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Effect of Various Genetic and Non-genetic Factors on Reproductive Traits in Large White Yorkshire Crossbred and Tamworth Crossbred Pigs

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ABSTRACT

The data on reproductive performance of 1850 crossbred pigs belonging to three genetic groups viz. ½ LWY-desi crossbred (845), ¾ LWY-desi crossbred (790) and ½ Tamworth-desi crossbred (215) maintained at AICRP on Pigs, Adhartal, Jabalpur (M.P.) covering period from 1994 to 2010 were subjected to least squares analysis to study the effect of genetic and non-genetic factors. The least squares means for litter weight at birth were 7.18±0.24 and 6.61±0.24 kg for ½ and ¾ LWY-desi crossbreds and 7.13±0.24 kg for ½ Tamworth-desi crossbreds respectively. The least squares means for litter weight at weaning were 55.82±2.58, 61.03±2.31 and 61.93±3.54 kg for ½ LWY-desi, ¾ LWY-desi and ½ Tamworth-desi crossbred respectively. The present investigation showed a significance influence of period and season of birth on litter traits indicated the potential for optimizing production performance of pig providing optimal environmental conditions.

Keywords: Least squares means, litter size, litter weight, LWY & Tamworth crossbreds

Pig is one of the most prolific and efficient feed converting domestic animal amongst the livestock. They grow very rapidly, mature quickly and provide quick and maximum return. Optimum production from pig can only be obtained through efficient breeding. Pig farming can be a promising source of meat production in India with inherent characteristics of its short generation interval, high prolificacy, higher dressing percentage, higher growth rate and efficient feed conversion ability and also because of its valuable quality of utilizing agriculture produce and other waste through scavenging (Yadav *et al*., 1993). It is expected that even though industry may develop in India to any extent, but piggery shall continue to be a subsidiary occupation and a major source of income for backward class and landless tribes of

India. Considering all facts, it is important to study the genetic potential of Large White Yorkshire and Tamworth crossbreds with respect to the various reproductive traits and also to know how these traits are influenced by various genetic and non-genetic factors.

MATERIALS AND METHODS

The data on 1850 pigs were collected from All India Coordinated Research Project (AICRP) on Pigs Livestock Farm, Jabalpur (M.P.), covered over a period from 1994 to 2010 belonging to three genetic groups viz. half bred Large White Yorkshire (LWY) crossbred (845), three-fourth bred Large White Yorkshire (790) and half bred Tamworth (215) crossbreds.

The pre-weaning and post-weaning body weight were recorded at monthly intervals from birth to 8 month of age. The weaning was done at the age of 60 days. The year was divided into 3 season on the basis of climatological data viz., Pre-Monsoon (January to May), Monsoon (June to September) and Post-Monsoon (October to December). The whole data were grouped into 3 periods of 5 years each viz., period 1 (1994 to 2000), period 2 (2001 to 2005) and period 3 (2006 to 2010). Least squares analysis was done to see the effect of genetic and non-genetic factors on weight at different ages and Duncan multiple range test as modified by Kramer (1957) was employed for pair-wise comparison means. Data corrected for significant non-genetic effects was utilized for estimating phenotypic correlations.

RESULTS AND DISCUSSION

Body weights at Birth and slaughter

The overall least square means (LSM) various reproductive traits are depicted in Table 1. The LSM of body weights at birth and weaning (2 months) of LWY and TMW grades ranged from 0.92 ±0.02 to 1.03 ±0.01 kg and 8.77±0.05 to 9.64 ±0.50 kg respectively. The LSN of weight at slaughter age (8 months) of 50% LWY, 75% and 50%TMW grades were 42.29 ±0.27, 43.51±0.31kg and 49.50±3.10 kg respectively. LSM body weights from birth to slaughter were found to be significantly different ($p<0.05$) for different LSW and TMW grades. The present body weights were found comparable with the findings of Phookan *et al*. (2009) and Sharma (2009) in crossbreds pigs.

The season wise LSM for monthly body weights in pre-monsoon season were found to lowest than the other seasons i.e. monsoon and post-monsoon seasons. The reason might be due to the heat stress conditions in the pre-monsoon months and in post-monsoon season there is availability of plenty of fodder, the rate of fodder is also economic that time and no heat stress conditions. The observations are in close agreement with the findings of Gupta *et al*. (1982), Gawande (2005) and Sharma (2009).

