A COMPARISON OF THE INDIGENOUS AND EXOTIC PURE AND CROSSBRED SOWS IN SOUTHERN NIGERIA: RELATIONSHIP BETWEEN DAM AND LITTER PERFORMANCE

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ABSTRACT

THE study embraced the evaluation of reproductive efficiency of pure and crossbred exotic and indigenous sows of Nigeria. Characters studied were litter size at birth and weaning, survival at weaning, average pig weight, litter weights at 3,5 and 8 weeks of age and weight loss of the dams during lactation.

Highly significant breed and seasonal effects were recorded in almost all traits studied on litter and piglet performance and the efficiency of milk utilization. No seasonal effect was reported for litter size, milk ingested per piglet and weight lost by the sow.

Seasonal factors accounted for 0.43% of variation in litter size but 60.9% of litter weight. Breed differences accounted for 25.7% of birth weight and 59.8% of milk utilization efficiency and the sow age contributed 5.3% of pig birth weight and 36.0% of litter size variation. Pooled estimate indicated average pig birth weight of 1.14kg in the indigenous pigs and 1.54kg for the reciprocal Large White x Landrace piglets; average weaning weights ranged from 4.39 to 9.91kg and preweaning gain from 3.38 to 8.25kg respectively. Litter size at birth also varied from 5.2 in the landrace to 8.4 in the Duroc Large White cross with 4.6 and 7kg weights of pigs weaned respectively.

INTRODUCTION

The sows productivity is best assessed by the total weight of her litter at weaning and the ability of the piglets to survive and gain well during her life time. The milk production of the dam plays a significant role in this regard especially in the pig where utilization of the milk from other sources and milk substitutes often meet with severe nutritional disadvantage in terms of utilization by the piglets.

Highly significant breed and seasonal effects had been reported on the amount of milk suckled by piglets from their dams (Gills, *et al* 1956; Roosve, 1967; Mahan, *et al* 1971b; Whittemore and Frazer, 1974) who had worked with improved breeds in temperate regions. This report is concerned with the relationships of the sows performance in terms of her milk production, litter productivity, and growth of her pigs involving improved pure and crossbred sows and the Nigerian Indigenous sows in the same tropical environment.

MATERIALS AND METHODS

Sows of seven genotypes (N = 113) were used as described in previous studies (Adebambo *et al* 1979 a, b). It is consisted of Large White and Landrace exotic purebreds, F_1 crosses of Large White and Landrace with Duroc boards and reciprocal crosses of the Large White and Landrace as well as indigenous sows nursing a total of 725 piglets.

The sows' weights were taken shortly after farrowing and at weaning 56 days later. Piglets where individually weighed at birth, three, five and eight weeks of age. Weight changes of sows during lactation and pre-weaning gain of their piglets over the nursing period were obtained. All variables were studies with regard to effects of genotype, parity (age of sow) and time of farrow (season).

Statistical Analysis:

Statistical model used for the analysis of variance was the Hierarchial Classification (Singh and Chaudhary 1977). Differences between mean within genotype were tested by Duncans (1955) multiple range test while trends in interrelationship were revealed by regression analysis using

an IBM 360 computer to calculate multiple linear regression co-efficients.

RESULTS

Productivity:

The means of the total yield of milk of the dam, number and weight of pigs at birth and weaning at 8 weeks as well as their gain in comparison with the dam weight loss during lactation are shown in Table 1.

TABLE 1:

