions without comprising economic results and the health of the final product (Mirabito, 1998; Morisse, 1998). Aim of the present study is to compare the effects of breeding systems (indoor bicellular cages and outdoor colonies), slaughtering ages (90 and 120 days) and sex on the performance of fattening rabbits.

Material and methods

Farm and management

The trial was carried out on an intensive rabbit farm in the Northwest of Italy for a four months period (September-December 1998). In the rabbitry there were two buildings

dedicated to weaning and reproduction, which were ventilated naturally and had a heating system for wintertime. The photoperiod was of 16L:8D. There were also two tunnels and modular open-air systems for fattening rabbits. The animals fed a commercial compound feed (crude protein 16%, crude fibre 17.5%), administered manually and *ad libitum*
Temperature (11.7°C), relative humidity (77.3%) and rainfall (47mm) data, collected through the meteorological unit of the area in which the rabbitry is located, are around the mean season values.

Animals and experimental treatments

The animals (commercial hybrids) were divided into two homogeneous groups at the weaning age (5 weeks), according to litter, sex and weight at weaning (40 rabbits per group). A control group of animals (mean weight of 738±115g) was placed in bicellular indoor cages (California, 40x30x28cm). The second group (mean weight of 769±117g) was placed in outdoor cages (flat deck, 40x90x28cm, 6 animals per cage) below a roof (open-air system). In both types of cage, the animal surface was 0,06m^2 per head. The rabbits were slaughtered at 90 and 120 days of age according to the norms of rabbit butchery.

Animal performance

Daily weight gain (DWG) and slaughtering weight (SW) were recorded; then, other measurements were taken on live animals: body length (BL), rump length (RL), chest circumference (CC), abdomen circumference (AC), thigh circumference (TC) (Paci *et al*., 1997). At slaughtering, weights of skin, full intestine and paws (distal part of fore and hind legs) were observed. On the warm carcasses, the following *post mortem* measurements were noted: carcass dorsal length (CDL), carcass rump length (CRL), carcass chest circumference (CCC), carcass lumbar circumference (CLC) (Blasco *et al.*, 1993). Finally, weights of carcass (CCW) after 24 hours refrigeration at 4°C were noted and carcass dressing percentage (CDP) was calculated. On a sample of 34 animals, the weight of head, liver, kidneys and pluck (thymus, trachea, oesophagus, lung and heart) was also detected.

Statistical analysis

Data were analysed using a general linear model (GLM - SAS/STAT, 1990) taking in account the slaughtering age (90 and 120 days), the housing systems (indoor and open-air cages) and the sex as fixed effects. The interaction "slaughtering age x type of housing" was also utilised according to the following model:

$$Y_{ijkl} = m + a_i + b_j + g_k + a_i b_j + e_{ijkl}$$

Y_{ijkl} = dependant variable;
m = general mean;
a_i = fixed effect of slaughtering age (i = 1,2);
b_j = fixed effect of type of housing (j = 1,2);
g_k = fixed effect of sex (k = 1,2);
$a_i b_j$ = interaction effect between slaughtering age and housing;
e_{ijkl} = random effect.

Results and Discussion

The measurements, taken on live animals before slaughtering (table 1), showed that rabbits slaughtered at 120 days were heavier than younger ones (P≤0.01). A higher DWG was observed (P≤0.01) in 90-day animals. This situation was confirmed also by body linear measurements (BL, RL, CC, TC); they're higher in the animals slaughtered at 120 days (P≤0.01) than the other ones. In the 90-day animals, only the AC measure was upper (P≤0.01), probably due to a higher feed consumption that makes the belly bigger. Animals reared indoor had higher DWG (P≤0.01) and SW (P≤0.01), due to reduced movement in a small surface (0.06 m^2 compared to 0.36 m^2). Few differences were found in linear measurements; only CC was higher (P≤0.01) in inside living animals, probably related to the higher SW.

No significative differences were found amongst body measurements in males and females.

The interaction between slaughtering age and type of housing showed great differences in animals slaughtered at 120 days; the animals reared indoors were heavier and bigger than the others, which recorded the lowest DWG.

