



A comparative analysis of reproductive performance of different pig breeds under intensive management systems in sub-tropical climate

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ABSTRACT

A comparative study was undertaken to evaluate the reproductive performance of various pig breeds reared under intensive system of rearing in sub-tropical climate. Trends in reproductive performance were studied in different breeds with respect to age at puberty and first fertile service, weaning to estrus interval (WEI), farrowing interval, litter size and farrowing indices. Analysis of data revealed earlier age at puberty in Ghungroo (7.8 ± 0.41 months) and crossbred pigs (7.86 ± 0.17 months). Correspondingly, age at first fertile service were earlier in crossbred sows (8.94 ± 0.16 months) and Ghungroo (9.3 ± 0.43 months). In general, an extended WEI could be observed in all breeds and the delay was more pronounced in primiparous compared to multiparous sows. Litter size at birth was significantly higher in Ghungroo (8.7 ± 0.25) and crossbreds [HS $\times$ GH (8.5 ± 0.48) and HS $\times$ NM (8.2 ± 0.55)] in comparison to other groups. Average numbers of piglets weaned per sow were significantly higher in Ghungroo sows and its crosses. Average pre-weaning mortality was found to be significantly lower in crossbreds with Hampshire-desi crosses having the lowest rate (2.94%). Out of all groups, crossbreds had a higher farrowing index value of 2.01 while indigenous breeds had a relatively lower farrowing index (1.72). Significant influences of different genetic groups on various reproductive variables were observed in the present study while environmental factors and selection practices also appeared to contribute overall variations in the reproductive performance.

Key words: Breed, Intensive management system, Reproductive performance, Sows

In tropical countries like India, pig rearing is considered as a valuable component in rural farming systems for providing viable employment opportunities to the tribal masses and resource-poor farmers (Tochhawng and Rewani 2013). Overall production efficiency of pig farming is majorly influenced by reproductive performance of the breeding herd (Ate and Oyedipe 2011). From the point of investigation, it is important to analyze reproductive performance and to record various reproductive problems in female breeding herd. Several attempts were made to evaluate and compare growth and reproduction parameters of pig breeds under different production systems (Petry and Johnson 2004, Kumari *et al.* 2008 and Saiprasanna *et al.* 2009). However, there still exists a paucity of concrete data regarding reproductive performance of pigs reared under intensive management systems of sub-tropical climate. Collection and analysis of such pertinent data is necessary to solve major reproductive problems and to plan sound reproductive management strategies under the changing

climatic scenario. In the light of the aforesaid facts, present study was carried to evaluate and compare reproductive performance of pig breeds reared under intensive management system.

MATERIALS AND METHODS

The breeds represented in this study were Hampshire (HS), Duroc, Ghungroo (GH), Niang Megha/Meghalaya Local (NM) and their crosses maintained in the Institute Farm Complex, National Research Centre on Pig, Rani, (Guwahati, Asom, 26.01° Lat. N., 91.34° Long. E, 56 metres above MSL). Herd records on 181 sows from six herds with individual performance data collected over a period of three years (2009–2011) were analyzed in relation to overall reproductive performance (Table 1). Reproductive traits such as age at puberty, age at first fertile service, weaning to estrus interval (WEI), farrowing interval (FI), farrowing index, litter size at birth, at weaning and pre-weaning mortality were evaluated in different breeds separately. Mean values with standard error of means were obtained for different variables at the breed level. Pre-weaning mortality, farrowing rate were expressed as percentages. Student's *t*-test was used to compare the means and the *P* value of less than 0.05 was considered as statistically significant.

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Table 1. Number of records used for analysis in each herd

Parameter	Number of observations			
	Exotic breeds	Indigenous	Cross bred	Total
Age at puberty	36	44	45	115
Age at first fertile service	36	44	41	111
Weaning-estrus interval	67	147	46	260
Farrowing interval	49	111	36	177
Litter size	91	194	55	340
Generation interval	36	44	40	107

RESULTS AND DISCUSSION

Descriptive statistics for different reproductive variables are presented in Table 2. Age at puberty and first fertile service in pigs were mostly influenced by body size and weight. Generally indigenous gilts attained puberty at 7–9 months of age. A comparative analysis of data revealed significantly earlier ($P<0.05$) age at puberty in indigenous breeds and HS × GH crossbred pigs (Table 2). Genetic factors have been considered to influence gonadal development, puberty and sexual maturity. Present finding of early age at puberty in indigenous breeds is in accordance with the previous report that indigenous pigs attained puberty and sexual maturity earlier than exotic breeds (Kumaresan *et al.* 2007). In the present study, mean age at puberty for other breeds ranged from 9.2 to 11.18 months. Correspondingly, age at first fertile service was also earlier in HS × GH crossbreds and Ghungroo with a range from

8.94 to 9.30 months. Average age at first fertile service for other breeds ranged from 10.28 to 12.18 months.

