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Production and reproduction performances of exotic breeds of rabbit under tropical climatic conditions of Tamil Nadu

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ABSTRACT

Data on 755 kindlings observed in White Giant (n,374) and Soviet Chinchilla (n,381) breeds of rabbits between the year 2005 and 2009, were analyzed to assess the influence of genetic and non-genetic factors on different traits at tropical climatic conditions of Tamil Nadu. The overall least-squares means for litter size at birth and weaning, litter weight at birth and weaning and pre-weaning growth rate were 5.1, 3.9; 260.5 g, 2537.6 g; 51.6 g, 668.4 g and 14.5 g, respectively. Breed had highly significant effect only on litter weight at weaning, individual kit weight at weaning and pre-weaning growth rate. In general, year and season of birth had significant to highly significant effect on all the traits studied. The heritability estimates obtained for litter size at birth and weaning and litter weight at birth and weaning were 0.469, 0.493; 0.475 and 0.309, respectively. Monsoon season (June to Nov) were the most favourable season, whereas summer (March to May) proved to be the most unfavourable season for different production traits. Because of higher heritability estimates, mass selection is recommended for genetic improvement of the production traits in White Giant and Soviet Chinchilla breeds of rabbit.

Key words: Litter size, Litter weight, Soviet Chinchilla, White Giant

Rabbits are becoming increasingly popular as an additional source of animal protein to meet the increasing demand from the ever-growing human population. Rabbit rearing gained momentum in the recent past among the developing countries including India, owing to their high prolificacy, early maturity, shorter generation interval and efficient feed utilization (Ghosh *et al.* 2008). Rabbit meat is relatively rich in protein and low in fat comprising 60% unsaturated fatty acids. In addition, rabbit meat is highly digestible and rich in omega-3 fatty acids, often recommended by nutritionists over other meats (McCroskey 2000). For the overall improvement of the rabbit production and a profitable enterprise, the performance level needs to be established for the various genetic groups under the local climatic conditions. Production efficiency of commercial rabbitary depends on the number of young born alive at kindling and variability from birth to weaning. In addition, pre-weaning growth is an important phase in meat type rabbits and has an important bearing on the meat produced at finisher stage. The prolificacy and growth rate are affected by genetic (viz. breed) and non-genetic factors such as year, season, sex and parity (Rathore *et al.* 2000).

Studies on performance of broiler rabbits under tropical climatic condition of Tamil Nadu are limited and not comprehensive. Therefore, the present investigation was undertaken to study the productive and reproductive performances of 2 exotic breeds of rabbits for establishing the performance levels under the local climatic conditions. In addition, an attempt was made to estimate the heritability for different traits, which is needed for devising suitable selection and breeding plans.

MATERIALS AND METHODS

The data on 755 kindlings observed in White giant (n,374) and Soviet Chinchilla (n=381) rabbits born in the period between 2005 and 2009 were collected from Livestock Farm, Veterinary College and Research Institute, Namakkal. The climate is generally hot, semi-arid and tropical in nature with an average annual rainfall of 907 mm. The rabbits were reared under uniform managerial conditions by housing them individually in clean metallic cage. A standard prophylactic schedule of endo- and ecto-parasitic control, besides symptomatic treatment was adopted for the control of various diseases. The production traits such as litter weight at birth

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and weaning (g) and pre-weaning growth rate (g) and reproduction traits, viz. litter size at birth and weaning were recorded. The data were classified according to breed, year, season and parity of dam. For analysis, years considered were from 2005 to 2009 and each year was divided into 4 seasons, viz. winter (December to February), summer (March to May), south-west monsoon (June to August) and north-east monsoon (September to November) seasons. First six parities were considered and the parities six and above were grouped together as sixth parity. To study the main cause of variation and to overcome the difficulty of disproportionate subclass numbers and non-orthogonality, the data were analyzed by least-squares procedure of fitting constants (Harvey 1990). In the initial method, all the interactions were found to be non-significant and hence all interactions were ignored in the final model, which was $Y_{ijkl} = \mu + B_i + P_j + S_k + P_m + e_{ijkl.}$ where, Y_{ijkl} , observed production/reproduction traits; μ, population mean; B_i, effect of ith breed (i=1 and 2); P_j, effect of jth year (j = 1 to 5); S_k, effect kth season (k = 1 to 4); P_m, effect of mth parity (m = 1 to 6); and e_{ijkl}, random errors.

RESULTS AND DISCUSSION

Reproduction performance

Litter size at birth and weaning are important traits, which actually determine the number of kits for future breeding programme and lifetime productivity. The least squares mean estimates (±SE) of litter size at birth and weaning are presented in Table 1. In this study there was no significant difference in litter size at birth between breeds. This concurs with the findings of Rathore *et al*. (2000), Kumar *et al.* (2006) and Das *et al*. (2001). The highly significant (P<0.01) difference in litter size at weaning observed in this study was similar to the report of Ghosh *et al*. (2006). The mean litter size at weaning of 3.9±0.1 observed was comparable to the earlier reports made at high altitude and tropical climatic conditions of Tamil Nadu (Ghosh *et al.* 2006, Das and Sikka 2007). However, the mean litter size at birth and weaning observed was higher than those reported by Kumar *et al.* (2006).

