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Sire Effect on Reproductive and Growth Performance of Local and Exotic Sows In Rivers State, Nigeria

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Abstract

The study was conducted to determine sire effect on reproductive and growth performance of local and exotic sows in Rivers State, Nigeria. The experiment involved three breeds of pigs (Local pigs (LP), Landrace (Lr) and Large White (Lw)). Eighteen breeding pigs consisting three local sires and fifteen gilts (local and exotic) were used to generate seventy two progenies for the experiment. Reproductive performance such as Gestation length (GL), Litter size at birth (LSAB), Litter weight at birth (LWAB), Litter size at weaning (LSAW) and Litter Weight at Weaning (LWAW) were taken from the three different crosses for comparison. Data on quantitative traits such as Body weight (BW), Body length (BL), Heart Girth (HG), Height at wither (HT) and Rear Girth (RG) were taken on seventy two progenies resulting from the three crosses. The results showed significant ($P<0.05$) difference of sire on GL, LSAB, LWAB, LSAW and LWAW. LP x Lw performed better than LP x Lr in all the reproductive performances considered while, LP x LP recorded the least. The result also revealed that there was significant ($P<0.05$) effect of sire on the growth performance (i.e body weight and linear body measurements) of the progenies produced from the different three crosses used for the study, where, progenies from LP x Lr recorded highest BW and linear body measurements than progenies from LP x Lw, while, progenies from LP x LP recorded the least at week 0 (birth), 6 (weaning) and 12. The improvement in crossbred could be attributed to dominant genes from the exotic sow.

Keywords: Local sires; Reproductive; Growth performance and exotic sows.

1. Introduction

Pig population in Nigeria is estimated to 4.4 million pigs and about 78% of these are found in the sub humid zones of Northern and southern guinea savannah [1]. Despite great reduction in populations of the indigenous pigs, they still represent an essential aspect of local genetic resources [2]. Local pigs are known to be hardy, tolerant to most common diseases and has the potential to survive under poor management and extremes of environmental conditions [3]. The local breeds perform better with extensive and semi-intensive systems of rearing than the exotic breeds [4]. Likewise, the population sizes of many of this has decreased dramatically and most of them are already in danger of being replaced, or hybridized with Western commercial breeds [5]. Several studies Adebambo [6]; Oseni [7] and Aladi, *et al.* [8] have revealed the attempts to improve the genetic abilities of the Nigerian indigenous pig (NIP) population by crossbreeding with different exotic breeds but this to some extent could not be maintained in Nigeria. Adeola and Omitogun [9], reported that local pigs are challenged with their genetic diversity being eroded as a result of unsustainable farming systems in Nigeria.

These reproductive traits are vital to reduce cost of raising pigs to maturity, reduce generation interval and increase genetic gain per unit time [10]. Reproductive ability in sows are influenced by several factors, such as breed, season, temperature, photoperiod and nutrition [11]. The use of indigenous pigs thus encourages the use of their valuable genes. It is widely believed that mating local and exotic breeds increases fertility [12, 13]. It is, therefore, important to determine the reproductive performance and growth indices of local boars crossed with local and exotic sows in Rivers State, Nigeria.

2. Materials and Methods

2.1. Experimental Site

The experiment was carried out at the piggery unit of Teaching and Research Farm of Department of Animal Science, University of Agriculture, University of Port Harcourt, Rivers State, Nigeria. Rivers state has latitude 4.8943 N and longitude 6.9105 E. The altitude is 15m above sea level. Rivers state has a tropical wet climate with very short dry seasons with annual rainfall of 2708mm, average temperature is between 25 – 28^{o}C and relative humidity is above 85%.

2.2. Breeding Procedure

The experimental animals, the exotic (Large white and Landrace) and Local pigs were sourced from Benue State Government Swine Project Farm and Gboko village, Benue State, Nigeria, respectively. The experiment involved three breeds of pigs namely Local pigs, Landrace (Lr) and Large White (Lw). A total of eighteen breeding pigs consisting three local sires and fifteen gilts (i. e. five local gilts, five large white gilts and five landrace gilts) were used to generate progenies for the experiment according to the mating scheme below in Table 1:

Table-1. Mating Scheme of Base Population and Number of Progenies Produced

Base Population /Genotypes	Replicates represented by number of progenies from each gilt					Total progenies produced
	1st Gilt	2nd Gilt	3rd Gilt	4th Gilt	5th Gilt	
Local pigs x Local pigs	3	4	4	5	5	21
Local pigs x Landrace	3	4	4	5	6	22
Local pigs x Large white	7	5	6	6	5	29

The mating ratio was 1boar to 5gilts. Mating was carried out in the morning by introducing the females on heat to the boar's pen. The experimental animals were kept in production conditions such as comfortable housing, quality feed given at ad libitum, serving fresh water daily and observing other routine management practices. Likewise, the experimental animals were fed according to the standard diets by categories of animals.

