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EVALUATION OF THE GENETIC POTENTIAL OF THE NIGERIAN INDIGENOUS PIG

By

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INTRODUCTION

Nigeria currently has an estimated pig population of 860,000 of which about 83% are indigenous pigs scattered all over the country under a free range scavenger system of traditional village management. The indigenous pig is characterised by its low productivity which has been partly ascribed to lack of genetic improvement.

An estimated 0.27 kg per capita of pig meat is consumed annually contributing only about 4.45% of the total meat consumed and 2.21% of the daily animal protein intake of the average Nigerian. The increasing demand for animal protein has therefore made it imperative for Nigeria to accelerate the development of its pig industry through improvements in the performance of the existing population.

Most of the research efforts in pig production has hitherto focussed attention on nutrition with very little effort on the genetic improvement of breeds.

It was therefore decided to embark on some pilot work on the evaluation of the genetic potential of the indigenous Nigerian pig.

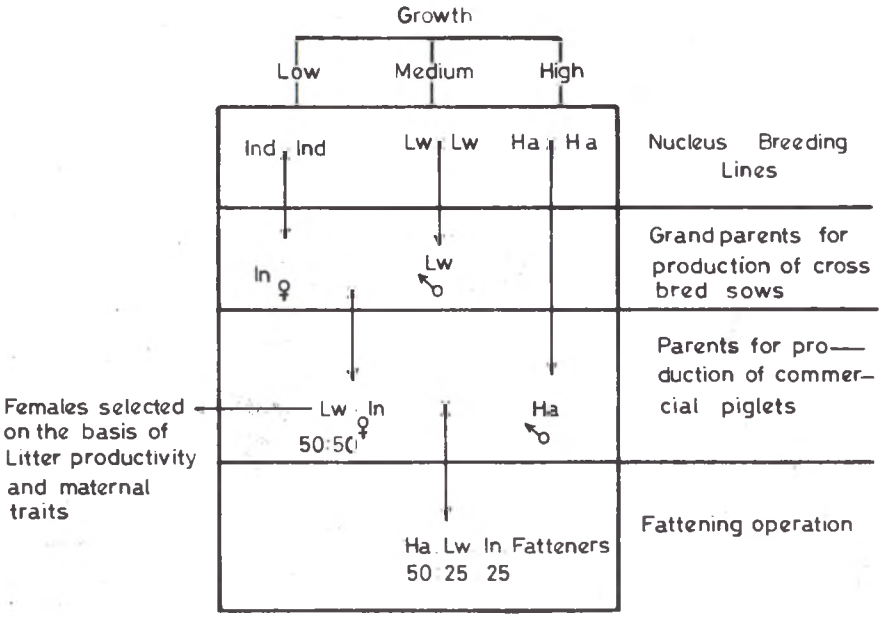
MATERIALS AND METHODS

The Institute's pig herd is composed of Large White, Hampshire and Durocs all of which have been imported into Nigeria at different times and had become fairly adapted to the hot humid conditions of the station.

Twelve sows of the indigenous Nigerian breed (slide 1) were introduced into the herd in 1977 as grand parents for the production of crossbred sows suitable for the commercial producer.

A three-line rotational crossing was used in a crossbreeding programme using the exotic breeds for the improvement of the indigenous pig. (Slide 2) Reproductive potential, growth rates and carcass quality for fattening of the indigenous pigs were evaluated alongside the exotic pigs and their crosses.

Fig. 2. BREEDING HIERARCHY IN THE 3 LINE ROTATIONAL CROSSING PRACTISED AT I.A.R.&T. BREEDING FARM



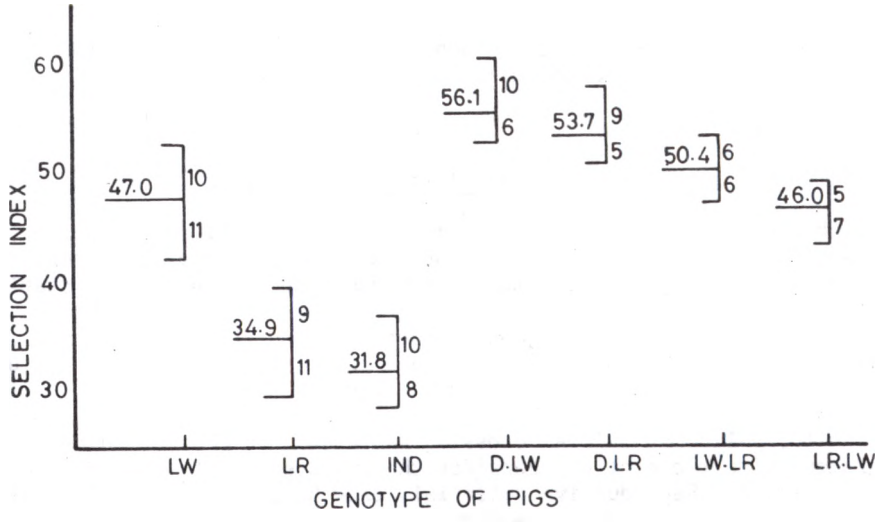


Fig. 3. Selection based on genotype

Table 1 Mean number of pigs born and weaned and mean litter weight (kg)