Weaning to estrus interval (WEI) is an important reproductive trait in pig production. Interval from weaning to estrus may be considered as non-productive days of sow and this is an economically significant trait for commercial swine production because longer sow non-productive days increase maintenance costs and decrease overall reproductive efficiency. Reduced daily feed intake during lactation, inadequate estrus detection and sows farrowed in the summer often have an extended weaning-to-estrus interval. Results from the present study revealed significantly shorter ($P<0.05$) WEI in crossbreds and Duroc sows and ranged from 21.75 to 26.54 days. Indigenous sows had an extended weaning to estrus interval with significantly longer ($P<0.05$) WEI in Niang Megha and Ghungroo breeds (Table 2). Resumption of estrus after weaning was delayed in a variable proportion of indigenous sows and possible nutrient drain during lactation might have a direct effect on resumption of cyclicity and subsequent weaning to estrus interval. Nutritional deficit and loss of backfat thickness during lactation is well known to increase the weaning to estrus interval, especially in primiparous sows (Skorjanc *et al.* 2008). In the present study, mean gestation period range was similar among the indigenous and crossbred pigs ($P>0.05$) with an overall least squares mean of 114.15 ± 0.23 days. Nevertheless, relatively longer gestation lengths were observed in Duroc and shorter gestation length in Ghungroo pigs (Table 2). Published literature revealed that gestation period ranged from 111.38 to 112.9 days in crossbreds

Table 2. Mean performance of different reproductive traits in exotic, crossbred and indigenous pigs reared under intensive management system (mean±SEM)

Reproductive traits	Hampshire (HS)	Duroc	Ghungroo (GH)	Niang Megha (NM)	HS × GH	HS × NM
Age at puberty (months)	10.1±0.69 ^b	11.18±0.65 ^b	7.8±0.41 ^a	9.85±1.08 ^b	7.86±0.17 ^a	9.2±0.39 ^b
Age at 1 st fertile service (months)	12.01±0.55 ^b	12.18±0.65 ^b	9.3±0.43 ^a	10.96±1.09 ^b	8.94±0.16 ^a	10.28±0.41 ^b
Age at 1 st farrowing (months)	15.98±0.21 ^b	16.18±0.15 ^b	13.1±0.65 ^a	14.76±0.32 ^b	12.74±0.34 ^a	14.08±0.56 ^a
Weaning-estrus Interval (days)	35.58±4.88 ^b	21.75±3.17 ^a	37.6±2.7 ^b	50.6±6.23 ^b	26.54±3.2 ^a	31.5±3.5 ^a
Gestation period(days)	114.5±0.35 ^a	116.5±0.28 ^a	113.8±0.16 ^a	114.5±0.19 ^a	114.3±0.3 ^a	114±0.29 ^a

*Values with different superscripts within the same row differ significantly ($P<0.05$).

Table 3. Post-farrowing traits of exotic, crossbred and indigenous pigs (mean±SEM)

Reproductive traits	Hampshire (HS)	Duroc	Ghungroo (GH)	Niang Megha (NM)	HS × GH	HS × NM
Litter size at birth	6.6±0.45 ^a	5.4±0.43 ^a	8.7±0.25 ^b	6.34±0.26 ^a	8.5±0.48 ^b	8.2±0.55 ^b
Litter size at weaning	5.7±0.47 ^a	4.5±0.35 ^a	7.4±0.24 ^b	5.4±0.29 ^a	8.3±0.47 ^b	7.7±0.51 ^b
Pre-weaning mortality (%)	13.63 ^b	16.66 ^b	14.94 ^b	14.28 ^b	2.94 ^a	6.1 ^a
Generation interval (months)	16±0.56 ^b	16±0.69 ^b	13.3±0.43 ^a	15±1.08 ^b	12.7±0.17 ^a	14±0.38 ^a
Farrowing interval (months)	6.76±0.23 ^b	6.4±0.33 ^a	7.2±0.19 ^b	7.18±0.3 ^b	5.96±0.2 ^a	6.5±0.17 ^a
Farrowing index	1.85	1.9	1.72	1.71	2.01	1.9
Farrowing rate (%)	87.5 ^a	84.21 ^a	80.95 ^a	83.42 ^a	86.84 ^a	80.35 ^a

*Values with different superscripts within the same row differ significantly ($P<0.05$).