2.3. Experimental Animals and Their Management

The experimental animals were intensively raised in standard pens based on the litters genetic groups. Heat was provided for the Piglets to make them warm in the morning and cool night. The experimental animals were fed *ad libitum* for six weeks with experimented starter diet comprising crude protein 22% and ME/kg 2900kcal. Iron dextran injection was administered to piglets at 2-3 days old to prevent anaemia, dewormed on routine basis and other therapeutic treatments were provided as the need arose. They were also tagged for proper identification. Drinking water was given *ad libitum* during the period of experiment. The weaned pigs were fed daily on diets compounded from conventional and non-conventional feed materials with crude protein 18.06% and D.E (Kcal/ Kg) 2986.70.

2.4. Parameters and Data Collection

Reproductive performance such as Gestation length (GL), Litter size at birth (LSB), Weight at birth (WAB), Litter size at weaning (LSW) and Weaning Weight (WW) were taken from the three different crosses for comparison and evaluation.

i. **Birth weight**: The piglets birth weight was measured within 24 h post-partum.
ii. **Body weight at Weaning**: This is the body weight of the animals taken at 42 days after birth, when piglets were weaned.
iii. **Litter size at birth** (LSB) is recorded as the sum of piglets produced in every farrowing by a sow.
iv. **Litter size at weaning** (LSW) is the aggregate of piglets that are alive at weaning.
v. **Litter body weight at weaning** (LWW) is the summation of the individual weaning weights in each litter.
vi. **Gestation Length** (GL): This was taken from the day the gilts were mated to the farrowing day.

Data on quantitative traits such as Body weight (BW), Body length (BL), Heart Girth (HG), Height at wither (HT) and Rear Girth (RG) were taken on seventy two progenies resulting from the three mating types biweekly using measuring tape and weighing scale.

Body Weight (kg), Represents the weight of the pig measured in kilogram

Body length (cm), (Distance from the head of the humerii to the distal end of the pubic bone), **Heart girth** (cm) (Measured as the circumference of the chest region),

Rear girth (cm) (the circumference of the loin region)

Height at withers was measured as the vertical distance from the top of the shoulders of the pig to the ground with the pig in an upright disposition.

Body length was measured as the distance from the anterior edge of the scapula to the pin bones.

All body dimensions were measured in the early hours of the day to avoid the effects of feeding and watering on the conformation using a standardised measuring tape, a standardised metre ruler and recorded in centimetres whereas all weight measurements were taken using a standardised weighing scale and recorded in kilogrammes. To ensure accuracy, all the body measurements were taken when the pigs were in a calm disposition in its pen. The pigs were intensively kept and hand mated. Sows farrowed in separate pens given the required attention with their piglets till weaning.

2.5. Experimental Design and Statistical/Data Analysis Procedure

The experimental design with which data were collected and analysed was Completely Ramdomized Design (CRD) with genotype as a factor of interest. The model is given as

$Y_{ij} = \mu_i + G_j + e_{ij}$

Where

Y_{ij} = single observation of the i^{th} genotypes

μ_i = Overall mean G_j = Main effect of genotypes

e_{ij} = Random error, independently and identically normally distributed with zero mean and constant variance{ (iind (0,o)}.]

Analysis of variance (ANOVA), using the General linear Model procedure of Statistical Procedure for the Social Sciences (SPSS), 2011 version 22, was employed in the analysis. Analysis was done on a biweekly basis. While, the mean separation for significant effects was done using Duncan's Multiple Range Test [14].