Milk Production and Litter Performance

Breed	N Traits	Milk produced (kg)	Pig born alive	% weaned	Litter Birth weight (kg)	Litter weaning weight (kg)	Pig pre-weaning gain (g/day) days	Dam weight at farrow (kg)	Weight loss in lactation kg/56
Large White (LW)	21 Mean	137.7	7.3	91.5	8.3	39.7	820	141.0	28.0
	CV	30.7	26.7	11.8	28.7	33.0	28.5	22.2	46.6
Land Race (LR)	20 Mean	133.4	5.2	92.1	6.7	35.8	1,110	131.0	33.0
	CV	33.1	35.7	14.6	33.2	35.9	40.4	25.1	67.5
Indigenous (IND)	18 Mean	74.0	5.3	85.9	5.0	21.3	600	60.5	22.0
	CV	23.7	36.0	22.7	40.6	60.5	47.3	42.9	55.1
Duroc X LW	16 Mean	148.3	8.4	90.3	11.3	61.6	1.140	128.0	33.0
DU . LW	CV	22.9	23.3	1.3	23.6	43.7	39.4	17.9	43.9
Duroc X LR	14 Mean	153.2	8.1	87.8	10.9	64.3	1,250	138.0	34.0
DU . LR	CV	25.9	27.3	15.1	22.9	39.2	29.2	23.5	34.0
LW X LR	12 Mean	129.2	6.9	91.0	9.2	57.1	1,440	133.0	29.0
	CV	25.8	45.5	11.9	47.5	44.9	40.8	23.5	43.0
LR X LW	12 Mean	144.6	7.5	93.0	10.6	63.1	1.470	138.0	26.0
	CV	27.3	46.7	8.5	44.4	49.0	66.6	25.8	52.2

CV = % Co-efficient of variation.

TABLE 2
Analysis of variance (MS) for effect of season, Genotype and parity on litter and Dam Performance

Source of variation	d.f	Total Milk	Milk/ piglet	Average litter size	Litter birth weight	Litter weaning weight	Weight gained/ litter	Sow weight loss utilization	Efficiency of milk
Season (s)	1	3,277.7*	14.7	0.12	38.4**	2995**	2376**	191	0.7
Breed (W/S)	12	9,212.8**	156.4*	14.01*	49.4**	2854**	2178**	427	16.4*
Age (W/b)	14	3,250.7*	69.0	10.05	19.6**	644**	467*	348	5.1
Within Variables	85	1,228.2	50.1	3.77	5.8	271	219	217	5.2

* P 0.05
** P 0.01
Average litter size = (No. of Pigs after 1st week + No. of Pigs after 7 week) —2.

There were highly significant breed effects ($P<0.01$) in almost all traits studied (Table 2). There was a significant breed effect ($P<0.05$) on the milk ingested per piglet, average litter size, individual birth weight and efficiency of milk utilization and also a highly significant seasonal effect on litter birth, weaning weight and weight gained ($P<0.01$).

Variation in Litter and Sow Performance:

There was no seasonal fluctuation in the average litter size (Table 3). The litter birth weight, weaning weight and average pre-weaning weight gained were higher and significant during the wet season than in the dry season and similar effects were observed in individual piglet weights at birth, weaning and in preweaning gains. Although weight loss in dams was not significantly different, accelerated weight loss occured during the hotter months.

Significant age effect was found on litter birth weight ($P < 0.01$) and differences were apparent for total milk produced ($P<0.05$) and the weight gained ($P < 0.05$) but with no pronounced effect on average milk ingested. The genotypic influence was most pronounced in the milk production and litter performance. This constituted 44% of the variation of pig weight at birth and 42% of the total weight gained in 56 days.

TABLE 3
Percent Variation in Litter and Sow Performance

Source of variation	Milk produced	Milk/ pig	Litter size	Litter birth wt.	Litter weaning wt.	Weight gained/ pig	Sow weight loss	Efficiency of milk utilization.
Season	19	5	0.4	34	45	44	16	2.0
Breed	54	54	50	44	42	43	36	60.0
Age	19	24	36	17	9	6	29	19.0
Unaccounted	7	17	13	5	4	7	18	19.0