Genotype	N	No. born Mean	No. born Range	No. weaned Mean	No. weaned Range	Weaning weight Mean	Weaning weight Range
LW	21	7.52	5-11	6.67	3-10	39.65	16.24 - 66.45
LR	20	5.25	2- 9	4.90	2- 8	35.77	18.64 - 61.78
IND	18	5.28	2 - 9	4.61	1- 8	21.31	3.80 - 48.45
D.LW	16	8.88	5-11	7.56	4-11	61.55	30.44 -130.54
D.LR	14	8.36	4-10	7.21	4- 9	60.63	32.54 - 82.89
LW.LR	12	7.51	2-12	6.75	2 -10	63.07	28.93 -115.22
LR.LW	12	6.67	2-10	6.25	2-10	57.10	31.23 -116.79

Table 2 Performance of Sows

	A	B	C	S. E. of Means	LEVEL OF SIGNIFICANCE
	56 Days Weaning	42 days	28 days		
Sows	9	9	9		
Average pig birth weight (kg)	1.5	1.5	1.3	0.18	N S
Litter Size at birth	9.1	8.8	8.3	0.57	N S
" " " 6 weeks	8.0	6.9	7.5	0.12	N S
Pig wt at 3 weeks (kg)	4.4	5.7	5.4	1.15	N S
" " " 8 " (kg)	10.6	11.3	11.7	2.74	N S
Interval from farrowing to mating	60.3	73.0	47.0	5.83	P $<$ 0.05
Interval from farrowing to next farrow	173.6	180.8	161.3	3.95	P 0.05
Litter produced/year	2.02	2.03	2.2	0.22	N S
Piglets " "	17.8	15.8	17.6	2.16	P 0.05

Table 3 Breed Performance

	Pure bred Large White	Exotic Crosses LW x Hampshire	Indigenous Crosses LW x Indigenous	SE of Means	Level of Significance Breed	Breed and Age at Weaning
Sows	9	9	9			
Average Litter size	7.0	7.5	9.0	0.05	N S	N S
Average birth wt (kg)	1.5	2.3	1.2	0.14	P 0.01	N S
Litter size at weaning	7.0	6.5	9.0	0.56	P 0.05	N S
Average wt at 3wk (kg)	5.4	6.1	3.1	1.22	P 0.05	P 0.01
" " " 8wk "	11.4	13.2	10.7	2.37	P 0.05	N S
Interval from farrowing to mating	83	72	66	4.92	P 0.05	N S
Interval from farrowing to next farrow	191	185.3	180	9.84	P 0.05	P 0.05
Litter produced / year	2.0	2.06	2.23	0.31	N S	N S
Total piglets produced per year	14.0	17.3	18.3	2.11	P 0.05	N S

Reproductive Potentials

A linear function of phenotypic values as obtained by Dickerson (1954) was used to rank the indigenous sow's reproductivity with six other genotypes (Adebambo and Dettmers 1978).

The index used being:

$$I = 2(N_b + 2N_w) + \frac{2T_w}{30}$$

where N_b = Number of pigs born alive

N_w = Number of pigs weaned

T_w = Total litter weight at weaning.

Individual selection indices for each genotypic group were calculated. The basic information on the variables used in the index are given in Table I and selection based on genotype and on population are summarized in slides 3 & 4. Expected genetic progress from selection using the index was estimated as the product of the selection differential and heritability of the traits.

The selection indices varied from 31.8 for the Indigenous (IND.) to 56.1 for the Duroc sired Large White sows. Out of 110 sows included in the project 59 could be selected on the basis of their genotypic average while only 53 ranked higher than the population mean out of which 3 were indigenous sows.

This selection on population mean proved advantageous for this group of pigs. It increased their productivity from an index of 31.8 $\pm$ 1.36 to 44.87 + 1.41 showing that the indigenous pigs would respond to increased productivity when ranked alongside other known classified breeds in the same population.