3. Results and Discussion

Table 2 shows the sire influence on reproductive performance of local and exotic sows. The result shows that there was significant (P<0.05) influence of sire on the litter size at birth (LSAB), the progenies from Local pig x Large white recorded the highest LSAB (6.40 ±0.25) followed by Local pig x Landrace progenies (4.40±0.51) while, Local pig x Local pig recorded the least (4.20 ± 0.55) LSAB. Significant (P<0.05) effect of boars was also shown on the litter size at weaning (LSAW). This also follows similar pattern as the LSAB where the progenies from Local pig x Large white had highest (6.00 ± 0.32) LSAW. While, the progenies from Local pigs x local pigs recorded the least LSAW (3.00 ± 0.32). Litter weight at birth (LWAB) was significantly (P<0.05) affected by boars influence and it was revealed that progenies from Local pig x Large White recorded the highest LWAB (8.02 ±0.89 Kg) followed by Local pig x Landrace (5.17 ± 0.69 Kg) while purebred Local Pigs x Local pigs recorded the least LWAB (3.56±0.49 Kg). Significant effect (P<0.05) of sire was also observed on the litter weight at weaning (LWAW), where, the progenies from Local pig x Large white recorded highest LWAW (36.94 ± 1.79 Kg) while, the progenies from Local pig x Local pigs had the least LWAW (11.96 ± 1.55 Kg). Significant effect (P<0.05) of sire was observed on gestation period among the breeds of sows, but, it is revealed that there was no significant (P>0.05) effect of sire on the gestation period of Local pig x Large white and Local pig x Landrace. The gestation period of the pigs used for the study ranges from 114 to 116.4 days. The result showed that Local pig x Large white recorded highest gestation period (116.40 ± 0.25), followed by Local x Landrace (115.80 ± 0.37) while Local pigs x Local pigs recorded the least gestation period (114 days). These differences in sires performance on LSAB were due to genetic makeup of the individual sows and environment provided for gene expression. The results obtained in this study are in line with the discoveries of Eyovwunu, *et al.* [15] where significant differences (P<0.05) of sire genotypes were observed on the LSAB of pigs. The significant difference among genotype groups in size of litter at birth (LSAB) in the study supports the findings of several authors [7, 15, 16]. The result obtained in this study also confirmed with findings of Nwakpu and Onu [17] where litter size was significantly (P<0.05) difference among the sire genotypes with the reciprocal crossbred having more than the main crossbreds. This is proven from Local gilts that provided the maternal effect and whose preponderant genes brought down the litter size number. The results obtained in this study are in agreement with the findings of Eyovwunu, *et al.* [15] where significant differences (P<0.05) of genotypes were observed on the LSAW of pigs.

Litter size is mainly controlled by heredity and can be improved by crossbreeding between genotypes [7]. Litter size at weaning seems to be the best trait to use as a selection criteria for improving the reproductive performance than litter size at birth. The productivity of pigs depends principally on the number of piglets surviving the pre weaning stage. Local pigs x Local pigs displayed a very poor mothering ability with the highest piglet mortality than other genotypes studied. Litter size at weaning is function of litter size at birth due to either the greater livability on the part of crossbred Local pig x Landrace progenies resulting from hybrid vigour or accredited to the enhanced nurturing capability of crossbred Local pigs x Large white. This further rationalize the significance of the usage of crossbreeding in commercial pig production which is due to the exploitation of hybrid vigour and improved maternal performance of crossbred pigs. Litter size at weaning is a sign of both prolificacy and mothering proficiency of a sow. Crossbred Local pig x Large white are therefore, suitable for carrying out selection targeted at improving reproduction and growth performance.

High body weight at birth could result from the fact that heavy piglets at birth compete well during suckling and are likely to overcome the infectious disease. The genes controlling pre-natal growth may also continue their influence even after birth. It was also suggested that non-additive genetic variation is an important source of variation in growth traits particularly in progenies of crosses of line differing greatly in growth rate and body confirmation. The variation in performance could be as a result of genetic make-up of the experimental animals used for the study. The weightiest litters at weaning were noted in the Local pig × Large white genetic group, followed by the genotype (Local pigs × Landrace). This development might be credited to huge size of litter at weaning as both characters (litter size at weaning and litter weight at weaning) are highly positively interrelated [18]. The observed variances among genetic groups in litter weight at weaning are also owing to variations in body weights and sizes of the breed of foundation stock [7]. The significant (P<0.05) influence of genotypes on weight of litter at weaning (LWAW) recorded in this study confirms the previous results obtained by Singh and Devi [19] and Pandey, *et al.* [16]. The result showed that Local pigs x Local pigs had 4.00±0.55 Kg and 3.00±0.30 Kg for both LSAB and LSAW respectively, these values were relatively lower than the LSAB and LSAW recorded by Oluwole, *et al.* [20] (5.36±1.87 Kg and 5.29±1.97 Kg).

This showed that crossbred pig has harnessed the best genes from the two parents in order to improve their performance as crossbreeding combined differences in genetic merit for specific characters to synchronize effective performance characteristics and adaptability resources that were most economical. Nwakpu [21], also recorded (6.5±1.66 Kg; 8.20±2.50 Kg and 6.50±1.70 Kg) for Local pigs x Local pigs; Local pigs x Large white and Local pigs x Landrace respectively. These were slightly higher than the values from the genotypes obtained in this study.

