# Nigerian local pigs

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Evaluation of the F1 and backcrosses of Nigerian local pigs and the Large White for litter characteristics in Southwest Nigeria

Investigation of the effect of pig genotype on litter performance under the humid tropical conditions of Southwestern Nigeria.

# Abstract

A total of 823 farrowing records representing five genetic groups of pigs - Nigerian local pigs (NP), the Large White (LW), NP×LW, (NP×LW) ×LW, and (NP×LW) ×NP - were used to investigate the effect of pig genotype on litter performance under the humid tropical conditions of Southwestern Nigeria. Past data records spanning a period of 12 years (1979 - 1990) were collected from the Swine Unit of the University Research Farm, Ile-Ife, Nigeria. Data were analyzed using least squares procedures. Effects in the model included genetic group of litter, year and season of farrowing, and genetic group × season of farrowing interaction. Traits evaluated included litter sizes and weights at farrowing and at weaning, including pre-weaning viability.

Results showed significant effect of genetic group for all the litter traits studied. The crossbred groups were superior in most of the litter traits studied except litter birth weight where the LW purebred group recorded the heaviest litter weights. Season of farrowing affected litter performance traits in LW×LW, NP×LW and (NP×LW)×LW groups. In terms of pre-weaning viability, litters from the (NP×LW) ×LW had 13.8% and 8.0% greater liveability at 42 days than litters from purebred NP and LW respectively.

Key words: Crossbreeding, Large White, litter traits, Nigerian local pigs, season

# Introduction

Crossbreeding is a successful management practice for improving litter productivity in swine. This mating system, by exploiting heterosis, is known to improve prolificacy, piglet viability and post-weaning gain (Gaughler et al 1984; McLaren et al 1987; Kuhlers et al 1988). Results of several crossbreeding studies in the humid tropics (Adebambo 1981, 1983, 1986; Pathiraja and Oyedipe 1990) have indicated varying levels of heterosis for sow productivity traits. These studies dealt mainly with two-breed crosses involving the Nigerian local pigs with any of the several exotic pig breeds in Nigeria - the Large White, Hampshire, and Landrace. Extension of these studies to evaluate backcrosses involving Nigerian local pigs and the Large White (the most common exotic breed in Nigeria) would provide extra information about the comparative performance of different genetic combinations involving both breeds. One advantage of such backcrossing, according to Falconer and Mackay (1996), could be to exploit the improved maternal ability of the crossbred sows. However, it is not exactly known which of the breed combinations involving the Nigerian local pigs and the Large White (e.g. 2-breed crosses, reciprocal crosses or 3-way terminal crosses or backcrosses) will give the most optimal performance under the humid tropical conditions of Southwest Nigeria. This study analyzed swine breeding data involving purebred Nigerian local pigs, the Large White and their F1 and backcrosses, in order to ascertain which of the breeds or breed combinations would give optimal performance, in terms of litter viability to weaning age.

# Materials and method

## Management

The breeding stocks included purebred Nigerian local pigs (NP) and the Large White (LW). These stocks were maintained routinely at the University Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife, Nigeria, for teaching and research purposes. The animals were grouped into pens according to breed, sex and physiological status (pregnant, suckling, growers, finishers). Each pen was provided with feeder and water troughs. The husbandry system was intensive, but animals were occasionally allowed on pasture. The open pasture areas were also provided with water and feeder troughs, a wallow, and surrounded by trees to provide shade to the animals. Table 1 shows the mating scheme for the purebred, F1 and backcrosses.

Table 1. Mating scheme for the purebred and crossbred groups of pigs

| | | |
|---|---|---|
| NP | NP | NP×NP |
| LW | LW | LW×LW |
| NP | LW | NP×LW |
| NP×LW | NP | (NP×LW)×NP |
| NP×LW | LW | (NP×LW)×LW |

Boars were introduced to sows and mature gilts on heat. Standard management practices were followed through mating, gestation and weaning. Pregnant sows were fed about 2.0 kg of a gestation diet (about 20% crude protein) daily. As the projected parturition date approached, sows were taken to farrowing pens that had been cleaned and disinfected. After farrowing, data were recorded on litter size and weight at birth - number dead and number alive were noted. As from two weeks of age, piglets were fed a commercial creep feed ad libitum until weaning at 42 d. It is to be noted that the quality and availability of the diets as well as the overall management of the unit could have fluctuated over the years.