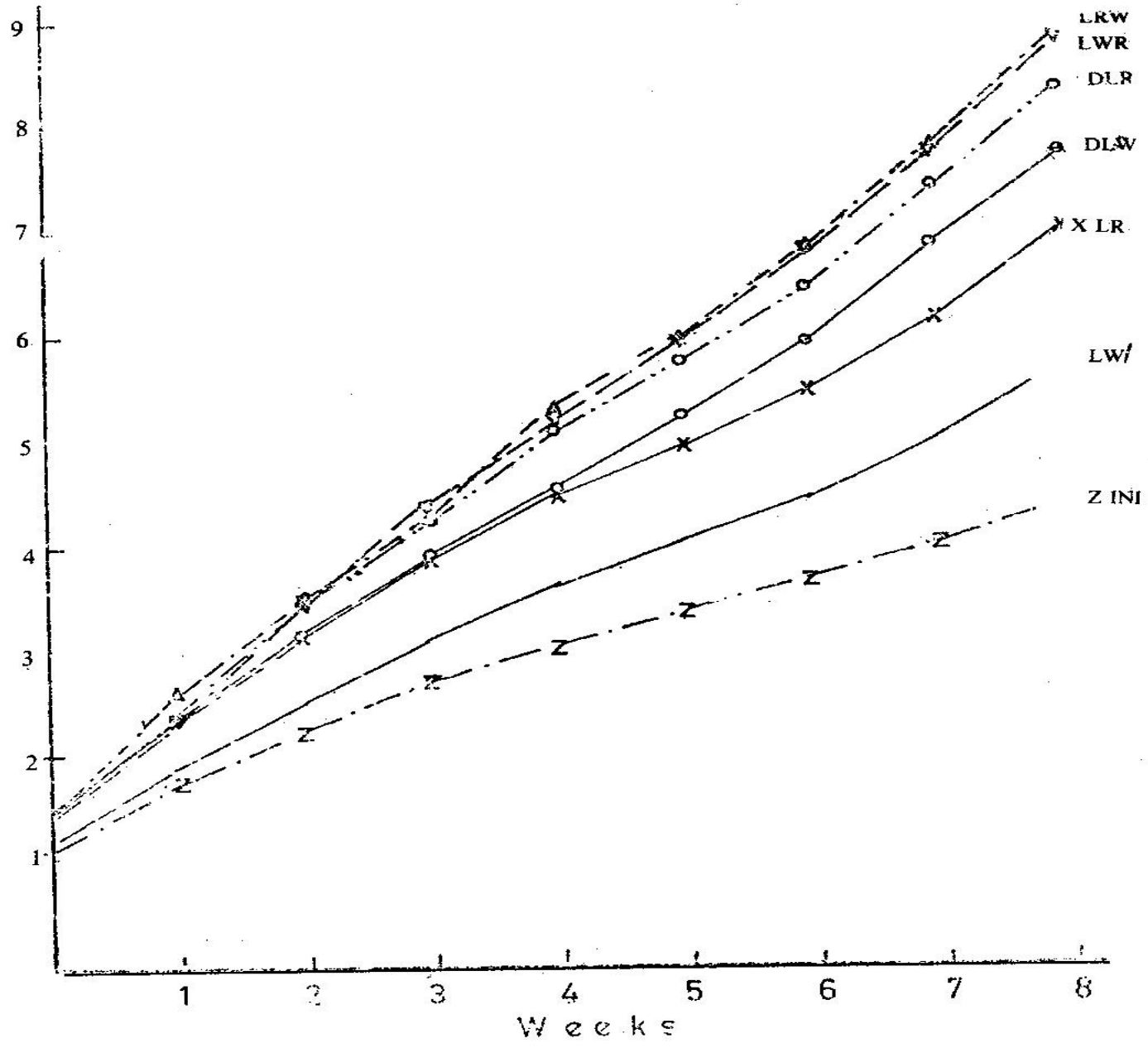

Fig. 1 Mean individual weights (kg) from birth to weaning by week and genotype.

From the growth curve (Fig. 1) the indigenous breed had the slowest rate of growth while the reciprocal crosses were fastest.

The number of pigs born per litter varied from 5.2 to 8.4 pigs in the Landrace and the Duroc-sired Large White pigs. A litter size of eight and more was very common among the Duroc crosses. The pre-weaning death losses were low with 8.9 and 9.3% for the purebred exotics and their reciprocal crosses, a higher loss of 12.3% was recorded for the Duroc crosses and 12.7% for the indigenous breed.