Table 1: Overall least squares means±SE for litter traits of crossbred pigs

Parameters		n	Litter size at birth Mean ± S.E.	Litter size at weaning Mean ± S.E.	Litter Weight (kg) at birth Mean ± S.E.	Litter Weight (kg) at weaning Mean ± S.E.	Body Weight (kg) at birth Mean ± S.E.	Body Weight (kg) at weaning Mean ± S.E.	Body Weight (kg) at Slaughter Mean ± S.E.
Genetic Group									
50% LWY		845	7.78 ±2.18^{a}	6.943 ±2.27^{a}	7.18 ±0.24^{a}	61.03 ±2.31^{a}	0.92±0.02^{b}	8.77±0.05^{b}	42.29±0.27^{b}
75% LWY		790	7.16 ±2.18^{b}	6.461 ±2.27^{b}	6.61 ±0.24^{c}	55.82 ±2.58^{b}	0.93±0.04^{b}	8.78±0.04^{b}	43.51±0.31^{b}
50% TMW		215	7.21 ±2.23^{b}	6.462±3.13^{b}	6.79 ±0.23^{b}	61.93 ±3.54^{a}	1.03±0.01^{a}	9.64±0.50^{a}	49.50±3.10^{a}
Period of birth (pooled overall genetic groups)									
1994-2000		531	6.26±5.24^{b}	6.39±0.58^{b}	6.63±0.46^{b}	55.83±5.30^{c}	0.92±0.01^{b}	8.71±0.08^{b}	39.01±0.50^{c}
2001-2005		346	6.86±7.88^{b}	7.09±0.82^{a}	6.86±0.67^{b}	58.72±6.19^{b}	0.88±0.01^{c}	8.43±0.15^{b}	42.58±0.76^{b}
2006-2010		836	7.57±4.85^{a}	6.68±0.59^{a}	7.26±0.46^{a}	61.71±4.75^{a}	0.97±0.02^{a}	9.59±0.10^{a}	49.14±0.61^{a}
Season of birth									
Pre- Monsoon	50% LWY	295	7.24±3.24^{b}	6.61 ±2.05^{b}	6.96 ±0.35^{a}	58.19 ±3.23^{b}	0.94±0.06^{b}	8.76±0.21^{b}	41.63±0.27^{b}
	75% LWY	257	7.61±2.87^{a}	6.74 ±3.02^{a}	6.74 ±0.37^{a}	57.76 ±3.26^{c}	0.92±0.07^{b}	8.70±0.17^{b}	41.49±0.34^{b}
	50% TMW	73	6.98 ±2.75^{b}	6.41 ±2.35^{b}	6.12 ±0.43^{b}	62.52 ±2.25^{b}	1.01±0.02^{a}	9.17±0.04^{a}	45.80±1.68^{a}
Monsoon	50% LWY	316	7.56±3.14^{a}	6.57 ±3.24^{a}	7.05 ±0.42^{b}	56.62 ±3.21^{b}	0.93±0.03^{b}	8.94±0.22^{b}	44.17±0.65^{b}
	75% LWY	221	7.75±2.64^{a}	6.84 ±2.38^{a}	6.82 ±0.41^{b}	56.35 ±3.23^{c}	0.89±0.03^{b}	8.79±0.19^{b}	42.83±0.52^{c}
	50% TMW	70	7.11 ±2.57^{b}	6.18 ±2.64^{b}	7.89 ±0.32^{a}	57.61 ±3.32^{c}	1.03±0.02^{a}	9.80±0.18^{a}	50.99±0.99^{a}
Post- Monsoon	50% LWY	285	7.28±3.32^{a}	7.10 ±2.52^{b}	6.97 ±0.42^{a}	61.13 ±3.21^{b}	0.96±0.08^{a}	9.02±0.10^{b}	45.19±0.72 ^{b}
	75% LWY	261	7.45±3.11^{a}	6.85 ±2.27^{b}	6.85 ±0.35^{a}	60.52 ±3.31^{c}	0.89±0.03^{b}	8.78±0.29^{c}	43.62±0.41 ^{c}
	50% TMW	72	6.85 ±2.77^{b}	7.82 ±3.45^{a}	6.38 ±0.29^{b}	65.67 ±2.65^{a}	1.05±0.01^{a}	11.04±0.11^{a}	55.49±0.33 ^{a}

$^{a\text{-}c}$ *Values within columns with different superscripts differ significantly ($P < 0.05$). LWY-Large White Yorkshire, TMW-Tamworth*

The genetic group wise LSM at slaughter age for both sexes were higher in 50% TMW (49.50±3.10 kg) than 75% LWY (43.51±0.31 kg) and 50% LWY (42.29±0.27 kg). The present findings are in close agreement with the reports of Jogi and Lakhani (2001) and Sharma (2009).

Gestation Periods

The overall LSM gestation periods were 112.85±2.13, 111.92±1.87 and 111.65±1.43 days respectively for 50 % LWY, 75% LWY and 50% TMW crossbred pigs. The present findings are in close agreement with the reports of Jogi and Lakhani (2001) and Prasanna *et al*. (2009).The non-significant effect of genetic groups observed in the present study is in conformity with the findings of Jogi and Lakhani (2001) and Prasanna *et al*. (2009). Significant effect of periods ($p<0.05$) and season of birth ($p<0.05$) was found on gestation periods. The present findings are in close agreement with the reports of Mukhopadhyay *et al* (1992) and Prasanna *et al*. (2009).