Litter Productivity

The indigenous pigs though of smaller size compared to the exotic breeds, mature very early, between 5 - 7 months of age and farrow first litters between 8 and 10 months of age (Adebambo 1982), successfully

Table 4. Mean of Performance, Carcass data and their standard deviations.

Trait N	C R O S S - B R E D							
	Purebred Large White 20		Breed Duroc x Large White 22		Cross Bred Hampshire x Large White 26		Large White x Indigenous 24	
Average	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Birth weight (kg)	1.38	0.410	1.45	0.325	1.52	0.250	1.04	0.219
8 Week weight (kg)	9.70	1.155	11.98	2.008	10.56	0.899	.8.72	1.280
Live weight at Slaughter (kg)	41.6	5.38	47.30	3.29	46.50	2.59	44.30	4.47
Dressed weight (kg)	26.86	4.92	30.83	4.18	30.07	3.13	28.29	3.10
Yield %	64.56	2.510	65.17	3.558	64.66	3.731	63.85	4.180
Length (cm)*	64.0	3.307	65.02	2.815	64.15	1.617	58.20	3.110
Backfat thickness cm*	1.886	0.630	1.756	0.752	1.760	0.196	2.244	0.660
Loin eye area cm^{2*}	20.95	3.41	22.61	1.603	23.354	2.822	20.12	3.155
Carcass lean %	53.667	4.31	53.483	3.281	53.019	4.110	52.532	3.008
Carcass fat %	27.675	1.281	28.514	2.019	27.916	2.821	29.156	2.155
Carcass bone %	18.618	2.151	18.603	1.789	19.665	1.675	18.412	1.621
ADG (kg)	0.325	0.085	0.360	0.072	0.367	0.013	0.309	0.065
FE	4.075	0.695	3.689	0.905	3.721	0.677	3.993	0.812

* Significantly different P/0.05

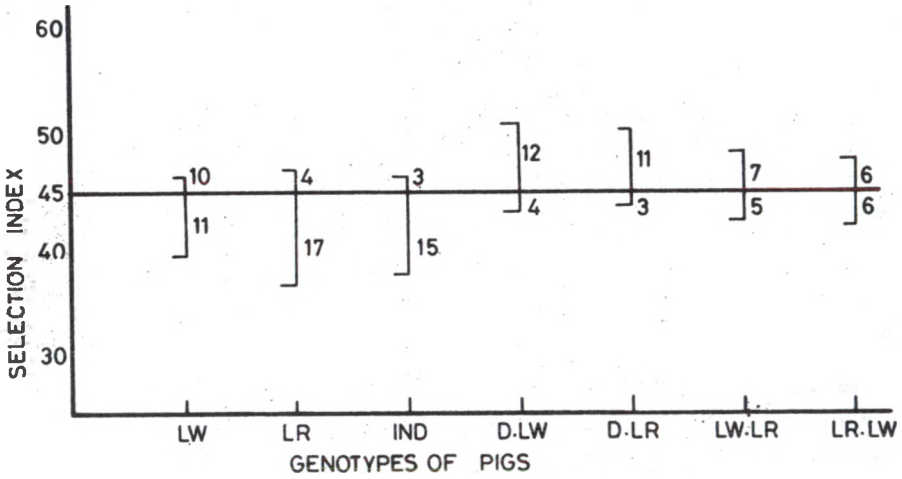


Fig. 4. Selection based on population mean

rearing 4 - 13 pigs.

Litter productivity of the purebred animal was ranked according to parity for six consecutive litters farrowed between 1978 and 1981. There was a steady increase in pigs born per litter to a peak of 8.50 ± 2.72 in the fourth parity gradually decreasing to 7.90 ± 1.88 at the 6th parity (slide 5). The uniformity and reducing in the co-efficient of variation after fourth parity would probably imply that the pigs become more uniform in size at birth after the third parity, however it was observed that the sows tend to grow with age and pregnancy up till about this fourth litter.

The litter characteristics of the pigs in an early weaning experiment to maximize number of pigs produced per sow per year was also investigated.

The pigs were weaned at 28, 42 and 56 days of age respectively. These is significant indication that weaning these pigs at 28 days post partum had no adverse effect on the conception rate of the sows. Farrowing to mating interval was reduced with early weaning (Tables 2 and 3) and significant breed variations were observed. The indigenous crossbred sows returned to heat sooner than the other breeds. Similar trends were observed for the farrowing interval betwen ages at weaning and the different breeds. Litter produced per annum was slightly improved by shortening lactation length to 28 days with 2.2 litters produced per year and 18.3 pigs raised per sow per year from the indigenous crosses.