## Data collection and analysis

Data were routinely recorded on the following: age and weight of sow at farrowing, litter sizes and weights at farrowing and at weaning, number live and dead at birth and at weaning, sow and boar of litter. These data were copied from the Master file at the University Swine Unit and transferred to a Personal Computer Swine database. The entire datasets spanned a period of 12 years (1979-1990).

Data were subjected to analysis of variance for unequal sub-class numbers, using the following model:

$Yijkl = \mu + Gi + Sj + Xk + (GS)ij + Eijkl$

Where:

Data were analyzed using the General Linear Model procedure of SAS (1999). Means for each variable effect were compared using the least squares means options of the same procedure. Preliminary analysis showed that the year of farrowing effect was not significant . This effect was therefore excluded from the final model.

# Results

Litter size at farrowing (LSF) ranged from 1 to 12 piglets with an overall mean of 7.60 piglets (Table 2). Genetic group of litter had a significant effect on this trait (P<0.05). Litters resulting from the NP×LW and (NP×LW) ×LW genetic groups recorded the largest live LSF. Litters from the (NP×LW) ×NP and LW×LW were intermediate and comparable (P>0.05) while NP×NP recorded the lowest LSF (P<0.05). Significant differences between genetic groups in LSF are consistent with the reports in the literature from the humid tropics and in the temperate regions alike (Adebambo 1983, 1986; Gaughler et al 1984; Kuhlers et al 1989; Pathiraja and Oyedipe 1990). The performance ranking above was also reflected in the rainy season means of LSF for the genetic groups. However, in the dry season period, the mean performance of (NP×LW) and LW×LW matings fluctuated, indicating a significant genetic group by season of farrowing interaction effect for this trait. For the LW×LW group, higher LSF values were recorded in the dry season period (P < 0.05), while the reverse case was observed for the NP×LW group. Other genetic groups were not affected (P>0.05).

Table 2. Least squares means and standard errors of litter sizes at farrowing (LSF) for five genetic groups of pigs in two seasons

| | | | | | | |
|---|---|---|---|---|---|---|
| **n** | **mean ± se** | **n** | **mean ± se** | **n** | **mean ± se** | |
| NP×NP | 122 | 6.45±0.12c | 89 | 6.60±0.12g | 211 | 6.50±0.09k |
| LW×LW | 78 | 7.44±0.30*b | 72 | 8.12±0.38*e | 150 | 7.81±0.24ij |
| NP×LW | 80 | 8.35±0.62*a | 73 | 7.59±0.47*f | 153 | 8.00±0.39i |
| (NP×LW)×LW | 86 | 8.09±0.67ab | 65 | 8.17±0.64e | 151 | 8.13±0.46i |
| (NP×LW)×NP | 90 | 7.36±0.59b | 68 | 7.64±0.42f | 158 | 7.50±0.36j |

| | | | | | | |
|---|---|---|---|---|---|---|
| All (pooled) | 456 | 7.54±0.35 | 367 | 7.62±0.39 | 823 | 7.60±0.30 |

The reasons for the re-ranking for these two genetic groups are not clear-cut but may be related to some adaptability features of the LW breed which could have affected its ability to adjust to environmental changes associated with different seasons. In contrast, the NP×NP and backcrosses ((NP×LW)×LW and NP×LW)×NP) did not show differences or re-ranking in performance between seasons. In particular, the NP×NP genetic group, according to Igboeli and Orji (1980), possesses greater heat tolerance and is thus able to display some stability in performance across different seasons when compared to the LW×LW and other genetic groups.

Genetic group and season of farrowing had marked effects on litter birth weight (LBWT) (Table 3). Litters from the LW×LW matings recorded the heaviest LBWT, followed by the (NP×LW) ×LW, while litters from the NP×LW and (NP×LW) ×NP were similar (P>0.05) and heavier than litters from the NP×NP group (P<0.05). This observed trend in LBWT could be due to the large size of LW sows and boars - about twice the size of the NP (Adebambo and Dettmers 1979). Significant differences between pig genotypes in LBWT have been reported by several studies (Johnson 1980; Adebambo 1983; Kuhlers et al 1988).