Year of birth had a highly significant (P<0.01) effect of litter size at birth and weaning. The present findings were in agreement with the findings of Sood *et al.* (2006), the litter size at birth observed in the year 2006 was the highest and they differed significantly (P<0.05) with the values observed in other years. Season of birth had no significant effect on litter size at birth but it had highly significant effect (P<0.01) on litter size at weaning. The highest litter size at weaning was observed in winter season and they differed significantly (P<0.05) with other seasons. The lowest litter size at weaning was observed in summer season kindlers. Kumar *et al.* (2006) also reported nonsignificant effect of season on litter size at birth for exotic rabbit breeds maintained at high altitude condition of Tamil Nadu. Parity had significant effect (P<0.05) on litter size at birth and weaning. For both traits,

Table 1. Least squares means (±SE) reproductive performance of rabbits

Effects	n	Litter size at birth	Litter size at weaning
Overall	755	5.1±0.1	3.9±0.1
Breed			**
White Giant	374	5.16±0.1	4.1±0.1^b
Soviet Chinchilla	381	5.09±0.1	3.7±0.1^a
Year of birth		**	**
2005	152	5.5±0.2^d	4.7±0.1^d
2006	216	5.3±0.1^c	4.2±0.1^c
2007	171	4.9±0.1^{ab}	3.7±0.1^b
2008	170	5.0±0.1^b	3.6±0.1^a
2009	46	4.9±0.3^a	3.5±0.2^a
Season of birth			**
Winter (Dec to Feb)	196	5.4±0.1	4.2±0.1^d
Summer (Mar–May)	183	5.1±0.1	3.6±0.1^a
Southwest monsoon (Jun-Aug)	146	4.9±0.2	3.8±0.1^b
Northeast monsoon (Sep to Nov)	230	5.2±0.1	4.0±0.1^c
Parity		*	*
First	179	5.5±0.1^c	4.1±0.1^b
Second	128	5.2±0.2^b	4.1±0.1^b
Third	97	5.1±0.2^b	4.1±0.2^b
Fourth	74	5.0±0.2^{ab}	3.7±0.2^a
Fifth	55	5.1±0.2^b	3.9±0.2$_{ab}$
Sixth and above	222	4.8±0.1^a	3.6±0.1^a

* P<0.05, ** P<0.01. Means bearing same superscript do not differ significantly (P>0.05).

lower values were observed in sixth and above parity and they differed significantly (P<0.05) with those kindling in first, second and third parities.

The overall gestation period pooled over the breed was 32.6±0.1 days. There was no difference in the gestation period among the breeds. Similar non-significant effect of genetic group on gestation period was described by Das *et al*. (2001) and Kumar *et al*. (2006).

Production performance

The least- squares means (±SE) for different production traits are set out in Table 2. The overall mean litter weight at birth pooled over different breeds observed was comparable with the values reported by other researchers (Sood *et al.* 2006; Singh and Jilani 2006). However, higher (Das and Sikka 2007) and lower (Kumar *et al.* 2006) than the present estimate was also reported for rabbits maintained in different places in India. The average individual kit weight of 51.6±0.5 g observed was comparable with the value reported by Gnana Prakash and Ramesh Gupta (2008). On the contrary, Ghosh *et al.* (2006, 2008) reported higher individual kit weight for

