Genetic and Non-Genetic Factors Affecting Reproductive Traits of Pakhribas Pig in Nepal

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ABSTRACT

Pakhribas pig is a black colour pig and is highly preferred by the people in the Eastern hills of Nepal. This breed was developed in Nepal by three-way crossing of exotic breeds (Saddle back, Fayuen and Tamworth) at Agricultural Research Station (ARS), Pakhribas, the then Pakhribas Agricultural Centre (PAC). The data of 348 pigs, born over a period of fifteen years (1990 to 2004) were used to study the effect of non-genetic factors on reproductive traits and estimate their genetic parameters. The findings revealed that the overall gestation length and farrowing intervals were 113.7 ± 0.12 days and 182.5 ± 2.2 days, respectively. Season of birth and parity of dams were not important sources of variation for reproductive traits, where as year affected these traits significantly. Heritability estimates of gestation length was low (0.02 ± 0.094), but heritability for farrowing interval was moderate (0.14 ± 0.147) suggesting selection based on farrowing interval would bring the improvement in the trait.

Key words: Genetic and non-genetic parameters, hills of Nepal, Pakhribas pig, reproductive traits

INTRODUCTION

Pakhribas pig is a result of three-way crossing of exotic breeds (Saddle back, Fayuen and Tamworth) developed at Agricultural Research Station (ARS), Pakhribas, the then Pakhribas Agricultural Centre (PAC) (Oli 1986, Gatenby et al 1990, Aryal et al 1992). The breed is very popular in the eastern hills of Nepal because of its black colour and a good litter size at birth and weaning (Gatenby et al 1990). For religious purposes, black colour is preferred over other colours in the eastern hills. It is medium in size and can be maintained by the farmers in the hills.

The performance records indicate that they are good in productive characters including the reproductive parameters. A study carried out at On-farm situation aiming to compare the productivity of Pakhribas pigs with the local and its crossbred with Pakhribas pigs showed that the Pakhribas pigs produced 90% more meat than the local and 60% than its crossbreeds at the farmers' feeding and husbandry system (Oli 1986). This indicated that Pakhribas pigs are more productive and well suited to local environments.

Information on genetic and non-genetic parameters of litter traits for Pakhribas pigs is available (Neopane 2005). However, information on the non-genetic and genetic factors affecting reproductive traits is not available for Pakhribas pigs. The study was undertaken to estimate the non-genetic factors affecting reproductive traits and estimate their genetic parameters. In order to accomplish the study, a retrospective study was done and for this data obtained over fifteen years were analysed.

MATERIALS AND METHODS

The study was conducted at Pakhribas Agricultural Centre (PAC), Dhankuta district, in the Eastern mid hills of Nepal. The area was located at an altitude of 1740 m above sea level. The geographical location is 27° 17' N and 87° 17' E.

Records of pigs born from sixteen sows and four boars were used for the study. Pigs with piglets were kept at separate farrowing pen. Piglets were provided heat by electric bulbs. In farrowing pen rice straw was kept in order to make bed for the mother and also to maintain the temperature. Piglets were weaned at 6 weeks of age and at this age they were distributed to the farmers.

Data recorded over fifteen years (1990 to 2004) for reproductive traits of Pakhribas pigs at the centre were analysed to estimate genetic and non-genetic factors affecting the traits. For this least-squares analysis techniques based on unequal subclass (Harvey 1990) were performed using the following model;

$$Y_{ijk} = u + a_i + b_j + c_k + e_{ijkl}$$

Where , μ is overall mean
a_i is the effect of i_{th} parity of dam (i = 1, 2,…..14)
b_j is the effect of j_{th} season of birth (j = 1, 2, 3)
c_k is the effect of k_{th} year of birth (k = 1, 2,…..15)
e_{ijkl} is a random element assumed to be normally and independently distributed

An overall analysis, ignoring sires and dams, was used first to examine environmental effects. Then sires and dams were included in the model as random effects to estimate the genetic components of variance and to eliminate non-significant fixed effects (Harvey 1990).

RESULTS AND DISCUSSION

Non-genetic factors
Least-square means of reproductive traits are presented in Table 1. The least square mean of farrowing interval (FI) in the herd was 182.5 ± 2.2 days. This value corresponds to earlier reports for Pakhribas pigs (Aryal et al 1992, Shrestha 2000). The figure was slightly lower than the average records of 191 days by Dhaubdel and Pokharel (1997) using the three genotypes (Landrace, Yorkshire and their crosses) in Khumaltar, Kathmandu, Nepal. A higher value of farrowing interval was also reported for Landrace (196 days) and Yorkshire (206 days) in Kathmandu, Nepal (SARP 1992). These indicated that Pakhribas pigs are better than exotic breeds in terms of farrowing intervals.

