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TECHNICAL NOTE: YEAR, SEASON, AND PARITY EFFECT ON WEANING PERFORMANCE OF THE CARMAGNOLA GREY RABBIT BREED

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Abstract: To evaluate the main environmental factors in the productivity of Carmagnola Grey rabbits –an endangered breed indigenous to northern Italy– data collected from a total of 1486 litters over 8 yr were analysed. Production data on the pure closed nucleus herd of the University of Turin were used. Effects of parity, season and age of weaning on the number of rabbits born alive and weaned, litter weight and individual average weight at weaning were studied. The following average performance rates over the 8 yr period were determined: 8.1 live born and 7.2 weaned kits per litter and a litter weight at weaning (on average of 35 d) of 7287 g or 1024 g individual weaning weight. Year and season both had a significant effect (P<0.001) on all the traits studied as well as weaning age (P<0.001). To summarise, all productive traits showed an improvement in the last two-three years of the trial, in does after the first delivery, and at the higher kid weaning age (6 week), while shown a decreasing in summer. The performances of the Carmagnola Grey rabbit are encouraging, even if not comparable to hybrid strains.

Key Words: local rabbit breed, year, season, parity, litter performance.

INTRODUCTION

An ongoing conservation programme for a local Italian breed (Carmagnola Grey Rabbit – from Piemonte), now underway for more than 20 yr in a closed nucleus herd selected for this purpose at the University of Turin (Pagano Toscano *et al.*, 1992), is the source of a large amount of data on phenotypic traits, reproductive parameters, slaughter weight and carcass quality, as well as on weaning performance and the growth curve of rabbits from birth to weaning (Lazzaroni, 2002, 2006; Toscano Pagano and Lazzaroni, 2004), with the final aim of also improving the breed from an economic and commercial viewpoint (Lazzaroni and Moriano, 2006).

Using the data collected over a period of 8 yr, the influence of main environmental factors (year, season, order of birth, age at weaning) on weaning performance of the Carmagnola Grey Rabbit were quantified.

MATERIAL AND METHODS

The trial was held from 1996 to 2003 in the breeding rabbitry (Department of Animal Science, Turin University), where a pure nucleus of the local breed Carmagnola Grey Rabbit is bred under semi-controlled environmental conditions, recording rabbit genealogy and performance.

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The rabbitry was equipped with 70 single flat-deck cages for does (0.4 m² with nest), 15 single flat-deck cages for bucks (0.4 m²), and a control system for (16 h/d), temperature (no lower than 12°C) and ventilation. The does were fed *ad libitum* with the same feed and reared with a semi-intensive system (first mating at least at 120 d of age and 3.5-4 kg of live weight, remating about 14-18 d after kindling, weaning at around 35 d of age, as general rules were occasionally modified according to needs), taking care to minimise the increase of the inbreeding coefficient.

Data on 1486 litters and 9438 weaned kits (1324 complete records) were collected and analysed using GLM (SPSS, 2008) and differences in mean values were tested by Duncan's multiple range test, using a first class error α=0.05 to accept the differences as significant.

Effects of year of birth (8 classes: from 1996 to 2003), weaning season (4 classes: spring, summer, autumn, winter), parity order (7 classes: from 1 to 5, 6-8, and 9-15), and age at weaning (4 classes: from 4 to 7 wk) were studied on the number of live born and weaned kits in each litter, the litter and the average individual weight at weaning, using the following model:

$$Y_{ijklm}=\mu+\alpha_i+\beta_j+\gamma_k+\delta_l+\varepsilon_{ijklm}$$

where Y=dependent variable, μ=general mean, α_i=fixed effect of year of birth, β_j=fixed effect of season at weaning, γ_k=fixed effect of parity order, δ_l=fixed effect of weaning age and ε_{ijklm}=residual error.

RESULTS AND DISCUSSION

The evolution of birth and weaning performance during the considered period (1996-2003) is reported in Table 1. Over the years, the number of live born and weaned kits was improved (from 6.63±2.78 to 8.10±2.72 and from 5.41±2.45 to 7.19±1.92, respectively; $P\leq0.001$), with a good effect also on mortality rate before weaning in contrast with expectation (Rashwan and Marai, 2000), and consequently also the litter weight (from 50417±2118 to 7287±1876 g; $P<0.001$) and the average individual weight at weaning (from 975±208 to 1025±136 g; $P<0.001$), even if the average daily gain in the first month seems be negatively affected by litter size at birth

Table 1: Means and standard deviation of birth and weaning performance according to year.

