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Growth and litter traits in crossbred pigs across the non-genetic factors

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ABSTRACT

Records of 195 crossbred pigs (75 % Landrace + 25% Desi), raised over a period of 2 years from 2014 to 2015, maintained at the Livestock Production Research (Pigs), Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh were used in this study to determine the effect of various environmental factors on growth and litter traits. Growth was recorded in terms of body weight at birth and thereafter at weekly interval up to 8 wks and then at 12, 16, 20 and 24 weeks of age. Generation interval had a significant effect on body weights at all ages. Piglets born in first generation had higher growth at most of the study period. Effect of sex was significant on body weight at most of the ages, except at 7, 8, 16 and 24 week. Male piglets had a higher growth at most of the weeks except at birth, 8 and 16 weeks. Piglets born in season II (March, April, May and June) had higher growth at most of the weeks, except at 4 and 5 weeks. Season of birth had a significant effect on body weight at birth, 1, 4, 5, 7, 8, 12, 16 and 20 weeks of age. Effect of year of birth was significant on body weight at birth, 1, 2, 6, 16 and 20 weeks of age only. Piglets born in 2014 had higher growth at most of the weeks, except at 4, 5, 6, 7 and 8 weeks of age. Generation I & II had a significant effect on litter traits, except average weight at birth. Piglets born in second generation had higher litter traits compared to the first generation. Effect of parity of dam was also significant on all litter traits.

Key words: Body weight, Crossbred pigs, Litter traits, Non-genetic factors.

Pig breeding programmes have been very successful with focus on few traits of economic importance, particularly growth and litter traits. Selection for growth is implemented at two stages in India. Piglets are formerly selected based on weaning weight and thereafter breeding pigs are selected during post-weaning period. Profitability of pig enterprise primarily depends on overall reproductive performance comprising age at first farrowing, farrowing interval, litter traits, sex ratio, and pre-weaning mortality (Singh and Khanna, 2000; Neopane, 2005; Siagian *et al*., 1986). These traits are also important to reduce the cost of rearing and generation interval and to increase genetic gain per unit of time (Das *et al*., 2005; Sharma and Singh, 1993). Crossbreeding has been widely used in India to improve the genetic makeup of local pigs. Various grades, developed during the process of crossbreeding reveal that performance declined in F2 due to many reasons including segregation loss (Gaur *et al*., 1999). The objective of the present study was to determine the influence of generation and other non-genetic factors on growth and litter traits in crossbred pigs.

The data were collected from Livestock Production Research (pigs), Indian Veterinary Research Institute (ICAR - IVRI), Izatnagar (UP), India, a unit of ICAR-AICRP on pigs which was started in 1970 to study the performance of exotic breeds of pigs under different agro-climatic conditions. This centre is situated at an altitude of 564 feet above the mean sea level at 28^0N latitude and 79^0E longitude. The climate of this place touches both the extremes and relative humidity ranges between 15 and 85 percent. A total of 195 crossbred (75% Landrace + 25% Desi) pigs, born during 2014 – 2015 were included in the present study. Weight at birth (W0), and that at 1 week interval upto 8 weeks of age (W1, W2, W3, W4, W5, W6, W7, W8) , and at 12 (W12) ,16 (W16), 20 (W20) and 24 (W24) weeks ; litter size at birth (LSB), litter size at weaning (LSW), litter weight at birth (LWB), litter weight at weaning (LWW), average weight at birth (AWB) and average weight at weaning (AWW) were recorded and used for analyzed. Each year of birth was divided into 2 farrowing seasons based on agro-climatic conditions (November to February, season I; March to June, season II). Data were analyzed in two sets i.e. for growth & litter traits using SAS Package with the following models:

$$\text{(i) } Y_{ijklm} = \mu + Y_i + S_j + SE_k + G_l + e_{ijklm}$$

where,

Y_{ijklm} = Observation on m^{th} pig in i^{th} year of birth, j^{th} season of birth, k^{th} sex group and l^{th} generation

μ = Overall mean

Y_i = Effect of i^{th} year of birth (1 & 2)

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S_j = Effect of j^{th} season of birth (1 & 2)
SE_k = Effect of k^{th} sex (male & female)
G_l = l^{th} generation (1& 2)
e_{ijklm} = Random error~NID (0, $ó^2_e$)
(ii) $Y_{ijk} = \mu + PA_i + Gj + e_{ijk}$
where,
Y_{ijk} = Observation on k^{th} pig in i^{th} parity and j^{th} generation
μ = Overall mean
PA_i = Effect of i^{th} parity (1 & 2)
G_j = j^{th} generation (1 & 2)
e_{ijk} = Random error~NID (0, σ^2_e)

Least - squares analysis of variance and means of growth traits are shown in Table 1. Body weight showed a continuous increase over age from birth to 24 weeks. Similar results were also observed by Singh and Khanna (2000) and Das *et al*. (2005) in Large White Yorkshire and Hampshire Pig breeds. Generation had significant effect on body weights at all the weeks. Piglets born in first generation had higher growth at most of the weeks as compared to second generation. Similar results were also reported by Singh and Khanna (2000) in Large White Yorkshire pigs. Effect of sex was significant on most of the body weights, except at 0, 7, 8 & 16 week of age. Male piglets had a higher growth similar observation was also reported by Gaur *et al.* (1999). Season had a significant effect on body weight at birth, 1, 4, 5, 7, 8, 12, 16 & 20 week of age. Piglets born in season II had a higher growth at most of the weeks, except 4^{th} and 5^{th} week. Significant effect of season of birth on growth were also observed by Mukhopadhyay *et al.* (1992) and Deo *et al*. (1979) in crossbred pigs. Effect of year of birth was significant on body weight at birth, 1, 2, 6, 16 & 20 week of age only. Piglets born in 2014 had higher growth at most of the weeks, except 4^{th}, 5^{th}, 6^{th}, 7^{th} and 8^{th} weeks.

