

## SELECTION DIFFERENTIALS AND PHENOTYPIC TRENDS FOR DAILY GAIN IN BOTUCATU RABBITS

Ana Sílvia A. M. T. MOURA\*<sup>1</sup>, Simone FERNANDES<sup>1</sup>, Thais F. M. BOZICOVICH<sup>1</sup>,  
Cynthia P. ZEFERINO<sup>1,2</sup>

\*corresponding author: [as.moura@unesp.br](mailto:as.moura@unesp.br)

<sup>1</sup> Universidade Estadual Paulista, UNESP, Faculdade de Medicina Veterinária e Zootecnia, Botucatu, SP, Brazil

<sup>2</sup> Universidade Brasil, Programa de Mestrado Profissional em Produção Animal, Descalvado, SP, Brazil

**Abstract:** O objetivo foi estimar os diferenciais de seleção e as tendências fenotípicas do ganho em peso médio diário pós-desmama (GPMD) de coelhos do grupo genético Botucatu de 2009 a 2017. A população consiste de 100 matrizes e 20 machos reprodutores. O procedimento de seleção envolveu pré-seleção de ninhadas com base no tamanho da ninhada a desmama, aos 35 dias de idade, seguida de seleção fenotípica individual para GPMD. Das 1.905 ninhadas produzidas foram pré-selecionadas 1.031 ninhadas, com seis ou mais coelhos a desmama. A cada ano foram selecionados de 5 a 9% dos machos e 12 a 24% das fêmeas das ninhadas pré-selecionadas com base no GPMD. Registros de 3.659 machos e de 3.728 fêmeas foram usados para estimar as tendências fenotípicas do GPMD. Os diferenciais de seleção esperados e realizados dos machos foram maiores do que o das fêmeas, devido à maior pressão de seleção sobre machos. Os diferenciais de seleção realizados foram inferiores aos esperados, em ambos os sexos, graças ao efeito da seleção natural. A tendência fenotípica foi de  $1,013 \pm 0,041 \text{ g dia}^{-1} \text{ ano}^{-1}$  ( $P < 0,0001$ ) para machos e de  $1,116 \pm 0,040 \text{ g dia}^{-1} \text{ ano}^{-1}$  ( $P < 0,0001$ ) para fêmeas, sugerindo que as tendências genéticas serão positivas também.

**Keywords:** growth rate, litter size at weaning, selection intensity

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## Introduction

The Botucatu genetic group is an albino, medium-sized strain descendent from Norfolk 2000 hybrids imported from England into Brazil in 1971. Since then, a closed population has been maintained at the UNESP selection nucleus in Botucatu, SP, Brazil. Only non-systematic selection and avoidance of mating between closed relatives were practiced for the first two decades after import and from 1995 to 1997. From 1992 to 1994 multi-trait index selection was carried out (Moura et al., 2001). Beginning in 1998, a program involving pre-selection of litters for litter size at weaning, followed by individual phenotypic selection for average daily gain has been implemented. The objective was to estimate selection differentials and phenotypic trends for average daily gain in the Botucatu genetic group selection nucleus from 2009 to 2017.

## Material and methods

The Botucatu rabbit selection nucleus, consisting of approximately 100 dams and 20 sires, was founded in 1971 at the UNESP Botucatu, SP, rabbitry. Beginning in 1998, a program involving pre-selection of litters for litter size at weaning, followed by individual phenotypic selection for average daily gain has been implemented. Rabbits from different generations have coexisted and could be mated, but mating between individuals whose relationship coefficient exceeded 0.125 was not allowed.

In the pre-selection of litters, the truncation point for litter size at weaning ranged from 6 to 8 rabbits, depending on the batch. There were 126 batches from 2009 to 2017. A total of 1,905 litters were evaluated for litter size at weaning; from those, 1,031 litters were pre-selected (Table 1). All first parity litters, irrespective of litter size at weaning, were excluded from the study.

Average daily gain was computed from weaning (35 d) up to market age (9 to 10 weeks). Weaned rabbits were housed in collective cages (6 to 7 rabbits per cage) and had free access to a commercial feed. Proportions of 5 to 9% of males and 12 to

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24% of females were selected as parents each year, based on average daily gain. Individual phenotypic selection was practiced, but sires were selected within sire families to minimize inbreeding. The maximum number of rabbits selected from the same litter was three (two females and one male). A total of 3,710 male and 3,901 female records were used in these analyses.