Year	No. of litters	No. of live born	No. of weaned kits	Weaning litter weight (g)	Average individual weight at weaning (g)
1996	100	6.63±2.78^{a}	5.41±2.45^{a}	5047±2118^{a}	975±208^{a}
1997	166	6.75±2.40^{a}	5.40±2.39^{a}	5023±2048^{a}	963±223^{a}
1998	192	7.16±2.43^{ab}	5.86±2.23^{ab}	5906±2067^{b}	1043±197^{c}
1999	128	7.39±2.29^{bc}	6.01±2.10^{b}	6018±2061^{b}	1020±170^{bc}
2000	64	7.86±2.06^{cd}	7.03±2.02^{c}	7206±2031^{d}	1035±120^{c}
2001	199	8.13±2.26^{d}	6.74±1.97^{c}	6620±2305^{c}	986±218^{ab}
2002	255	7.89±2.64^{cd}	7.09±2.10^{c}	7275±2152^{d}	1040±147^{c}
2003	220	8.10±2.72^{d}	7.19±1.92^{c}	7287±1876 ^{d}	1025±136^{c}
overall	1324	7.57±2.55	6.43±2.24	6403±2,256	1013±183

$^{a, b, c, d}$: Means not sharing superscript in a column are significantly different at $P<0.05$.

Table 2: Means and standard deviation of birth and weaning performance according to season.

Season[1]	No. of litters	No. of live born	No. of weaned kits	Weaning litter weight (g)	Average individual weight at weaning (g)
Spring	342	7.51±2.22 ^{b}	6.46±2.09 ^{bc}	6570±2121 ^{b}	1033±164 ^{b}
Summer	268	6.94±2.60 ^{a}	5.68±2.30 ^{a}	5417±2284 ^{a}	985±252 ^{a}
Autumn	357	7.97±2.51 ^{b}	6.86±2.20 ^{b}	6507±2202 ^{b}	1014±153 ^{b}
Winter	357	7.68±2.75 ^{cd}	6.53±2.25 ^{c}	6879±2201 ^{c}	1014±166 ^{b}
overall	1324	7.57±2.55	6.43±2.24	6403±2256	1013±184

[1] Season; Spring: March 1st to May 31st, Summer: June 1st to August 31st, Autumn: September 1st to November 30th, Winter: December 1st to February 28th.

a, b, c Means not sharing superscript in a column are significantly different at *P*<0.05.

(Poigner *et al.*, 2000). The results can be compared to those reported by Brun and Baselga (2005) for a synthetic rabbit strain.

The season has shown a significant effect ($P<0.001$) on all studied parameters (Table 2). In particular, the negative effect of temperature and relative humidity on summer production performance is confirmed (number of live born and weaned kits 6.94±2.60 and 5.68±2.30, respectively; weaned litter and individual weight 5417±2284 and 985±252 g, respectively), while in winter the productive performance was higher (number of live born and weaned kits 7.68±2.75 and 6.59±2.25, respectively; weaned litter and individual weight 6879.01±2201.41 and 1014±166 g, respectively). Spring and autumn showed average performance compared to the other seasons.

Parity order did not show an effect on the number of live born, but on the weaning parameters (Table 3; $P<0.05$), increasing according to mother age, from the 1st delivery to the 5th (from 6.07±2.33 to 6.67±2.31 for weaned kits, from 5924±2375 to 6761±2309 g for litter weight, and from 9897±189 to 1033±178 g for average individual weight). The worst values were reached by the females of 9th-15th parity order for all the analysed variables. This could be due to the adopted semi-intensive reproductive system, in which does are first inseminated later and are

Table 3: Means and standard deviation of birth and weaning performance according to parity order.

Parity order	No. of litters	No. of live born	No. of weaned kits	Weaning litter weight (g)	Average individual weight at weaning (g)
1	395	7.21±2.44^{a}	6.07±2.33^{a}	5923±2375^{a}	989±189^{a}
2	286	7.76±2.68^{a}	6.70±2.18^{b}	6653±2184^{b}	1012±184^{ab}
3	198	7.76±2.48^{a}	6.54±2.13^{ab}	6590±2124^{b}	1031±193^{b}
4	146	7.86±2.59^{a}	6.66±2.10^{b}	6585±2067^{b}	1009±186^{ab}
5	102	7.55±2.48^{a}	6.67±2.31^{b}	6761±2309^{b}	1032±178^{b}
6-8	144	7.72±2.52^{a}	6.45±2.12^{ab}	6585±2125^{b}	1036±152^{b}
9-15	53	7.19±2.58^{a}	6.15±2.46^{ab}	6299±2450^{ab}	1047±164^{b}
overall	1324	7.57±2.55	6.43±2.24	6403±2256	1013±184

a, b: Means not sharing superscript in a column are significantly different at *P*<0.05.