(Prakash *et al.* 2008). Cases of prolonged gestation and smaller litter size were also associated with higher incidences of stillbirths and pre-weaning mortality especially in exotic breeds.

Table 3 shows different post-farrowing traits of exotic, crossbred and indigenous pigs maintained in the Institute farm complex. Exploratory data analysis revealed that litter size at birth were significantly higher ($P<0.05$) in Ghungroo and crossbreds in comparison with the other groups. Mean litter size at birth for other breeds in the present study ranged from 5.4 to 6.6 in exotic breeds and 6.34 in indigenous Niang Megha breed. Litter size improvement in crossbred pigs could be ascribed to greater levels of heterosis and dominant genes for litter size trait from the exotic parents. Saiprasanna *et al.* (2009) reported an overall litter size of 6.78 ± 0.11 at birth in desi-crossbred pigs. Kumari *et al.* (2008) also found a comparatively smaller litter size which ranged from 6.22 to 6.82. Litter size at weaning were significantly higher ($P<0.05$) in crossbreds as compared to exotic breeds (Table 3). Mean litter size at weaning ranged from 4.5 to 5.7 for other breeds. Saiprasanna *et al.* (2009) also reported an overall least squares mean litter size of 6.22 ± 0.11 piglets at weaning. Kumari *et al.* (2008) and Prakash *et al.* (2008) reported comparatively lesser mean litter size ranging from 5.54 to 6.33 piglets at weaning in exotic-desi crossbreds.

Average pre-weaning mortality was found to be significantly lower ($P<0.05$) in crossbreds with HS×GH crosses having the lowest rate (Table 3). In contrast, both indigenous and exotic breeds had a relatively higher piglet mortality rate. Previous studies have suggested that diarrhoea, pneumonia, crushing, trembling death and some non-specific disease conditions like debility and naval ill are the major causes of piglet mortality (Murugkar 1999) while it has also been reported that indigenous breeds are more susceptible to piglet diarrhoea and pneumonia (Pal *et al.* 2000). Ate and Oyedipe (2011) reported an overall piglet mortality rate of 25.22% in Institutional swine herds. The economic failure of small-scale pig production is often due to higher incidence of piglet mortality. Svetina *et al.* (2006) opined that piglet mortality remains a problem for pig production in tropical climate despite improved technology and management. Manipulation of the lactating sows to secrete more milk through nutrition and improved management practices aiming at minimising environmental stress may further enhance the growth and survival of piglets.

Another noteworthy finding was significantly shorter ($P<0.05$) generation interval in Ghungroo and their crosses in comparison with exotic breeds (Table 3). This might be due to the fact that Ghungroo and crossbred pigs reach puberty much earlier than the exotic breeds. However, indigenous sows had a significantly longer ($P<0.05$) farrowing interval than the crossbred sows. The reason for this rather paradoxical difference might be due to their apparently longer weaning to estrus interval (WEI). Farrowing index also referred to as, litter per sow per year,

indicates the average number of times sows that farrow in a year and is influenced by length of lactation, weaning to estrus interval and non-productive days. Out of all, crossbreds had a higher farrowing index value of 2.01 while indigenous breeds had a relatively lower farrowing index (1.72). Farrowing rates were found to be similar with no significant difference ($P>0.05$) among the breeds, however relatively higher rate was observed in Hampshire sows and lower rate in Ghungroo (Table 3).

Reproductive problems are one of the major reasons for culling in the breeding herd. In the present study, attempts were also made to investigate the incidence of various reproductive problems in sows. Major reproductive disorders identified include repeat breeding, prolonged weaning-estrus interval, cystic ovarian disease, pseudopregnancy and gestational estrus. Significantly higher ($P<0.05$) incidence of repeat breeding was observed in HS×GH crosses (22%) while overall incidences of repeat breeding in other breeds ranged from 3.13 to 13.64%. Prolonged interval from weaning to estrus was observed in indigenous pigs. Nutritional deficit during lactation is well known to increase the weaning to estrus interval, especially in primiparous sows (Skorjanc *et al.* 2008). In the present study, cases of cystic ovaries (8.33%) could be observed in multiparous crossbred sows during slaughter checks of culled breeding stock. Overall, it was found that ovarian cysts were present in approximately 8% of sows that were culled for fertility problems. Castagna *et al.* (2004) opined that the presence of cysts before insemination and conception might not interfere with ovulation from other follicles but it could decrease the number of normal viable ova. Sows with weaning to estrus intervals shorter than 3 days and a shorter lactation length have a greater probability of developing ovarian cysts which might be attributed to the insufficient LH surge causing ovulation failure and subsequent cyst formation.