Table 3 Effect of genetic group of pig and season of farrowing on litter birth weight (kg) in two seasons

| | | | | | | |
|---|---|---|---|---|---|---|
| **n** | **mean ± se** | **n** | **mean ± se** | **n** | **mean ± se** | |
| NP×NP | 122 | 6.77±0.55d | 89 | 6.80±0.65h | 211 | 6.79±0.60l |
| LW×LW | 78 | 12.42±0.30*a | 72 | 13.64±0.38*e | 150 | 13.03±0.35i |
| NP×LW | 80 | 11.59±0.33*b | 73 | 10.17±0.36*g | 153 | 10.85±0.35k |
| (NP×LW)×LW | 86 | 11.33±0.30*b | 65 | 12.00±0.33*f | 151 | 11.70±0.32j |
| (NP×LW)×NP | 90 | 9.94±0.40*c | 68 | 10.39±0.37*g | 158 | 10.20±0.38k |
| All (pooled) | 456 | 10.41±0.38 | 367 | 10.60±0.48 | 823 | 10.51±0.44 |

The same trend described above for LSF was reflected in the least squares means for litter size at weaning (LSW) (Table 4). LSW ranged between 1 and 9 weaners with an overall mean of 7.12. The highest LSW was recorded by the NP×LW and (NP×LW)×LW. Such superior performance could be attributed to heterotic effect resulting from crossbreeding. Several authors (Adebambo 1983, Gaughler et al 1984; Kuhlers et al 1988) have reported highly significant differences between purebred and crossbred genetic groups of pigs in litter traits at farrowing and at weaning. Litter size at weaning is a function of LSF and the rate of pre-weaning mortality. In the present study, it was observed that the genetic groups that recorded large LSF also maintained that superiority up to weaning. This development could be attributed to the following reason(s): (a) greater liveability on the part of the crossbred NP×LW litters due to hybrid vigour and (b) improved maternal ability on the part of the crossbred NP×LW sows mated to LW boars. These reports further justify the main incentive for the wide use of crossbreeding in commercial swine production, which is due primarily to the exploitation of hybrid vigour and improved maternal performance of crossbred sows (Bereskin 1983; Pathiraja and Oyedipe 1990; Falconer and Mackay 1996).

Table 4. Least squares means of litter sizes at weaning for five genetic groups of pigs in two seasons

| | | | | | | |
|---|---|---|---|---|---|---|
| **n** | **mean ± se** | **n** | **mean ± se** | **n** | **mean ± se** | |
| NP×NP | 122 | 5.58±0.14c | 89 | 5.47±0.14 g | 211 | 5.53±0.11 k |
| LW×LW | 78 | 6.91±0.29b | 72 | 7.21±0.37f | 150 | 7.10±0.23j |
| NP×LW | 80 | 8.12±0.60* a | 73 | 7.27±0.46* f | 153 | 7.70±0.38i |
| (NP×LW)×LW | 86 | 8.00±0.65a | 65 | 8.08±0.62 e | 151 | 8.04±0.45i |
| (NP×LW)×NP | 90 | 7.14±0.54b | 68 | 7.29±0.14f | 158 | 7.22±0.35j |
| All (pooled) | 456 | 7.15±0.40 | 367 | 7.06±0.37 | 823 | 7.12±0.31 |

Table 5 shows the least squares means of litter weaning weight (LWWT) in two farrowing seasons. The heaviest litters at weaning were recorded by the LW×LW genetic group, followed by the (NP×LW)×LW group, while the LWWT for the NP×LW and the (NP×LW)×NP) were similar (P> 0.05). This trend could be attributed to large LSW since both traits (LSW and LWWT) are highly positively correlated (Khalil et al 1986). The observed differences between genetic groups in LWWT are also due to dissimilarities in body weights and sizes of the original parental breeds. Genetic group of litter and season had a marked effect on this trait, in agreement with McLaren et al (1987), and Kuhlers et al (1989).