Table 1. Descriptive statistics of litter size at weaning for Botucatu litters with at least one rabbit weaned and of pre-selected litters from 2009 to 2017

Year	All litters weaned <sup>a</sup>				Pre-selected litters			
	N	Mean	SD	Range	N (%)	Mean	SD	Range
2009	244	6.67	2.18	1-12	168 (69)	7.78	1.38	6-12
2010	240	6.36	2.10	1-11	140 (58)	7.76	1.14	6-11
2011	249	6.94	2.17	1-12	154 (62)	8.20	1.28	6-12
2012	183	6.83	1.86	1-11	110 (60)	8.04	1.06	7-11
2013	168	6.20	2.31	1-11	89 (53)	7.90	1.25	6-11
2014	221	6.05	2.40	1-11	100 (45)	8.18	1.21	6-11
2015	196	6.15	2.30	1-11	95 (48)	8.05	1.02	6-11
2016	172	5.84	2.22	1-11	71 (41)	7.99	1.10	6-11
2017	232	6.09	2.24	1-11	104 (45)	7.96	1.16	6-11

<sup>a</sup> First parity litters not included

Expected (the product of selection intensity by the phenotypic standard deviation each year) and realized selection differentials for average daily gain (the difference between the mean phenotypic value of selected individuals and the mean phenotypic value of all rabbits measured each year) were estimated for males and females separately, because selection intensity was higher for males (Falconer and Mackay, 1996).

Phenotypic trends for average daily gain were estimated by the regression of trait phenotypic values on year, from 2009 to 2017. A total of 3,659 male and 3,728 female records were used in these analyses.

## Results and discussion

Decreasing trends for number weaned per litter and percentage of pre-selected litters were noticed over the years (Table 1). Depressing effects of inbreeding accumulation on reproductive performance and viability (Ragab et al., 2015) may have reduced the proportion of litters with a higher number of rabbits weaned. Daily gain was negatively correlated with semen quality in paternal lines selected for growth rate (Lavara et al., 2011) and embryo, fetal and perinatal losses were higher in paternal than in maternal lines (Vicente et al., 2012).

Expected and realized selection differentials were higher for males than for females, due to the higher selection intensity (Table 2). On the other hand, realized selection differentials were much lower than expected selection differentials for both genders (Table 2). Several factors may have contributed to this result. Differences of fertility and viability among selected individuals, which resulted in some parents contributing more offspring than others, may have been one of them.

Table 2. Expected and realized selection differentials for average daily gain ( $\text{g day}^{-1}$ ) of male Botucatu rabbits from 2009 to 2017

Year	Males				Females			
	N	Selected (%)	Selection differential		N	Selected (%)	Selection differential	
			Expected	Realized			Expected	Realized
2009	626	4.8	12.23	5.51	600	13.0	9.36	5.21
2010	384	8.3	14.15	7.82	584	11.8	9.03	6.81
2011	581	6.4	11.67	5.42	529	18.3	9.30	3.47
2012	378	5.6	11.77	6.34	432	12.7	9.52	4.15
2013	316	8.9	15.58	7.27	342	21.3	10.97	5.07
2014	353	8.2	9.66	5.62	383	20.1	7.18	4.88
2015	388	7.2	9.68	6.22	340	20.0	7.45	3.96
2016	272	8.8	10.54	4.76	275	24.4	7.38	3.55
2017	412	6.8	10.45	5.24	416	17.5	8.43	4.95

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Phenotypic trends for average daily gain were  $1.013 \pm 0.041 \text{ g day}^{-1} \text{ year}^{-1}$  ( $P < 0.0001$ ) for males and  $1.116 \pm 0.040 \text{ g day}^{-1} \text{ year}^{-1}$  for females ( $P < 0.0001$ ), suggesting that genetic trends would be also positive. These are preliminary results, thus further analyses incorporating pedigree data should be carried out to estimate inbreeding effects and genetic trends.

### Conclusion

Although the realized selection differentials were much lower than the expected selection differentials, phenotypic trends for average daily gain over a period of nine years were favorable. If we consider the postweaning period fixed at 35 days, final market weight have increased over 35 g each year. Further analyses incorporating pedigree data should be carried out to estimate inbreeding effects and genetic trends.

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