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HETEROSIS OF EARLY GROWTH IN NATIVE AND LANDRACE PIGS.

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Target Audience: Pig farmers, breeders and extension agents.

ABSTRACT

An experiment was conducted to evaluate the heterosis of early growth of native and landrace pigs and their crosses using growth parameters like live weight, weight gain, feedintake and feed efficiency as well as body linear parameters like body length, heartgirth and height at withers of the piglets. The study was carried out for a period of eight weeks using locally sourced feed ingredients containing about 22 percent crude protein to formulate the creep feed. A total of six progenies per strain comprising three males and females each were randomly selected to represent one breeding group. A total of four breeding groups were monitored namely: Native, Landrace, Purebreds, and their progenies of main and reciprocal crosses. The result of the experiment showed that the crossbreds were superior to the native purebreds but were statistically (P>0.05) similar with the exotic purebreds in all traits except weight gain, feed intake and feed efficiency that were not statistically different in most of the weeks. The result also indicated significant (P<0.05) heterosis in body weight and other linear body parameters at the preweaning and weaning age periods but were not significant (P>0.05) for other growth parameters like live weight gain, feedintake and feed efficiency from first to 5th week of growth. At 7th to 8th week of age, heterosis were highly significant among the growth parameters monitored. Results also portrayed the reciprocal crossbreds as having higher heterotic performances than their maincrossbred. Result suggests that F1 progenies growth potentials could be exploited through reciprocal crossings of native sire with exotic landrace dam to explore the benefits of heterosis.

Keywords: Heterosis, growth, strain, native, exotic, and crossbreeds.

DESCRIPTION OF PROBLEM

The word heterosis according to (1), was described as the increased vigour of crossbreds relative to their parents irrespective of the cause. Heterosis or hybrid vigour also refers to the superiority of a crossbred animal over the average performance of its parents (2).

are better than the mean of the both parents, (7), regarded it as a positive heterosis; and negative heterosis if offsprings were worse than the mean of both parents.

Similarly, (8), observed that, when crosses are made between two parental lines which differ genetically, such as different inbred lines or different breeds or strains within a particular specie, heterozygosity is presumably generated in the resulting F1 progeny. The mean performance of three F1 progeny may exceed the mean of both parents (mid-parent heterosis), or the performance of the poorer parents (poorer parents heterosis).

Generally, (9), stated that the genetic explanation for the hybrid extra vigour is basically the same, whether it be animal or crop. Heterosis is produced by the fact that the dominant gene of a parent is usually more favourable than the recessive partner. When the genetic group differ in frequency of gene they have and dominance exist, then heterosis will be produced.

The objective of this study is to compare data in growth rate and feed efficiency of the Native and Landrace purebreds and their crosses and to estimate the amount of heterosis that will be exhibited by the F1 when compared with the parents. With the present awareness of agricultural acceleration, it may be worthwhile to breed and develop our own strain of pigs for the farmers. It might be a misconception that our native pigs be left in the background at this time when they could be bred and upgraded in a way as to develop a new strain of pigs.

It is sternly believed that, this native strain have something to offer to swine industry, perhaps, far more than we have been able to extract from them until now. (10), have earlier reported some results of cross breeding between largewhite and local black of Ghana and among large white and saddle back of Nigeria.

By embarking on a special breeding programme involving the exotic and native pigs, it is possible to improve on some economic traits of the native strain and if possible create entirely new strains elsewhere in the world. The effort is justifiable because, this will create a base for the much needed solid foundation for our swine industry.

The establishment of an improved Native strain of pigs will go along way to conserve our almost extinct Native strains and their potentials tapped using the exotic strains whose performance and adaptation is poor compared to their counterparts in the temperate regions.

MATERIALS AND METHODS

The experiment was carried out at the piggery unit of T & R farms of Ebonyi State University, Abakaliki. The experimental site was a standard block with open sides covered with net, concrete floor, and roofed with asbestos roofing sheets, each pen were measuring 4m x 7.5m long, with a feeding, drinking and wallowing troughs.

A total of six progenies comprising three males and females each were randomly selected per strain using age and weight to group them into replicates of three piglets per group. A total of four groups were established namely:- Native, Landrace, Landrace x Native, and Native x Landrace strains. Crosses of these progenies were generated from the breeding programme going on in the farm and as such, parental data were available to the researchers.

These piglets were monitored for a period of eight weeks. During the experiment, all daily management operations including general inspection of pens and piglets, provision of water ad libitum, regular feeding and other practices deemed necessary like deworming (once) were performed from time to time. The piglets were fed with creep feed whose ingredients were locally sourced and formulated from the following ingredients.