Table 5. Least squares means and standard errors of litter weight at weaning (kg) for five genetic groups of pigs in two seasons

| | | | | | | |
|---|---|---|---|---|---|---|
| **n** | **mean ± se** | **n** | **mean ± se** | **n** | **mean ± se** | |
| NP×NP | 122 | 32.76±2.63e | 89 | 32.16±2.66j | 211 | 32.46±2.50n |
| LW×LW | 78 | 74.28±1.70* a | 72 | 77.87±2.16*f | 150 | 76.08±1.38k |

| | | | | | | |
|---|---|---|---|---|---|---|
| NP×LW | 80 | 72.41±3.49*b | 73 | 63.25±2.68*h | 153 | 67.83±2.20l |
| (NP×LW)×LW | 86 | 70.40±3.79*c | 65 | 67.06±3.63*g | 151 | 68.70±2.62l |
| (NP×LW)×NP | 90 | 57.12±3.36d | 68 | 58.17±2.68i | 158 | 57.66±2.06m |
| All (pooled) | 456 | 61.39±2.44 | 367 | 59.70±2.22 | 823 | 60.54±2.01 |

Litters from (NP×LW)×LW displayed the highest viability at 6 weeks (Table 6). This genetic group showed 13.8% and 8.00% higher liveability at 42 d than litters from purebred NP×NP and LW×LW respectively. This result may indicate some inherent advantages (e.g. improved viability) in the crosses derived from (NP×LW)×LW which essentially is 75% LW and 25 % NP. The performances of (NP×LW)×NP and NP×LW were similar and higher than the LW×LW purebred. The lowest pre-weaning survival rate (85%) was recorded by the NP purebred group, which agrees with the upper limit of 85% pre-weaning survival rate for Nigerian indigenous sows raised under intensive management (Pathiraja and Oyedipe 1990). The pre-weaning survival rate of 90% recorded for the LW×LW is however, higher than the value of 84% reported by Agbagha et al (2001) in South-eastern Nigeria.

Table 6. Effect of pig genotype on pre-weaning viability

| | | | | |
|---|---|---|---|---|
| NP×NP | 211 | 6.50±0.09c | 5.53±0.11k | 85.08 |
| LW×LW | 150 | 7.81±0.24ab | 7.10±0.23j | 90.91 |
| NP×LW | 153 | 8.00±0.39a | 7.70±0.38i | 96.25 |
| (NP×LW)×LW | 151 | 8.13±0.46a | 8.04±0.45i | 98.89 |
| (NP×LW)×NP | 158 | 7.50±0.36b | 7.22±0.35j | 96.27 |
| All (pooled) | 823 | 7.60±0.30 | 7.12±0.31 | 93.68 |

Survival rate to weaning, as affected by the proportion of genes contributed by NP or the LW is shown in Figure 1. This figure indicated that all crossbred litters showed some advantages over the purebred LW, which was superior to the NP. The figure further reveals that the highest pre-weaning survival rate was recorded at the inclusion of 75% LW to 25% NP (or NP×LW sows backcrossed to LW boars).

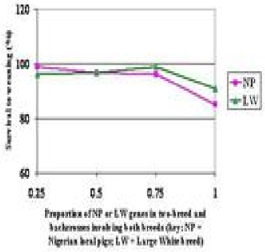


**Figure 1.**
Survival rate to weaning age (%) as affected by the proportion of NP or LW genes in two-breed and backcrosses (NP = Nigerian Local pigs; LW = Large White).

According to Falconer and Mackay (1996), such superior performance of backcrosses could be due partly to hybrid vigour of the crossbred sows and partly due to the additive effect of the sire line. Reports from other studies (Fahmy et al 1978; Adebambo 1983; Kuhlers et al 1988) showed that pre-weaning survival rate differed significantly among breeds and crosses, indicating that this trait is largely influenced by the breed of sire (boar) and the type of dam (purebred or crossbred sow). However, contrary to the reports of Steinbach (1971) and Adebambo (1986) that the NP×NP litters were superior in pre-weaning viability, our study showed that the F1 crosses and the backcrosses involving the NP and LW showed superior pre-weaning survival rate. Such disparities between reports could be due to the manifestation of wide variations in performance traits within the populations of NP evaluated in all these studies, the present study inclusive. According to Pathiraja and Oyedipe (1990), the NP has been reported to display wide differences in performance traits across different ecological zones in Nigeria. These authors noted that among different populations of NP, LSW ranged from 0 to 8 weaners while pre-weaning survival rate ranged from 65% to 85%. These observations further strengthen the desirability to upgrade the NP through appropriate within breed selection and mating systems.

Final recommendations on the suitability or otherwise, of any genetic group should consider other measures of performance evaluation, including fertility levels in different seasons, average daily gain and feed efficiency (Schneider et al 1982). In addition, other breeds (Duroc, Hampshire) and breed combinations need to be evaluated for performance traits in order to determine their comparative advantages for profitable pork production in Southwest Nigeria.