Analysis of records also revealed a higher incidence of pseudopregnancy or 'not-in-pig' condition (15.2%) in indigenous breeds like Ghungroo. Further, incidence of gestational estrus was observed in crossbreds (10.0%) and Ghungroo (3.82%). In case of indigenous breeds, it has been observed that, primiparous sows had a smaller litter size relative to multiparous sows. Cases of prolonged gestation and smaller litter size were also associated with higher incidences of stillbirths and pre-weaning mortality especially in exotic breeds. In contrast, Chu (2005) opined that increased litter size at birth was accompanied with higher stillbirth rate. Stillbirths appear to be most common in Duroc (17.65%) while indigenous breeds had a lower value (1.5 to 2.2%). A stillbirth rate of 6–8% is common in farrowing units in intensive systems (Ate and Oyedipe 2011). Interestingly, Petry and Johnson (2004) reported that genotype had a highly significant effect on number of stillborn piglets per litter. Irregular estrus cycle is also a common problem in female herd especially indigenous and crossbreds. Higher rate of piglet mortality was observed in indigenous and exotic breeds (14–16%). Piglet mortality

in Ghungroo breed was more pronounced during peak winter months.

Reproductive performance of the breeding herd is one of the key components in controlling the efficiency of swine production. Sub-optimal reproductive efficiency can result in low profitability and consequently will limit the attempts to improve overall herd performance. In the current production systems of sub-tropical climate, failure of sows to become pregnant within the expected time after weaning and with lower litter size at weaning can result in major economic loss. Significant influences of different genetic groups on various reproductive variables were observed in the present study indicating scope for improvement. By implementing continuous and better managerial practices, the performance of breeding herds could be improved for various reproductive and productive traits. However, other factors such as environment and selection practices also appeared to contribute overall variations in the herd performance.

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REFERENCES

- Ate I and Oyedipe U. 2011. Sow reproductive performance in institutional herds in Benue State, Nigeria. *Journal of Reproduction and Infertility* **2**(2): 24–31.
- Castagna C D, Peixoto C H, Bortolozzo F P, Wentz I, Neto G B and Ruschel F. 2004. Ovarian cysts and their consequences on the reproductive performance of swine herds. *Animal Reproduction Science* **81**: 115–23.
- Chu M X. 2005. Statistical analysis of stillbirths in different genotypes of sows. *Asian-Australasian Journal of Animal Sciences* **18**(10): 1475–78.
- Kongsted A G. 2006. Relation between reproduction performance and indicators of feed intake, fear and social stress in commercial herds with group-housed non-lactating sows. *Livestock Science* **101**: 46–56.
- Kumaresan A, Bujarbaruah K M, Pathak K A, Chhetri B, Das S K, Das A and Ahmed S K. 2007. Performance of pigs reared under traditional tribal low input production system and chemical composition of non-conventional tropical plants used as pig feed. *Livestock Science* **107**: 294–98.
- Kumari B P, Rao D S and Ravi A. 2008. Genetic and non-genetic factors affecting the litter traits in desi and crossbred pigs. *Indian Veterinary Journal* **85**: 170–72.
- Murugkar H V. 1999. Diagnosis and control of piglet mortality. *Annual Report 1998–99*. ICAR-NEH, Barapani, Meghalaya, pp. 30.
- Pal P P, Naskar N and Kumar R. 2000. Performance assessment of introduced technology in livestock productivity. *Annual Report 2000–01*. ICAR-NEH, Barapani, Meghalaya, pp. 41.
- Petry D B and Johnson R K. 2004. Responses to 19 generations of litter size selection in the Nebraska Index line. I. Reproductive responses estimated in pure line and crossbred litters. *Journal of Animal Science* **82**: 1000–06.
- Prakash M G, Ravi A, Kumari B P and Srinivasrao D. 2008. Reproductive and productive performance of crossbred pigs. *Indian Journal of Animal Sciences* **78**: 1291–97.
- Saiprasanna J, Gnanaprakash M, Gupta B R and Mahender M. 2009. Genetic study on reproductive traits in crossbred pigs. *Livestock Research for Rural Development* **21**: 142–47.
- Skorjanc D, Hohler M and Brus M. 2008. Effect of backfat loss during lactation on weaning-to-oestrus interval of sows at gonadotropin application. *Archiv fur Tierzucht* **51**: 560–71.
- Svetina A, Vrabac L, Belic M and Turk R. 2006. Relation between erythrocyte parameters and stillbirth in piglets. *Veterinary Archives* **76**(4): 297–303.
- Tochhawng L and Rewani S K. 2013. Constraint analysis of backyard pig farming in tribal areas of Mizoram. *Indian Research Journal of Extension Education* **13**(2): 123–25.