Table 1: Composition of Experimental diets (%)

Ingredient	Composition
Crushed dry cassava chips	30
Maize bran	20
Palm Kernel cake	20
Wheat offal	10
Soyabean cake	10
Bone meal	5
Salt	1
Premix*	4
Total	100
Calculated (%)	
Crude protein	22.10
M.E (K cal/kg)	33.50
Calcuim	1.10
Phosphorus	0.80

*Premix supplies the following per/kg:
Vit A 10,000 iu, Vit K, 1.900mg, B12, 19mg, *Riboflavin* 7,000mg; *Pyridoxine* 3,800mg; *Thiamin* 2,200mg, *d-pantothenic Acid* 11000mg, *National Acids*, 45,000mg, *Folic Acid* 1,400mg, *Biotin* 113mg, *Cu* 8000mg, *mn* 6400mg, *Zn* 40,000mg, *Fe* 32,000mg,, Se 160mg, *Iodine* 800mg, *Cobalt* 400mg, *Cholin* 475,000mg, *methionine* 50,000mg. *Spiranmycin* 5,000mg.

The animals were allowed to run with their dams for the first three weeks and were subsequently weaned exactly at third week when feeding was tremendously improved among the piglets. In addition to the creep feed, supplementary feeding of fresh grasses and legumes were ensured.

Ear notching was the system employed for identification and dried sulphur mixed with motor oil (used engine oil) were used to treat ectoparasites like mange where it occurred. The pens were scrubbed with disinfectant everyday to remove faeces, and urine as well as leftover feeds.

The piglets were grouped and replicated according to their littermates to avoid fighting or unhealthy competition. The arrangement of the piglets into replicate groups was by randomization and data on body-weight, weight gain, feedintake, body-length, heart girth, and height at withers as well as feed efficiency were calculated.

The ANOVA model for purebred and crossbred data was:-
$x_{ij} = \mu + a_i + e_{ij}$; where x_{ij} = individual observation, μ = mean, a_i = Effect of breeding group. e_{ij} = Random error. Whereas Duncan multiple range test Duncan (11), were used to test the level of each factor for significant differences. Heterosis were estimated as the means of a cross minus unweighted average of the respective means of the two appropriate parents and expressing that as a percentage.

The statistical test of F1 heterosis was used to compare the crossbred group with midparents for significance of heterosis performance using procedures outlined and adopted by (7).

RESULTS AND DISCUSION

Table 2, Show that there was significant ($P<0.05$) differences in the bodyweight of the Native purebred and the rest of other strains from the first to eight weeks. However no significant ($P>0.05$) differences existed between the purebred Exotic and the crossbreds.

The weight gain did not show any difference ($P>0.05$) at the first, third and fifth weeks of age, but were different ($P<0.05$) at the second, fourth, sixth, seventh and eight weeks of growth. The weight gain of the Native purebred was superior than the rest of other genotypes at the 6th week of age.

Similarly, Feed intake and Feed efficiency were not statistically ($P>0.05$) different at the first to third week, but as from the 4th week, significant ($P<0.05$) difference started manifesting without any definite trend among the genotypes.

Also, the performance data of the linear body measurement of the progenies in Table 3 shows superiority ($P<0.05$) of the Exotic Landrace and the crossbreds over the Native purebreds at the preweaning and weaning age periods.

The similarity in bodyweight of the crossbreds and the Exotic portrays some improvement resulting from the heterotic effects transferred by the Exotic strain to the Native strain. This improvement in bodyweight is in line with the objective of crossbreeding as reported by (12)

In the same vein, improvement of other body linear measurements demonstrated dominance heterosis development resulting from Exotic strain