This confirms further that the indigenous pig have something to offer the livestock industry in its germplasm as far as breeding and reproduction are concerned. These results indicate that in terms of its shorter generation interval, early maturity, number of pigs produced per sow per year and the reduced mating interval the indigenous pig had considerable potential for increasing great production and the overall output of the livestock industry in Nigeria.

Growth Potential

Ninety-two crossbred indigenous and exotic pigs reared and managed under standardized conditions were used to evaluate growth rate and carcass quality (Williamson and Paynes (1968)). Twenty-four indigenous crosses were included in the experiment involving rearing to approximately 45kg live weight (Adebambo 1981). The exotic crosses had to be slaughtered at 25 weeks (175 days) to bring them up to comparable weights. The performance data are presented in Table 4.

laving been reared under similar conditions, the improvement in the performance of the crossbred indigenous pigs is quite apparent. There is no significant difference between barrows and gilts. In combination with Large White, the indigenous breed exhibited a significant maternal influence on body composition with slightly fatter carcass and shorter length. It only suggests that evaluation of specific breed combination might be necessary to maximize crossbred advantage followed by careful consideration of all alternatives and research information vital in planning mating for efficient production of the indigenous pig.

Further to above suggestion therefore breed combinations were embarked upon to verify the hypothesis of Combining Ability in meat animals such as the pig between the indigenous and exotic breeds and determine the most appropriate combinations that gives the highest percentage of heterosis maintaining high proportion of heterozygosity.

Summary on the results of heterosis obtained are presented in Table 5. Percent heterosis of 11 - 61% were obtained for number of pigs born and 26 - 31% for average pig birth weight between the Large White x Indigenous cross and the back cross from the Hampshire x Indigenous boar mated to exotic females (50 & 25% Indigenous contribution respectively).

From bith to weaning at 6 weeks heterosis similarly varied from 15 - 80% for 25% indigenous contribution through the second generation and the tack cross. This is followed by 49 - 123% from weaning till 175 days of age. The overall trend in average daily gain from bith to 175 days showed improvement in the growth performance of the second cross over the first cross and a higher contribution from the Hampshire boar to growth (HA x IND cross than Lw X IND crosses), back crossing similarly resulted in higher heterosis than the first cross but they are still lower than the Hampshire crosses in growth rate.

Are we then justified to have the 3-line rotational crossing with the terminal sire line - the Hampshire - for fattening operations (Fig. 2)? Could there be any relationship between colour combination and adaptability of these breeds? Both the Indigenous and Hampshire breeds have the black and white colour combinations, well defined black and medium white belt in the Hampshire but relatively undefined in the Indigenous. Since coloured pigs are able to withstand stressful conditions of the hot humid tropics than white pigs which in essence affects growth performance and carcass values this may be one of the attributes to emphasize in the crossbreeding to upgrade the indigenous pigs.

This results have been obtained on a handful of animals as indicated, more work is in progress as more animals are continuously being evaluated.

TABLE 5 *HETEROSIS IN LITTER PERFORMANCE AND GROWTH RATE OF INDIGENOUS CROSSES.*

	FIRST CROSS								SECOND CROSS			BACK CROSS					
	INDIGENOUS PURE IND.	IND.	LARGE WHITE & IND. LW. IND.			HAMPSHIRE x IND. Ha. IND.			HAMPSHIRE x IND. Ha. LW x IND			IND. CROSS x EXOTIC LW. IND x LARGE WHITE			IND. CROSS x EXOTIC * Ha. IND. x LARGE WHITE		
	100% IND		50 : 50 IND.		%	50 : 50 IND.		%	75 : 25 IND		%	75 : 25 IND		%	75 : 25 IND		%
		SD		SD	Heterosis		SD	Heterosis		SD	Heterosis		SD	Heterosis		SD	Heterosis
Average Litter size Birth-weaning	5.5	2.12	6.14	2.27	11.64	6.90	1.85	25.45	7.63	1.63	38.7	8.88	2.75	61.4	7.25	1.18	31.8
Pig birth weight (kg)	1.0	0.00	1.81	0.40	81.0	1.43	0.42	43.0	1.59	0.34	59.0	1.31	0.49	31.0	1.26	0.55	26.0
GROWTH																	
Pig weaning weight (kg)	5.01	0.24	7.00	0.85	39.7	8.02	1.17	60.1	5.80	1.30	15.8	7.97	1.04	59.1	7.94	0.87	58.48
Average Daily Gain (g)																	
Birth – weaning at 6 weeks	99.29	71.05	124.4	73.38	25.3	116.4	84.6	67.6	163.3	49.0	64.5	161.03	117.3	62.2	159.5	74.7	60.6
Weaning – 20 weeks	155.0	52.10	249.1	12.99	60.7	345.7	23.9	123.0	282.9	50.6	82.5	276.6	97.9	72.6	304.6	55.3	96.5
Total A D G.	127.15	55.8	186.75	54.4	46.9	256.05	97.9	101.4	223.1	47.4	75.5	218.8	97.9	72.1	232.05	63.1	82.5
N – sows	10		12			18			15			10			10		
N – pigs	55		74			124			115			92			74		