Relationship between Preweaning traits:

There were highly significant positive correlations between litter size and litter birth weight. The regression values ranged from 0.52 to 0.93 (Table 4). The differences were not significant between the exotic pure and crossed but between the two groups and the indigenous breed. The relative increase in birth weight per unit increase in litter size was highest for crossbreds (1.19kg — 1.40kg) and lowest for the Large White (0.66kg) followed by the indigenous litter (0.87kg).

There were significantly higher correlations between litter size and weights of the crossbreds with correlation co-efficients of 0.70 to 0.93 at birth 0.51 to 0.76 at 8 weeks compared with low values of 0.52 to 0.53 in the Large White.

In all animals the correlations decreased as the dams matured. The relative increase in weight per unit increase in litter size rose with the age of the animal (Table 5). There were weight increases of 2.43 kg at three weeks in the purebred Large White offsprings, 2.90 kg at five weeks and 3.61 kg at 8 weeks per unit increase in litter size; higher in the other breeds to an increase of 6.40 kg in the Duroc crosses at three weeks and 6.46 kg at 8 weeks.

The correlation of litter birth weight on preweaning litter weights decreased with the age of the pigs. The co-efficient decreased from 0.46 at three weeks to 0.45 at 8 weeks in the Large White and from 0.94 to 0.89 in the reciprocal crosses. The relative increase in weight per unit increase in birth weight of the offspring were 1.61 kg at three weeks and 5.58 kg at 8 weeks in the Large White, increasing to 2.85 kg at three and 5.58 kg at eight weeks in the reciprocal crosses.

TABLE 4
Correlation Co-efficient between Reproductive Traits

PUREBREDS — Pooled estimates

	Litter Size	Litter Birth weight	Litter weights 3 wks	5 wks	8 wks
Litter size	—	0.522*	0.571**	O.531*	0.530*
Litter brith weight	—	—	0.471	0.458	0.631
Sow's Body weight at farrow	0.345	—	—	— —	—
Lactational weight loss	0.161	—	—	—	—
Milk yield	0.370	0.300	—	—	0.672**

CROSSBREDS — Pooled estimates

	Litter Size	at Birth	Litter weights 3 wks	5 wks	8 wks
Litter size	—	0.932**	0.775**	0.684**	0.652**
Litter Birth weight	—	—	0.938**	0.897**	0.846**
Sow's Body weight atf farrow	0.117	—	—	—	—
Lactational weight loss	0.591*	—	—	—	—
Milk yield	0.742**	0.883**	—	—	0.854**

INDIGENOUS SOWS

	Litter Size	*At Birth*	*Litter 3 wks*	*Weights 5 wks*	*8 wks*
Litter size	—	0.826**	0.732**	0.718**	0.649**
Litter birth weight	—	—	0.733*	0.710**	0.634**
Sow's Body weight at farrow	0.455**	—	—	—	—
Lactational weight loss	0.595*	—	—	—	—
Milk yeild	0.806**	0.821**	—	—	0.677**

* $P < 0.05$
* $P < 0.01$

TABLE 5
Relationship between some linear measurements

Performance Traits / *Litter size*		*Purebred Pooled Estimate Prediction equation sb*	*Crossbred Pooled Estimate Prediction equation sb*	*Indigenous Bred Prediction equation sb*
Litter weights at birth		1.42 + 1.043x 0.136	0.98 + 1.401x 0.173	0.81 + 0.873x 0.149
	3 weeks	1.96 + 3.474x 0.540	5.34 + 3.542x 0.913	0.36 + 2.632+ 0.506
	5 "	6.65 + 3.648x 0.789	12.36 + 4.273x 1.444	0.84 + 3.214x 0.670
	8 "	16.87 + 3.702x 1.250	17.56 + 6.464x 2.376	0.37 + 4.355x 1.109
Body weight at farrow		4.02 + 0.021x 0.013	4.27 + 0.020x 0.040	2.77 + 0.034x 0.017
Lactational weight loss		20.35 + 1.118x 0.572	7.94 + 2.610x 1.112	3.96 + 3.743x 1.267
Milk Yield				
Litter size		77.75 + 8.304x 4.772	78.78 + 9.360x 2.670	39.09 + 7.226x 1.374
Litter birth weight		93.56 + 5.342x 3.871	66.42 + 7.410x 1.240	42.20 + 6.321x 1.453
Litter birth weight		50.27 + 2.205x 0.557	69.45 + 1.875x 0.352	50.57 + 1.099x 0.200
Preweaning weight gained		63.60 + 2.360x 0.607	60.88 + 1.431x 0.260	53.83 + 1.233x 0.243

sb = standard error of slope b.