Table 2: Growth performance of different strains of piglets

Age weeks	Statistics	Parameters (Kg)	N	L	(LCN) Main cross	(NCL) Reciprocal
1	x±S.E	Body weight	1.0±0.60^{a}	1.50±0.20^{a}	1.43±0.30^{b}	1.60±0.5^{b}
	(C.V)		(0.50)	(0.60)	(0.60)	(0.40)
		Weight gain	0.80±0.20^{a}	1.00±0.10^{a}	0.90±0.30^{a}	1.00±0.40^{a}
			(0.10)	(0.00)	(0.00)	(0.00)
		Feed intake	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}
			(0.00)	(0.00)	(0.00)	(0.00)
		Feed efficiency	0.80±0.20^{a}	1.0±0.10^{a}	0.90±0.30^{a}	1.0±0.40^{a}
			(0.20)	(0.10)	(0.00)	1.00.40)
2.	x±S.E	Body weight	3.0±0.4^{a}	4.50±0.50^{b}	3.9±0.60^{b}	4.6±0.10^{b}
	(C.V)		(0.80)	(0.90)	(1.00)	(1.20)
		Weight gain	1.20±0.30^{a}	1.8±0.20^{b}	1.6±0.40^{b}	2.0±0.10^{b}
			(1.10)	(1.50)	(1.00)	(1.20)
		Feed intake	0.4±0.00^{a}	0.80±0.10^{a}	0.65±0.10^{a}	0.60±0.10^{a}
			(0.10)	(0.30)	(1.40)	(0.10)
		Feed efficiency	0.80±0.30^{a}	0.8±0.20^{a}	0.6±0.40^{a}	0.90±0.10^{a}
			(0.60)	(0.11)	(0.40)	(0.30)
3.	x±S.E	Body weight	4.0±1.0^{a}	6.0±0.10^{a}	4.5±0.10^{a}	5.6±0.30^{a}
	(C.V)		(1.20)	(1.40)	(1.60)	(1.70)
		Weight gain	1.10±0.30^{a}	1.60±0.40^{a}	1.30 ±0..20^{a}	1.01±0.67^{a}
			(0.70)	(0.90)	(0.8)	(0.70)
		Feed intake	0.86±0.10^{a}	0.96±0.10^{a}	0.95±0.20^{a}	0.96±0.20^{a}
			(0.30)	(0.20)	(0.40)	(0.20)
		Feed efficiency	1.60±0.20^{a}	1.40±0.10^{a}	1.50±0.1^{a}	1.80±0.10^{a}
			(0.41)	(0.36)	(0.49)	(0.50)
4.	x± S.E	Body weight	5.1±0.30^{a}	7.0±0.10^{a}	6.0±0.50^{a}	6.8±0.30^{a}
	(C.V)		(1.20)	(1.40)	(1.50)	(1.30)
		Weight gain	1.20±0.10	1.8±0.30	1.6±0.40	1.7±0.30
			(0.70)	(0.90)	(0.80)	(0.67)
		Feed intake	0.90±0.20^{a}	1.00±0.2^{a}	1.05±0.4^{a}	1.06±0.03^{a}
			(1.30)	(1.40)	(1.45)	(1.35)
		Feed efficiency	1.56±0.20^{a}	1.7±0.5^{a}	1.50±0.4^{a}	1.70±0.6
			(1.20)	(1.30)	(1.50)	(1.80)
5.	x±S.E	Body weight	6.50±0.50^{a}	8.50±0.7^{a}	7.60±0.50^{a}	8.40±0.60^{a}
	(C.V)		(2.04)	(3.50)	(2.70)	(2.80)
		Weight gain	1.60±0.40^{a}	1.60±0.30^{a}	1.65±0.30^{a}	1.7±0.50^{a}
			(3.00)	(2.80)	(3.20)	(4.0)
		Feed intake	1.0±0.10^{a}	1.2±0.5^{a}	1.1±0.30^{a}	1.30±0.60^{a}
			(3.0)	(3.50)	(2.70)	(4.0)
		Feed efficiency	1.70±0.10^{a}	1.53±0.3^{a}	1.50±0.30^{a}	1.35±0.60^{a}
			(0.10	(0.40)	(2.80)	(5.0)
6.	x±S.E.	Body weight	8.00±0.10^{a}	9.00±1.20^{b}	8.5±1.0^{b}	9.2±1.00^{b}
	(C.V)		(4.50)	(3.20)	(4.20)	(5.20)
		Weight gain	1.50±0.50^{b}	0.90±1.0^{a}	0.90±0.8^{a}	0.80±0.80^{a}
			(3.20)	(2.50)	(2.10)	(2.00)
		Feed intake	1.00±0.20^{a}	1.20±0.50^{a}	1.10± 0.4^{a}	1.30±0.80^{a}
			(4.0)	(4.20)	(4.20)	(5.10)
		Feed efficiency	1.55±0.10^{b}	0.86±1.20^{a}	0.86±0.10^{a}	0.75±0.10^{a}
			(3.80)	(4.80)	(4.90)	(2.58)
7.	x± S.E	Body weight	9.00±0.50^{a}	12.00±1.00^{b}	11.50±0.50^{b}	13.00±0.60^{b}
	(C.V)		(3.20)	(4.80)	(3.10)	(3.50)