The least square mean of gestation length (GL) in the herd was 113.7 ± 0.12 days. The value obtained was close to the records reported by Shrestha (2000) for Pakhribas pigs. This value also corresponds to the value reported by Fahmi and Bernard (1972) for European breeds of pigs. The value is well in range within values reported in the literature.

Parity of dam and season of birth were not important source of variation for reproductive traits (Farrowing interval and Gestation length). This suggested that the Pakhribas pigs can be reared up to 14th parity without any decline productivity level. Year was however, significant source of variation for farrowing interval (P < 0.05) and gestation length (P < 0.001). The probable reason for significant effect of year on farrowing interval was better environment (mild climate, less parasitic burden, less diseases, etc) in some years than others. Year itself is not a good environmental or non-genetic factors for any production traits (farrowing interval). However, its effect has to be corrected before heritability estimation of the trait is made.

Table 1. Least-squares means of reproductive traits (days) of Pakhribas pigs for different non-genetic factors

Factors	Farrowing interval			Gestation length		
	N	Mean	SE	N	Mean	SE
Overall	307	182.5	2.2	348	113.7	0.12
Parity of dams						
1	-	-	-	40	113.3	0.30
2	42	179.9	5.1	42	113.9	0.32
3	32	179.1	5.6	32	112.8	0.34
4	30	177.2	5.7	30	113.8	0.34
5	28	185.6	5.9	28	113.9	0.36
6	25	171.1	6.3	25	113.3	0.39
7	23	177.4	6.2	23	113.5	0.38
8	22	184.0	6.3	22	113.9	0.39
9	20	181.9	6.8	20	114.3	0.39
10	19	179.3	6.8	20	113.9	0.42
11	18	183.5	7.3	18	113.8	0.45
12	17	182.6	7.4	17	113.8	0.46
13	16	203.4	8.1	16	114.4	0.50
14	15	187.8	7.9	15	113.8	0.49
F-test		ns			ns	
Season of birth						
Early dry (Dec-Feb)	65	185.9	4.4	75	113.5	0.25
Late dry (Mar-May)	91	177.4	3.4	105	113.6	0.19
Wet (Jun-Nov)	151	184.2	2.6	168	114.1	0.15
F-test		ns			ns	
Year of birth						
1990	12	174.5	12.9	15	115.1	0.50
1991	13	182.9	8.1	14	113.6	0.49
1992	13	190.1	8.0	19	115.2	0.42
1993	15	198.5	7.6	15	113.9	0.47
1994	16	187.9	7.3	20	113.3	0.41
1995	22	186.3	6.4	25	113.1	0.38
1996	26	183.6	5.8	29	113.3	0.35
1997	28	193.5	5.6	30	113.9	0.34
1998	32	174.8	5.1	32	112.3	0.32
1999	30	166.9	5.4	30	113.1	0.34
2000	21	169.5	6.3	27	112.8	0.35
2001	22	186.6	6.2	24	113.0	0.37
2002	21	175.8	6.3	25	114.7	0.36
2003	19	184.6	8.2	23	114.8	0.46
2004	17	182.5	7.8	20	114.6	0.44
F-test		*			***	

N, Number of records. SE, Standard errors.

Genetic factors

Heritability estimates of reproductive traits are presented in table 2. Heritability estimates of gestation length was low (0.02 ± 0.094) but estimates of heritability for farrowing interval was moderate (0.14 ± 0.147) suggesting selection based on farrowing interval would bring the improvement. Crump et al (1997) reported moderate estimates of heritability for gestation length. Estimates of heritability for farrowing interval from the study are close to several research reports (Johansson 1981, Rydhmer et al 1995, Tholen et al 1996, Crump et al 1997). However, some other authors have reported lower estimates of heritability for farrowing interval ranging from 0.06 to 0.09 (Johansson and Kennedy 1985, Adamec and Johnson 1997, Oh et al 2005). Haley et al (1988) reviewed the estimates for farrowing intervals within a range of 0.04 to 0.22.

Table 2. Heritability estimates of reproductive traits of Pakhribas pigs

Trait	Heritability	Standard error
Farrowing interval	0.14	0.147
Gestation length	0.02	0.094

Low to moderate estimates of heritability indicated that some genetic variance is available for these traits and hence selection based on the trait (farrowing interval) may bring genetic improvement and consequently improve productivity by reducing farrowing interval.

CONCLUSION

Non-significant effect of parity on farrowing interval (1-14 parity) suggested that the pigs may be reared up to 14 parity without declined productivity level in terms of farrowing intervals. Moderate estimates of heritability for farrowing interval indicated that the dams if selected based on the shorter farrowing interval may improve the traits.

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