The longer gestation periods observed in the crossbred sows could be as a result of larger size of exotic sows compared to that of Local sows. The result obtained in this study, however, agrees with Sharma and Singh [22], who reported that local sows that were mated to Large white boars had longer gestation periods than those mated to local boars. Therefore, the improvement in this trait can be done by planned crossbreeding in order to explioit the existing heterosis. Likewise, selection for a reduction in gestation length may indirectly increase prolificacy of pigs. The gestation period of Local pigs (111.7 days) was significantly shorter (p<0.01) than that of LW (116.0 days) [15]. The gestation period discovered in this investigation also concurred with the discoveries of Holness [23], who reported gestation lengths of 113 to 138 days for Mukota sows. The high association noticed between size of litter at birth and weaning is anticipated for the reason that an increase in the numeral of piglets in a litter will cause an increase in the entire weight of the litters. The relationship between the litter size and weaning weight is also agreed with the results by Nwakpu [21].

Table-2. Sires influence on Reproductive Performance of Local and exotic sows

Genotypes/ Parameters	Local Pig x Local Pig	Local Pig x Landrace	Local Pig x Large white
Litter size at Birth	4.00 ± 0.55^{b}	4.40 ± 0.51^{b}	6.40 ± 0.25^{a}
Litter size at Weaning	3.00 ± 0.32^{c}	4.20 ± 0.49^{b}	6.00 ± 0.3.2^{a}
Litter weight at Birth	3.56 ± 0.49^{c}	5.17 ± 0.69^{b}	8.02 ± 0.26^{a}
Litter weight at Weaning	11.96 ± 1.55^{c}	24.88 ± 2.94^{b}	36.94 ± 1.79^{a}
Gestation Period	114.00 + 0.32^{b}	115.80 + 0.37^{a}	116.40 + 0.25^{a}

abc mean within row with different superscripts are significantly different (P<0.05)

Table 3 Showed the mean of Boars influence on growth performance of progenies of local and exotic sows from week 0, 6 and 12 of age. Week 0 is weight at birth while week 6 is for weight at weaning. The result shows consistent increase in body weight and linear body measurements with age as expected. The analysis of variance revealed significant (P<0.05) influence of boars on BW and LBMs at birth, weaning and 12 weeks. At birth (week 0), significant difference (P<0.05) effect of genotypes was obtained on the BW and LBMs among the three genotypes of sows studied, the result revealed that crossbred Local pigs x Large white progenies recorded the highest BW and LBMs while, Purebred Local pig x Local pigs progenies had the least. The results obtained at week 6 (weaning) and 12 showed that progenies of crossbred Local pigs x Landrace had highest performance in BW and LBMs while, progenies from Purebred Local pig x Local pigs had the least performance. The result also revealed that no significant (P>0.05) effect of genotypes was observed on the rear girth at week 0, 6 and 12. The results obtained in this investigation were related to the observations of Nwakpu [21] who revealed significant difference (P< 0.05) effect of sire genotypes on body weight at birth and at weaning where crossbred Local pig x Landrace progenies were superior to other progenies from purebred Local pigs x Local pigs genotypes.

Oseni [7] and Pandey, *et al.* [16] also reported that crossbred Local pigs x Landrace was significantly highest (P<0.05) for body weight and LBMs at birth, weaning and 16 weeks of age. The significant difference observed among the crossbred pigs can contribute to the improvement of the Local pigs. According to Adeoye [24] the inheritance of the traits in the crossbred pigs were owing to non additive genetic effects. The highest body weights and linear body measurements at weaning recorded by the progenies of the crossbred Local x Landrace pigs in this study also indicated that the overall litter weight at weaning was superior for the crossbred Local pigs x Landrace and this was in agreement with the finding of Oluwole, *et al.* [20]. The implication of this in breeding programme is to plan and encourage crossbreeding in order to exploit the existing heterosis in crossbred Local pig x Landrace pigs. Such findings could also sustain the argument that crossbred pigs can be exploited beneath smallholder farming systems. Body length is linked to the body weight of an animal, therefore, any genetic improvement on BL reflects on the BW of farm animals.

Adeniyi, *et al.* [25] is in tune with result of this study where HTW of crossbred pigs is significantly higher than local pigs. Therefore, crossbred Local pig x Large white progenies could be adopted for selection and improvement of Local pigs. The result obtained indicated that HTW is interrelated to body weight of the experimental animals used for this study, therefore, HTW is a good determinants of body weight that is knowing the value of HTW will help in estimating the body weight of the animals.