Table 1 - Least square means and standard error of body measurements

	SW (g)	DWG (g)	BL (cm)	RL (cm)	CC (cm)	AC (cm)	TC (cm)
n	160	160	160	160	160	160	160
Age (d)							
90	2758±29^{B}	36.61±0.42^{A}	36.65±0.19^{B}	12.39±0.16^{B}	27.48±0.17^{B}	29.78±0.33^{A}	14.09±0.14^{B}
120	3356±29^{A}	29.89±0.42^{B}	37.89±0.18^{A}	13.67±0.16^{A}	28.74±0.17^{A}	28.48±0.33^{B}	14.79±0.14^{A}
Housing							
Indoor	3156±29^{A}	34.10±0.42^{A}	37.10±0.19	13.00±0.16	28.53±0.17^{A}	28.89±0.33	14.63±0.14
Outdoor	2958±29^{B}	32.40±0.42^{B}	37.44±0.18	13.06±0.16	27.69±0.17^{B}	29.37±0.33	14.25±0.14
Sex							
Male	3036±30	33.00±0.43	37.24±0.19	13.13±0.17	27.89±0.17	29.21±0.34	14.46±0.15
Female	3078±28	33.49±0.40	37.30±0.18	12.92±0.16	28.34±0.16	29.05±0.32	14.42±0.14
Age*Housing							
90 In	2724±41^{C}	36.12±0.59^{A}	36.38±0.26^{B}	12.12±0.23^{B}	27.54±0.24^{B}	28.44±0.47^{B}	14.05±0.20^{B}
90 Out	2793±41^{C}	37.09±0.59^{A}	36.92±0.26^{b}	12.66±0.23^{b}	27.41±0.24^{B}	31.13±0.47^{A}	14.13±0.20^{B}
120 In	3589±41^{A}	32.07±0.59^{B}	37.83±0.26^{a}	13.88±0.23^{A}	29.53±0.24^{A}	29.35±0.47^{B}	15.20±0.20^{A}
120 Out	3123±43^{B}	27.70±0.59^{C}	37.95±0.26^{A}	13.46±0.23^{a}	27.96±0.24^{B}	27.60±0.47^{B}	14.38±0.20^{B}

Means values with different small letters, in the same column, showed a statistical significance of P≤0.05 and with different capital letters a statistical significance of P≤0.01.

The slaughtering measurements (table 2) were reported and analysed as percentage of live weight of each rabbit, to avoid the effect of differences in SW. These parameters pointed out a significative difference amongst animals slaughtered at different ages. In detail, intestines and fore and hind-paws weights were higher in younger rabbits (P≤0.01), due to the different development of tissues and internal organs.

For the same reason, the animals reared outdoor showed higher percentage values (skin, fore and hind-paws, P≤0.01; intestines, P≤0.05). The greater percentage of fore and hind-paws in the outdoor animals, according to other authors (Di Lella *et al.*, 1996; Xiccato *et al.*, 1999), could be also due to the bigger possibility to make exercise in such animals compared to the indoor ones.

As regard the sex, differences in slaughtering measurements were found between males and females, with skin and fore-paws heavier in males (P≤0.01 and P≤0.05, respectively) and intestines heavier in females (P≤0.01). Maybe it is due to the different body development in both sexes, more than to the presence of female reproductive organs.

For slaughtering measurements, a significative interaction between slaughtering age and type of housing could be noticed. For living measurements, the bigger differences were found in animals slaughtered at 120 days of age, reared indoor or outdoor cages (skin and fore-paws, P≤0.05; intestines and hind-paws, P≤0.01).

Table 2 - Least square means and standard error of slaughtering measurements

		Skin (%)	Intestines (%)	Fore paws (%)	Hind paws (%)
n		160	160	160	160
Age (d)					
90		15.78±0.18	17.81±0.21^{A}	0.84±0.01^{A}	2.61±0.03^{A}
120		15.54±0.18	15.43±0.21^{B}	0.71±0.01^{B}	2.20±0.03^{B}
Housing					
Indoor		15.32±0.18^{B}	16.30±0.21^{b}	0.74±0.01^{B}	2.29±0.03^{B}
Outdoor		16.01±0.18^{A}	16.94±0.21^{a}	0.80±0.01^{A}	2.52±0.03^{A}
Sex					
Male		16.21±0.19^{A}	16.22±0.22^{B}	0.79±0.01^{a}	2.44±0.03
Female		15.11±0.18^{B}	17.02±0.21^{A}	0.75±0.01^{b}	2.37±0.03
Age*Housing					
90	In	15.36±0.26^{b}	18.00±0.30^{A}	0.83±0.01^{a}	2.53±0.04^{B}
90	Out	16.21±0.26^{a}	17.62±0.30^{A}	0.84±0.01^{a}	2.68±0.04^{A}
120	In	15.28±0.26^{b}	14.60±0.30^{C}	0.65±0.01^{c}	2.04±0.04^{D}
120	Out	15.81±0.26^{ab}	16.27±0.30^{B}	0.76±0.01^{b}	2.37±0.04^{C}

Means values with different small letters, in the same column, showed a statistical significance of P≤0.05 and with different capital letters a statistical significance of P≤0.01.