Litter size at Birth (LSB)

The overall LSM of LSB were 7.78 ±2.18, 7.16 ±2.18 and 7.21±2.23 for 50% LWY, 75% LWY and 50% TMW grades respectively. The Least Square Analysis of Variance for year, season and breed effects showed significant effect (Pd”0.05) of year and genetic group. Year wise LSM showed a wide variation from 5.38 ±5.67 in 1999 to 8.56 ±45.91 in the year 1997 of LWY crossbred grades and TMW crossbred grades showed a variation from 6.75 ±6.16 in year 2007 to 7.67 ±6.48 in the year 2008. The differences within year could be due to different managemental and hygienic conditions during different years. These findings are in comparison to Sharma (2009). The performances of sows were almost same in all the three seasons. LSM value had difference between 50% LWY, 75% LWY and 50% TMW grades which is greater for half-breeds of LWY and TMW i.e. 7.78 ±2.18 and 7.21 ±2.23 respectively than 75% LWY (7.16 ±2.18) grades. It could be attributed to the fact that as the blood inheritance approaches towards more purity, then the breed requires their own environmental conditions and performance is reduced in the unfavorable conditions.

Litter Size at Weaning (LSW)

The overall LSM of LSW were 6.943 ±2.27, 6.461 ±2.27 and 6.462 ±3.13 for 50% LWY, 75% LWY and 50% TMW grades respectively. These findings are in disagreement with Johar *et al*., (1974). Post monsoon season showed the highest LSM value due to well availability of fodder and the maternal influence for both LWY and TMW crossbreds. These findings are in agreement with Johar *et al*., (1974) and Sharma (2009). All the effects i.e. year, season and breed were found to be non significant. However, Gawande (2005) reported a highly significant sex effect on litter size at Weaning. Significant effect of sex have also been reported by Sukhdeo *et al*. (1979), Das *et al*. (1982) and Sharma (2009).

Litter Weight at Birth (LWB)

The overall LSM of LWB were 7.18 ±0.24, 6.61 ±0.24 and 6.79 ±0.23 for 50% LWY, 75% LWY and 50% TMW grades respectively. A significant year effect and breed effect (Pd"0.05) on litter weight at birth was found. These values are in agreement with the findings of Jogi and Lakhani (2000) and Sharma (2009). However, Gawande (2005) recorded a significant effect of genetic group on litter weight at birth.

Litter Weight at Weaning (LWW)

The overall LSM of litter weight at Weaning were 61.03 ±2.31, 55.82 ±2.58 and 61.93 ±3.54 kg for 50% LWY, 75% LWY and 50% TMW grades respectively. This follows the same trend of litter weight at birth. Year wise LSM showed a wide variation varying from 46.48±7.13 kg to 69.29±4.91 kg. for LWY grades in the year 1999 and 1997 respectively and for TMW grades in the year 2007 and 2008 ranged from 58.61 ±4.36 kg to 65.23 ±5.95 kg respectively, which could be due to availability of a small amount of data and the chances of error variances are more. A significant year effect (Pd"0.05) was found due to different managemental practices. The effect of season and breed were non-significant. Year effect was also significant (Pd"0.05) in the findings of Gawande (2005) and Sharma (2009).

Correlations

The Phenotypic Correlation for sow productivity traits are ranged from 0.94±0.2 to 0.81±0.3 and 0.74±0.01 to 0.82±0.02 for LWY and TMW grades respectively. Most of the phenotypic correlations are at higher side with positive direction. Environmental correlations also followed the same trend where some values are higher with positive direction. It shows that there is high influence of environmental factors on the sow productivity traits. Prasanna *et al.* (2009) also reported significant and positive phenotypic correlations among litter traits in crossbred pigs.

Heritability estimate

The h2 estimates of LWY and TMW crossbred pigs for traits LSB, LSW, LWB and LWW were 0.19 ±3.89 and 0.18 ±2.21, 0.10 ±4.10 and 0.10 ±4.13, 0.58 ±4.13 and 0.58 ±5.52 and 0.37 ±4.23 and 0.36 ±4.28 for LWY and TMW crossbred pigs respectively. These results were expected because these are the reproductive traits and have low heritability. The present findings are in close agreement with Schlindwein (1975), Gupta *et al*. (1982) and Sharma (2009). However the results are not in agreement with the findings of Johar *et al*. (1974) and Mishra *et al*. (1989).

The present investigation showed a non-significant influence of genetic groups on reproductive traits. The significance influence of period and season of birth on litter traits indicated the potential for optimizing production performance of pig providing optimal environmental conditions. Monsoon season appeared to be favorable as the sows farrowing during this season had larger heavier litters.

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