Table 4: Means and standard deviation of birth and weaning performance according to weaning age.

Weaning age (wk)	No. of litters	No. of live born	No. of weaned kits	Weaning litter weight (g)	Average individual weight at weaning (g)
4	44	6.39±2.61[a]	5.41±2.55[a]	4153±1773[a]	805±197[a]
5	366	7.32±2.48[b]	6.09±2.34[b]	5482±2131[b]	924±199[b]
6	837	7.76±2.55[b]	6.70±2.13[c]	6918±2113[c]	1048±148[c]
7	77	7.34±2.52[b]	5.61±2.23[ab]	6458±2441[c]	1177±169[d]
overall	1324	7.57±2.55	6.43±2.24	6403±2256	1013±184

[a, b, c,d]:Means not sharing superscript in a column are significantly different at $P<0.05$.

able to recover the standard weight between deliveries with no influence on litter size (Rommers *et al.*, 2002).

Weaning age is shown in terms of effect ($P<0.001$) on weaning performance (Table 4). In detail, the number of weaned kits improved from 4th to 6th wk of weaning age (from 5.41±2.55 to 6.70±2.13). Litter weight and individual average weight showed the same distribution (4153±1773 and 805±197 g for the 4th wk weaning, and 6918±2113 and 1048±148 g for the 6th wk weaning), according to the review of Pascual (2001).

The productive traits of this purebred rabbit are encouraging, even if not completely comparable to hybrid strains.

REFERENCES

Brun J.M., Baselga M. 2005. Analysis of reproductive performances during the formation of a synthetic rabbit strain. *World Rabbit Sci., 13: 239-252. doi:10.4995/wrs.2005.514*

Lazzaroni C. 2002. The Carmagnola Grey rabbit. *In: Khalil M.H., Baselga M. (eds.), Rabbit genetic resources in Mediterranean Countries. Options Méditerranéennes, B-38: 141-150.*

Lazzaroni C. 2006. Origin and productive performances of the Carmagnola Grey Rabbit. *The Fawn, the White and the Grey, vol. 5, Asproavic Piemonte – DSZ Unito, Carmagnola – Grugliasco (Torino), Italy. Available at: http://www.dsz.unito.it/Grigio/009.pdf*

Lazzaroni C., Moriano G. 2006. The role of Producers' Associations in the valorisation of traditional products: an Italian north-west poultry and rabbit breeds Consortium. *In: Olaizola A., Boutonnet J.P., Bernues A. (eds.), Mediterranean livestock production: uncertainties and opportunities. Options Méditerranéennes, A-78: 267-271.*

Pagano Toscano G., Lazzaroni C., Zoccarato I., Benatti G. 1992. Conservation and improvement of the Carmagnola Grey Rabbit. *Journal of Applied Rabbit Research, 15: 240-246.*

Pascual J.J. 2001. Early weaning of young rabbits: a review. *World Rabbit Sci., 9: 165-170. doi:10.4995/wrs.2001.461*

Poigner J., Szendro Zs., Levai A., Radnai T., Biro-Nemeth E. 2000. Effect of birth weight and litter size on growth and mortality in rabbits. *World Rabbit Sci., 8: 17-22. doi:10.4995/wrs.2000.413*

Rashwan A.A., Marai J.F.M. 2000. Mortality in young rabbits. A review. *World Rabbit Sci., 8: 111-124. doi:10.4995/wrs.2000.427*

Rommers J.M., Meijerhof R., Noordhuizen J.P.T.M., Kemp B. 2002. Relationships between body weight at first insemination and subsequent body development, feed intake and reproductive performances of rabbit does. *J. Anim. Sci., 80: 2036-2042.*

SPSS. 2008. SPSS Statistics 17.0. *SPSS Inc., Chicago, Illinois, USA.*

Toscano Pagano G., Lazzaroni C. 2004. Il Coniglio Grigio di Carmagnola: recupero e selezione della razza. *Rivista di Coniglicoltura, 41: 14-20.*