* *First mentioned is the male line.*

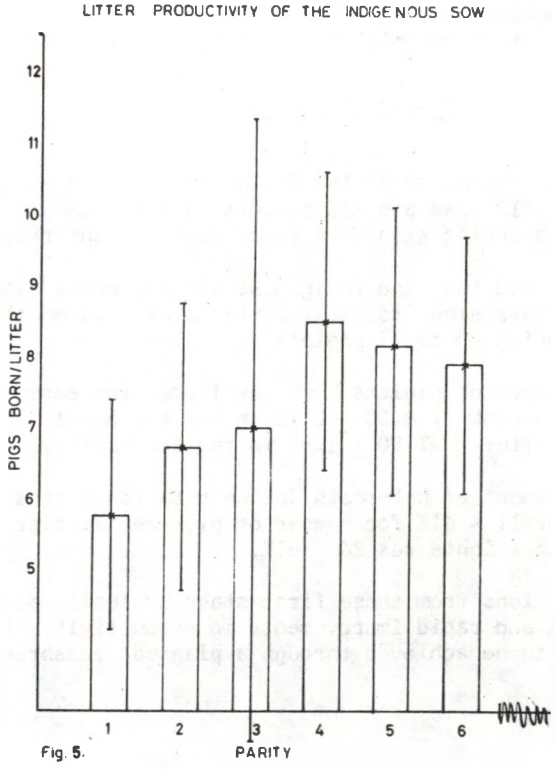


Fig. 5.

From the breeding point of view it is necessary to consider specific genotype x environment interaction in gene transfers from other climatic zones as well as formulation of breeding aim in other to resolve the discrepancy between the breeders goal of higher yield and the natural ability of the animal for performance. A continuous link to non-tropical breeding centres and the concentration on breeding of maternal stock in indigenous stock for further distribution is essential. The choice of breeding methods however must be adapted to the organizational situation in the tropics.

CONCLUSION

The Indigenous pigs of Nigeria could be said to possess some unique attributes, phenotype and suitability to its geographical location. These characters must be fully evaluated and exploited through pure breeding and systematic cross breeding so as to preserve its germ plasm. It is then necessary to extend some of its gene complement to other breeds which find the hot humid climate too harsh for their existence.

The complementary effect observed between the Large white boar x the Indigenous sow for litter productivity and the Hampshire boar x Indigenous sow for growth performance could be further investigated and exploited in improving the genetic traits of the indigenous sow for the required acceptability to the commercial pig producer.

ABSTRACT

The genetic potential of the indigenous pig was evaluated using a total of 212 sows and 636 piglets involved in a 3 - line rotational crossbreeding with some imported European breeds.

Results showed that the indigenous pig matures earlier (5 - 7 months) farrowing its first litter at 8 - 10 months and successfully rearing up to 13 piglets per litter.

Average number of piglets born per litter increased with dam parity with a peak of 8.50 ± 2.72 in the 4th parity and declining there after to 7.90 ± 1.88 in the 6th parity.

An assessment of heterosis in the rotational crosses showed a range of 11 - 61% for number of pigs born/litter whilst average pig birth weights was 26 - 81%.

The indications from these first stage evaluations are that substantial and rapid improvements in productivity of the indigenous pig can be achieved through a planned crossbreeding programme.

R E S U M E N

El potencial genético del cerdo indígena se valoró utilizando un total de 212 cerdas y 636 lechones en un cruzamiento de 3 líneas, rotacional, con algunas razas europeas importadas. Los resultados demostraron que el cerdo indígena adulto precoz (5-7 meses) produce la primera camada a los 8 - 10 meses y cría con éxito hasta 13 lechones por camada. El número medio de lechones nacidos por camada aumentó por cada parto de las cerdas con un pico de 8,50 ± 2,72 en el cuarto parto y declinó después a 7,90 ± 1,88 en el 6º parto. Una determinación de la heterosis en los cruces rotacionales demostró una oscilación de 11 - 61% para el número de lechones nacidos por camada, con una media de pesos al nacer por lechón de 26 - 81%. Las indicaciones en relación con estas primeras evaluaciones son que la mejora sustancial y rápida en la productividad del cerdo indígena puede ser lograda a través de programas de cruzamiento.

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