# Conclusion

This study showed significant genetic group effect on prolificacy and piglet viability to weaning. The F1 and backcross involving the (NP×LW) sows mated to LW showed the most superior performance in terms of highest liveability to weaning.

Further cross-breeding studies involving other breeds (Hampshire, Landrace) under different management systems should be conducted so as to determine the most suitable breed combinations for pig meat production under humid tropical conditions of Southwestern Nigeria.

# References

1. Adebambo O A 1981 A comparison of indigenous and exotic purebred and crossbred sows in Southern Nigeria: relationship between dam and litter performance. Nigerian Journal of Animal Production, 8: 67 - 74. Adebambo O A 1983 Comparative growth and carcass performance of progenies sired by purebred Large White and Hampshire boars and their crosses with the Nigerian local breed. Nigerian Journal of Animal Production, 10 (1 and 2): 124 - 133.Adebambo O A 1986 Pig improvement and development in the tropics: the applications of breeding and genetics. Proceedings of the International Seminar on pig production in the tropics, Nsukka, Nigeria, February, 1986.

2. Adebambo O A and Dettmers A E 1979 Comparative performance of the indigenous and exotic sows in Nigeria.1. Milk yield, persistency of production and utilization by litter. Nigerian Journal of Animal Production 6 (1 and 2): 26 - 32.
3. Agbagha F M, Ezema F U and Omeke C O 2001 Studies of management effects on fertility of purebred and crossbred exotic gilts in two breeding farms at Nsukka, Nigeria. Nigerian Journal of Animal Production, 28(1):20 - 25.
4. Bereskin B 1983 Performance of selected and control lines of Duroc and Yorkshire pigs and their reciprocal crossbred progeny. Journal of Animal Science 57(4): 867 - 878.
5. Fahmy M H, Hottman W B, Macintyre T M and Moxley J E 1978 Evaluation of piglet mortality in 8 two-breed crosses among breeds of pigs. Animal Production 26: 277 - 286.
6. Falconer D S and Mackay TFC 1996 Introduction to Quantitative Genetics, 4th Edition, Longman. pp 285 - 286.
7. Gaughler H R, Buchanan D S, Hintz, R L and Johnson R K 1984 Sow productivity comparisons of four breeds of swine: purebred and crossbred litters. Journal of animal Science, 59 (4): 941 - 947.
8. Igboeli G and Orji B I 1980 Female reproduction of tolerant breed and possibility of artificial insemination in West Africa. FAO/SIDA Workshop on the breeding of trypanotolerant livestock, Lome, Togo.
9. Johnson R K 1980 Heterosis and breed effects in swine. North Central Regional Publication Number 262, USA.
10. Khalil M H, Owen J B and Afifi E A 1986 A review of phenotypic and genetic parameters associated with meat production traits in rabbits. Animal Breeding Abstracts, 9: 725-749.
11. Kuhlers D L, Jungst S B and Morre R A (Jr) 1988 Comparison of specific crosses from Yorkshire-Landrace, Chester - White -Landrace and Chester-White-Yorkshire sows. Journal of Animal Science 66 (5):1132 - 1139.
12. Kuhlers D L, Jungst S B and Little J A 1989 Comparison of specific crosses from Duroc-Landrace, Yorksire -Landrace and Hampshire - Landrace sows managed in two types of gestation systems: pig performance. Journal of Animal Science 67 (10): 2595 - 2602.
13. McLaren D G, Buchanan D G and Johnson R K 1987 Industrial heterosis and breed effects on post-weaning performances and carcass traits in four breeds of swine. Journal of Animal Science 64: 83 - 88.
14. Pathiraja N and Oyedipe E O 1990 Indigenous pigs of Nigeria. Animal Genetic Resources Information, 7: 67 - 78.
15. SAS 1999 User's Guide: Statistics. SAS Inc., Cary North Carolina, pp 575 - 607.
16. Schneider J F, Christian L L and Kuhlers D 1982 Crossbreeding in swine: genetic effects on litter performance. Journal of Animal Science 54 (4): 739 - 746
17. Steinbach J 1971 Effect of season and breed on sow performance in the seasonal equatorial climate of Southern Nigeria. Journal of Agricultural Science (Cambridge), 77: 331 - 336.

# Full Reference

Yes