The carcass measurements, except CDP, were affected by the age of animals (table 3). In fact, CCW, CDL, CLC and CCC showed statistically significant differences (P≤0.01) as well as CRL (P≤0.05), with higher values in animals slaughtered at 120 days of age. The carcass measurements did not show statistically significant differences in relation with the housing system, except for CLC and CCC (P≤0.01). The indoor animals showed higher values than outdoor ones; it is probably related to the higher slaughtering weight. No significative differences were found amongst carcass measurements divided for sex. Regarding the interaction between slaughtering age and type of housing, there were statistically significant differences for CCW, CDL, CLC and CCC (P≤0.01) and CDP (P≤0.05). Finally, the carcass composition (as percentage on live weight, table 4) was very lightly influenced from age and housing. In detail, the head and liver were heavier in younger animals (P≤0.01), as well as the pluck (P≤0.05) and the liver were also heavier in the outdoor animals (P≤0.01). Interaction between slaughtering age and type of housing affected only the head and the liver data (P≤0.05 and P≤0.01, respectively).

Table 3 - Least square means and standard error of carcass measurements

		CCW (g)	CDP (%)	CDL (cm)	CRL (cm)	CLC (cm)	CCC (cm)
N		144	144	160	160	160	160
Age (d)							
90		1562±23^{B}	56.03±0.49	30.24±0.15^{B}	8.26±0.08^{b}	21.21±0.14^{B}	18.08±0.15^{B}
120		1871±24^{A}	55.88±0.49	31.08±0.15^{A}	8.48±0.08^{a}	23.78±0.14^{A}	19.28±0.15^{A}
Housing							
Indoor		1750±23	55.37±0.48	30.64±0.15	8.37±0.08	23.16±0.14^{A}	19.17±0.15^{A}
Outdoor		1684±25	56.54±0.50	30.68±0.15	8.36±0.08	21.83±0.14^{B}	18.19±0.15^{B}
Sex							
Male		1732±25	56.61±0.51	30.43±0.16^{b}	8.40±0.08	22.60±0.15	18.45±0.15^{b}
Female		1701±23	55.31±0.47	30.89±0.15^{a}	8.34±0.07	22.39±0.14	18.91±0.15^{a}
Age*Housing							
90	In	1548±34^{C}	56.40±0.69^{a}	30.44±0.22^{B}	8.27±0.11	20.99±0.20^{C}	17.99±0.21^{B}
90	Out	1576±34^{C}	55.66±0.69^{ab}	30.04±0.22^{BC}	8.25±0.11	21.43±0.20^{C}	18.16±0.21^{B}
120	In	1951±32^{A}	54.34±0.66^{b}	30.85±0.22^{AB}	8.48±0.11	25.33±0.20^{A}	20.35±0.21^{A}
120	Out	1791±36^{B}	57.42±0.73^{a}	31.31±0.22^{A}	8.48±0.11	22.23±0.20^{B}	18.21±0.21^{B}

Means values with different small letters, in the same column, showed a statistical significance of P≤0.05 and with different capital letters a statistical significance of P≤0.01.

Table 4 - Least square means and standard error of carcass composition

		Head (%)	Liver (%)	Kidney (%)	Pluck (%)
n		34	34	34	34
Age (d)					
90		4.96±0.17[A]	3.09±0.10[A]	0.63±0.03	1.04±0.05[a]
120		4.24±0.20[B]	2.39±0.13[B]	0.59±0.03	0.82±0.07[b]
Housing					
Indoor		4.58±0.19	2.51±0.12[B]	0.64±0.03	0.93±0.06
Outdoor		4.62±0.18	2.97±0.11[A]	0.58±0.03	0.93±0.06
Sex					
Male		4.78±0.20	2.70±0.12	0.61±0.03	0.94±0.06
Female		4.42±0.17	2.78±0.11	0.60±0.03	0.92±0.06
Age*Housing					
90	In	4.87±0.24[ab]	2.86±0.15[Bb]	0.63±0.04	1.05±0.08
90	Out	5.05±0.24[a]	3.32±0.15[Aa]	0.63±0.04	1.03±0.08
120	In	4.29±0.31[ab]	2.15±0.19[C]	0.64±0.05	0.81±0.10
120	Out	4.19±0.27[b]	2.62±0.17[BC]	0.53±0.04	0.83±0.09

Means values with different small letters, in the same column, showed a statistical significance of P≤0.05 and with different capital letters a statistical significance of P≤0.01.

As a conclusion, different slaughtering age could be used even if with lower DWG, as found also by other authors (Di Lella *et al*., 1996; Luzi *et al*., 1999; Paci *et al*., 1999). That happens especially if animals were reared outdoor, without big influence on carcass dressing percentage, and if heavier but lean carcasses were requested, as showed by Cavani *et al.* (2000).

Beside, the choice of the open-air rearing system could be very interesting for the farmers, if a premium price is paid on market for this kind of rabbit (Lazzaroni *et al*., 2000)

Moreover, the colony open-air cages allow better environmental conditions (less dust, mould, and harmful gases) and animal welfare conditions more consistent with the market and consumer demands, especially in the fattening period compared to bicellular indoor cages.

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