Table 2. Least squares means (±SE) production performance of rabbits

Effects	n	Litter weight at birth (g)	Kits weight at birth (g)	Litter weight at weaning (g)	Pre-weaning growth rate (g)	Weaning weight (g)
Overall	755	260.5±2.4	51.6±0.5	2537.6±28.7	14.5±0.2	668.4±8.8 (2370)
Breed				**	**	*
White Giant	374	261.2±3.1	51.9±0.7	2420.9±37.3[a]	13.6±0.3[a]	657.7±10.6[a] (821)
Soviet Chinchilla	381	259.7±3.1	51.3±0.7	2654.3±36.8[b]	15.4±0.3[b]	679.1±8.9[b] (1549)
Year of birth		**	*	**	**	**
2005	152	258.7±4.5[b]	51.1±1.0[ab]	2463.5±54.1[c]	13.6±0.4[a]	627.9±9.4[a] (489)
2006	216	270.7±3.7[b]	53.0±0.8[bc]	3006.9±44.0[d]	17.6±0.3[b]	768.4±7.9[d] (664)
2007	171	268.2±4.2[b]	54.1±0.9[c]	2367.4±50.2[a]	13.7±0.4[a]	621.2±9.4[a] (464)
2008	170	255.6±4.1[b]	50.8±0.9[a]	2353.4±49.1[a]	13.9±0.4[a]	651.0±8.6[b] (555)
2009	46	249.1±8.0[a]	49.1±1.7[a]	2496.6±95.6[b]	13.7±0.7[a]	693.4±14.7[c] (198)
Season of birth		**	**	**	**	**
Winter (Dec to Feb)	196	262.5±4.0[b]	52.1±0.9[b]	2185.2±47.7[a]	12.5±0.3[a]	604.8±10.1[a] (710)
Summer (Mar – May)	183	237.5±4.1[a]	46.6±0.9[a]	2571.7±49.6[b]	14.8±0.4[b]	656.0±11.6[b] (596)
Southwest monsoon (Jun-Aug)	146	268.8±4.8[b]	53.2±1.0[bc]	2759.7±57.1[d]	15.8±0.4[c]	722.5±13.4[d] (367)
Northeast monsoon (Sept to Nov)	230	273.0±3.8[c]	54.6±0.8[c]	2633.7±45.5[c]	14.9±0.3[b]	690.4±11.0[c] (697)
Parity				**	**	**
First	179	255.1±4.1	50.4±0.9	2155.0±48.9[a]	12.4±0.4[a]	572.7±14.0[a] (560)
Second	128	262.3±4.8	51.7±1.0	2351.2±56.9[b]	13.4±0.4[b]	616.3±16.2[b] (404)
Third	97	266.5±5.3	53.5±1.1	2600.5±63.7[c]	14.3±0.5[c]	660.9±18.2[c] (301)
Fourth	74	254.5±6.0	50.2±1.3	2593.7±72.0[c]	15.1±0.5[d]	674.9±20.6[c] (231)
Fifth	55	260.7±7.0	51.7±1.5	2697.1±83.8[d]	15.4±0.6[d]	695.1±23.9[c] (174)
Sixth and above	222	263.7±3.8	52.2±0.8	2827.9±45.4[e]	16.4±0.3[e]	735.5±13.0[d] (700)

* $P<0.05$, ** $P<0.01$. Means bearing same superscript do not differ significantly ($P>0.05$). Figures in parentheses are number of observations.

exotic breeds of rabbit maintained at subtropical climatic conditions of India. The litter weight at weaning observed for different breeds were lower than the value reported by Singh and Jilani (2006) and Ghosh *et al.* (2006, 2008). The overall individual kit weight at weaning and pre-weaning growth rate obtained in this study were comparable with the reports of Ghosh *et al*. (2006). A slightly higher than the present estimate was also observed by Kumar *et al.* (2006)

Breed had no significant effect on litter weight at birth and individual kit weight at birth, however, litter weight at weaning, individual kit weight at weaning and pre-weaning growth rate differed highly significantly ($P<0.01$) between the breeds studied. Significant effect of litter weight at weaning was also reported by Kumar *et al.* (2006) and Laxmi *et al.* (2009) for broiler rabbits reared at different places in India. However, Ghosh *et al*. (2008) reported non significant effect of breed on individual kit weight at birth. Year of birth had significant ($P<0.05$) to highly significant ($P<0.01$) effect on all the production traits, which was comparable with the finding of Sood *et al*. (2006). Season of birth had highly significant ($P<0.01$) effect on all the production traits studied. Kits born during the monsoon seasons attained a significantly ($P<0.05$) higher body weight than those born during summer seasons. The seasonal effect upon the early growth performance of rabbit was also reported by Kumar *et al*. (2001, 2006), Sood *et al*. (2006) and Ghosh *et al.* (2008). The difference associated with the kindling season can be attributed to the prevalent environmental conditions and to stress factors affecting feed intake. The higher growth rate during monsoon season could be due to the availability of abundant supplies of green forage. Sex had no significant effect on individual kit weight at weaning. Similar observations were made by Kumar *et al.* (2006) and Sood *et al*. (2006).

The heritability estimates for litter size at birth, weaning and litter weight at birth, weaning were 0.469±0.141, 0.493±0.141; 0.475±0.141 and 0.309±0.131, respectively. The heritability estimates obtained for litter size at birth and weaning were in close agreement with earlier studies (Sood *et al.* 2006, Singh and Jilani 2006). The higher heritability estimates of different traits reveals its governance by genotype of the individual. The higher heritability estimate is also indicative of a high genetic variability among the population for the traits studied. Because of higher heritability estimates obtained for different traits, mass selection is recommended for further genetic improvement.

From the results of the present study, it may be concluded that both breeds performed well in tropical climatic conditions of Tamil Nadu and could be used for profitable meat production. The highly significant influence of non-genetic factors such as season of birth and year of birth observed on different production trait emphasizes the role played by the management in optimizing the realization of genetic potential under local agro-climatic conditions. Monsoon seasons presented the most beneficial values of rabbit performance, whereas the summer season offered the worst returns. The higher heritability estimates obtained for different traits indicated that traits are largely governed by additive gene action, hence adopting individual selection programmes can attain improvement of the traits studied.

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