Least - squares analysis of variance and means of litter traits are shown in Table 2. Effect of parity of dam was significant on all litter traits. First parity dams had lower litter traits compared to second parity dams. Second parity dams had better litter traits as compared to first parity dams. Significant effect of parity of dam on litter weight at birth and weaning in this study was in accordance with the reports of Thapa *et al*. (2009), Pokharel *et al.* (2013) and Mohanty and Nayak, (1986). Generation I & II had significant effect on litter traits, except average weight at birth. Second generation dams showed higher litter traits at birth and weaning as compared to 1^{st} generation dams. Improvement in performance in 2^{nd} generation was however, unexpected phenomena in crossbred population. Performance, in general, declines in F2 as a consequence of segregation loss. Unexpected results in the present investigation might be due to less number of observations in the study and varying status of parity of dams in two generations was in accordance with the report of Gaur *et al*. (1999).

Table 1 : Least – squares analysis of variance and means of growth traits of crossbred pigs

	Least – squares mean												
Factor	**W0**	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**	**W7**	**W8**	**W12**	**W16**	**W20**	**W24**
m	1.06±0.02	1.99±0.04	3.19±0.06	4.50±0.09	5.60±0.12	6.86±0.15	7.83±0.15	8.98±0.17	10.39±0.19	18.21±0.35	30.65±0.49	44.19±0.63	60.39±0.68
Sex-	*	*	*	*	*	*	-	-	*	-	-	-	
Male	1.03±0.51	1.99±0.34	3.40±0.08	4.67±0.15	5.67±0.30	6.84±0.19	7.75±0.18	8.41±0.64	9.55±0.91	18.72±0.34	30.83±0.78	44.49±0.44	60.87±0.18
Female	1.05±0.51	1.92±0.34	3.20±0.08	4.41±0.15	5.44±0.30	6.49±0.19	7.37±0.18	8.27±0.64	9.59±0.91	18.14±0.34	31.12±0.78	43.65±0.44	59.22±0.18
Generation	*	*	*	**	*	**	**	**	**	*	**	*	*
1	1.02±0.40	2.03±0.03	3.43±0.02	4.89±0.03	6.25±0.01	7.59±0.01	8.43±0.01	9.38±0.01	10.81±0.01	19.92±0.01	32.69±0.03	46.13±0.04	64.17±0.01
2	1.05±0.40	1.87±0.03	3.16±0.02	4.20±0.03	4.85±0.01	5.74±0.01	6.69±0.01	7.29±0.01	8.32±0.01	19.92±0.01	32.69±0.03	46.13±0.04	64.17±0.01
Season of birth**		*	*	-	*	*	-	**	**	**	**	**	**
1	1.15±0.01	2.09±0.07	3.43±0.12	4.57±0.85	5.43±0.44	6.48±0.32	7.67±0.59	9.14±0.02	10.40±0.07	20.66±0.01	34.23±0.01	48.77±0.01	60.47±0.62
2	0.92 ± 0.01	1.82±0.07	3.17±0.12	4.52±0.85	5.67±0.44	6.85±0.32	7.45±0.59	7.53±0.02	8.73±0.07	16.19±0.01	27.77±0.01	39.35±0.01	59.62±0.62
Year of birth	*	*	*	-	-	*	*	*	-	-	**	**	-
2014	1.11±0.03	2.03±0.21	3.55±0.22	4.64±0.58	5.43±0.57	6.31±0.15	7.37±0.46	8.29±0.85	9.36±0.52	20.63±0.01	34.24±0.01	47.95±0.02	60.16±0.91
2015	0.96±0.03	1.88±0.21	3.05±0.22	4.45±0.58	5.67±0.57	7.01±0.15	7.76±0.46	8.39±0.85	9.77±0.52	16.23±0.01	27.76±0.01	40.18±0.02	59.93±0.91

μ= Overall mean, W0, W1, W2, W3, W4, W5, W6, W7, W8, W12, W16, W20, W24 = Body weight at birth, 1, 2, 3, 4, 5, 6, 7, 8, 12, 16, 20 and 24 wks of age

Table 2: Least – squares analysis of variance and means of litter traits of crossbred pigs

	Least – squares mean					
Factor	**LSB**	**LSW**	**LWB**	**LWW**	**AWB**	**AWW**
m	8.83±0.23	6.84±0.31	8.40±0.27	46.89±1.90	0.97±0.02	7.79±0.42
Generation	*	**	**	*	-	**
1	8.15±0.05	5.86±0.02	7.66±0.09	43.78±0.13	0.95±0.79	9.00±0.05
2	9.45±0.05	7.80±0.02	9.07±0.09	49.67±0.13	0.97±0.79	6.53±0.05
Parity	**	*	**	*	*	*
1	7.99±0.07	6.19±0.04	7.33±0.02	41.88±0.01	0.94±0.36	8.20±0.31
2	9.61±0.07	7.48±0.04	9.40±0.02	51.57±0.01	0.99±0.36	7.33±0.31

μ= Overall mean, LSB = Litter size at birth, LSW= Litter size at weaning, LWB = Litter weight at birth, LWW = Litter weight at weaning, AWB = Average weight at birth, AWW = Average weight at weaning; **P < 0.01 and *P < 0.05

CONCLUSION

The results of the present study recorded that body weights in pigs at most of ages from birth to 24 weeks of age are influenced by generation, sex and season and year of birth. Similarly litter traits are affected by parity of dam and generation. These results underline the need to adjust the performance records for non-genetic factors for genetic evaluation of crossbred pig herd.

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