Sow Performance

The weight lost during the period of lactation varied from 22.0 kg in the indigenous to 34.3 kg in the Duroc crosses although there were no significant differences between the different genotypes (Table 1) The indigenous breed lost 36.4% of its weight at farrow, although only 36% of the variation in wieght loss was due to genotypic differences.

Litter Size and Body Weight Changes

There was an insignificant positive relationship between body weight of the dam and the average litter size farrowed with only a significant correlation of 0.46 obtained in the indigenous pigs.

DISCUSSION

There was a general improvement in most performance traits in crossbred pigs over purebreds particularly marked is the pre-weaning growth of crossbreds compared to purebreds and of the Large White among the purebreds.

The age (parity) effect on the milk production, litter size and subsequently litter weights followed the usual natural pattern of growth of the dams in that the animal's body size, mammary gland and uterine capacity increased up to about the third to fifth parity.

The number of pigs farrowed and weaned compared favourably with the results of Walker *et al* (1972). The number farrowed was quite low when compared with reports by Omtvedt *et al.* (1966) and Wilson *et al* (1961) who obtained litter sizes of 10 — 14 piglets but their percentage losses in both studies were very much higher 22% compared to only 8.7 — 12.7% obtained in this study. Larger litter size was associated with increased preweaning death losses (Weaver and Bogart, 1943; and Winters *et al.*, 1947). The reduced effect of litter size on weaning weight as compared with birth weights suggests that weaning weight is controlled to a large extent by the mothering ability of the dam.

The negative correlation between litter size at birth and pig weaning weight and preweaning gain may be explained from the positive relationship between litter size and milk production. While the milk produced may not be sufficient enough to give each pig in a large litter the same amount of milk as one in a smaller litter, the result is a reduced wieght gain per pig as the pigs per litter increases. As litter size increases both litter birth and weaning weight increases while mean piglet weight decreases as a result of increased competition for the available nutrient supply from the dam.

The decreasing correlation co-efficients between litter birth weight and litter weights in these studies are within the ranges obtained by Lodge and Pratt (1963) with values of 0.89, 0.52 and 0.45 respectively for Landrace and values of 0.64 obtained by Omtvedt *et al.* (1966) for Duroc crosses and 0.69 for Yorkshire crosses (Fahmy and Bernard, 1970).

The relationship between litter weights at birth and weaning depends mainly on the common effect of litter size on both traits. These findings indicate that selection for litter size could be more important in improving litter weight at weaning than selection for heavier pigs knowing that heritability of both traits is relatively low (0.05 to 0.20; Craft, 1958). The crossbreds with higher litter size had higher increases in weight per unit increase in litter size and litter weight at thedifferent ages. This was in line withresults reported by Lodge and Pratt (1963). However the relative increments obtained per unit increase in birth weight were higher in this study than 0.795, 1.59 and 2.27 kg at three, five and eight weeks obtained respectively.

Because of the many factors involved in litter productivity and the interrelationships between sow and litter performance at different stages of lactation, it would appear desirable to carry out trials with sows over subsequent parities.

CONCLUSION

Breed differences were observed in all traits studied. Striking seasonal differences in all variables were also observed except for litter size and efficiency of milk utilization. Correlation co-efficients between most of the traits were high and significant and all traits were positively correlated with litter weight and negatively with individual pig weight at birth and weaning.

The higher degree of relationship between the rate of growth of the offspring of the indigenous pigs and the milk production of their dams indicated a tendency for the pigs performance to be more dependent on the dams reproductive efficiency.

The productivity of these animals could therefore be maximized if they are intensively managed in confinement coupled with very rigid selection during post natal and growth phases after weaning.

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