According to Oluwole, *et al.* [20] BW was found very highly associated with all body dimensional characters considered, but HG and BL were the most correlated trait to body weight of pigs. HG is an essential linear body measurement which can be used to predict body weight where deliberating balance is not accessible and good indicator of growth in pigs. It is also used to relate growth in the muscle and fat tissues. HG can also offer a medium for designing breeding index.

The results obtained in this study were similar to the findings of Oke, *et al.* [26] and Oluwole, *et al.* [20], who noted that effect of genotypes was significantly difference (P<0.05) on linear body measurements such as BL, HG, HTW and RG. The different in performance between the genotypes possibly will be influence of difference in metabolism of growth hormones in the pigs. Okoro, *et al.* [27], also obtained related result, where significant difference (P<0.05) of genotypes was obtained in all the linear body measurements except in tail length. Many factors are stated to influence body weight in most domestic animals, which include body length, chest girth etc. as reported by Wu, *et al.* [28] in rabbit, Cankaya, *et al.* [29] in calves, Subalini, *et al.* [2] in pigs. These associations are considered an imperative way to define growth and development of farm animals. Linear body measurements (heart girth, height at wither, rear girth and body length) are used in estimating the body weight of pig [30]. These parameters have a tendency to increase as the animal grows with time. The body size of pig is the greatest natural trait index in pig production and very essential in assessing the economic traits in pigs which is mainly decided by body height, body weight, body length and chest circumference [31]. The high associations amid body weight and all the linear body dimensions show a certain relationship of the linear body length with body growth [32].

Table-3. Sire influence on Growth Performance of Progenies of Local and Exotic Sows at Birth, Weaning (6 weeks) and 12 weeks

Genotypes / Parameters	Local Pig x Local Pig	Local Pig x Landrace	Local Pig x Large white
Body weight (kg)	0.89 + 0.24[c]	1.12 + 0.03[b]	1.26 + 0.30[a]
Body Length (cm)	27.74 + 2.13[c]	29.16 + 1.19[b]	32.06 + 0.43[a]
Body Height (cm)	17.41 + 0.44[c]	22.74 + 0.26[b]	23.31 + 1.22[a]
Heart Girth (cm)	23.18 + 3.28[a]	22.65 + 0.99[b]	22.87 + 0.45[b]
Rear Girth (cm)	22.97 + 3.05	21.99 + 1.29	23.78 + 0.61
AT WEEK 6 (Weaning)			
Genotypes / Parameters	Local Pig x Local Pig	Local Pig x Landrace	Local Pig x Large white
Body weight (kg)	3.96 + 0.67[b]	5.72 + 0.46 [a]	5.37 + 1.06 [a]
Body Length (cm)	41.55 + 1.56 [c]	52.57 + 2.11 [a]	45.60 + 1.85 [b]
Body Height (cm)	26.69 + 1.15 [c]	31.50 + 1.72 [a]	27.37 + 0.24 [b]
Heart Girth (cm)	31.26 + 3.93 [c]	35.23 + 0.81 [a]	33.62 + 1.44 [b]
Rear Girth (cm)	31.64 + 2.72	35.75 + 2.29	33.91 + 0.74
AT WEEK 12			
Genotypes / Parameters	Local Pig x Local Pig	Local Pig x Landrace	Local Pig x Large white
Body weight (kg)	7.18 + 0.77[c]	10.71 + 0.65 [a]	9.49 + 0.87[b]
Body Length (cm)	52.06 + 2.72 [c]	69.37 + 0.68 [a]	61.30 + 1.58 [b]
Body Height (cm)	32.83 + 3.51 [c]	36.63 + 0.89 [a]	33.00 + 2.46 [b]
Heart Girth (cm)	38.04 + 2.58 [c]	45.75 + 1.02 [a]	42.89 + 1.97 [b]
Rear Girth (cm)	38.28 + 3.14	44.60 + 1.77	43.26 + 2.34

abc mean within row with different superscripts are significantly different (P<0.05)

4. Conclusion

The results obtained revealed that using local sire to cross exotic sows produced better performance in both reproductive and growth indices. Therefore, crossbred Local pig x Large white progenies could be adopted for selection and improvement of Local pigs. The various linear body measurements from different genotypes in this investigation may assist as starting position information for designing suitable conservation strategies for these genotypes most especially with Local pigs and their crossing with exotic breeds.

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