		Weight intake	1.00 ± 0.10^a (0.80)	1.20 ± 0.50^b (0.90)	1.20 ± 0.50^b (1.10)	1.30 ± 0.80^b (1.00)
		Feed efficiency	1.10 ± 0.30^a (5.8)	2.00 ± 0.33^b (4.30)	$2.00 0.43^b$ (2.80)	2.38 ± 0.46^b (4.10)
8.	$x \pm S.E$ (C.V)	Body weight	10.50 ± 0.40^a (2.50)	15.00 ± 1.0^b (4.60)	14.20 ± 1.0^b (2.80)	16.00 ± 1.00^b (4.10)
		Weight gain	1.05 ± 0.50^a (1.05)	3.00 ± 1.0^b (2.40)	2.81 ± 1.0^b (1.86)	2.9 ± 1.05^b (2.81)
		Feed intake	1.20 ± 0.10^a (1.46)	1.4 ± 0.30^b (1.36)	1.40 ± 0.30^b (1.82)	1.50 ± 0.40^b (2.01)
		Feed efficiency	0.89 ± 0.10^a (0.36)	2.15 ± 0.10^b (1.10)	2.00 ± 0.10^b (1.30)	1.93 ± 0.33^b (1.40)

a,b,:- Means bearing different superscripts are statistically ($P<0.05$) different.

which has improved the Native strain. This observation can be supported by the report of (8), who stated that heterosis can arise from dominance and epistasis, each resulting from combination of different favorable alleles from parental lines, which are homozygous dominant or resulting from interaction of favorable non allelic genes in the parents. The lack of significant differences in the weight gain and feed efficiency among the progenies reflects the impact of maternal effect on the traits (13). As long as the piglets were still being nursed by their sows, they were getting all their body requirements from the sows milk. But as soon as their piglets were weaned, the effects of weaning coupled with lack of milk from their dams started manifesting giving way to real genetic development.

The lack of trend in the performance of these parameters could be due to the maternal performance which continued even after the piglets were weaned and which varied due to their additive genetic effects (7).

Table 3: Performance data of body linear measurements of different strains of piglets

Age (weeks) (1) preweaning	$\pm S.E.$ (C.V)	Body length	12.70 ± 0.31^a (4.20)	17.40 ± 1.30^b (2.09)	16.70 ± 0.50^b (3.10)	18.00 ± 0.10^b (4.20)
	$\pm S.E$ (C.V)	Height at withers	7.8 ± 0.10 (4.10)	10.50 ± 0.5^b (5.10)	11.05 ± 0.10^b (3.10)	12.50 ± 0.9^b (4.30)
	$\pm S.E$ (C.V)	Heart girth	9.30 ± 0.10^a (3.10)	12.10 ± 1.10^b (2.80)	14.10 ± 0.10^b (3.10)	13.10 ± 1.10^b (4.20)
8. weaning	$\pm S.E.$ (C.V)	Body length	43.10 ± 4.0^a (8.10)	63.20 ± 3.0^b (6.0)	60.10 ± 4.0^b (7.0)	65.0 ± 4.0^b (8.10)
	$\pm S. E.$ (C.V)	Height at withers	24.10 ± 1.50^a (3.8)	30.10 ± 0.50^b (4.10)	30.50 ± 0.10^b (2.93)	33.10 ± 2.0^b (4.50)
	$\pm S.E$ (C.V)	Heart girth	29.20 ± 1.80^a (2.80)	38.10 ± 4.0^b (3.10)	35.10 ± 4.2^b (4.10)	36.10 ± 2.5^b (5.10)

a b:- Means with same superscrit are statistically ($P>0.05$) similar

Table 4 shows the mean ±.S.E statistics of percentage heterosis of the growth performance traits. Result indicates highly significant (P< 0.01) heterosis in the body weight of the reciprocal crossbred than in the main cross bred from 1- 8 weeks of age. Result also indicates non- significant (P>0.05) heterosis among other growth performance traits between 1- 6th weeks of age for both main and

Table 4:- Mean ±S.E Statistics of percentage Heterosis of the growth performance parameters of F1 crossbreds.

Age weeks	Statistics	Parameters	Mid-parent	LxN) main cross	(NxL) reciprocal
1	x±S.E (%Heterosis)	Body weight	1.25 ± 0.40	14.40*	28.00**
		Weight gain	0.90 ± 0.10	0.10ns	11.11ns
		Feed in take	0.00 ± 0.00	0.00ns	0.00ns
		Feed efficiency	0.90 ± 0.10	0.00ns	11.11ns
2	x±S.E (%Heterosis)	Body weight	3.65 ± 1.0	6.85ns	26.03**
		Weight gain	1.50 ± 0.10	6.67ns	33.33**
		Feed in take	0.60 ± 0.01	8.33ns	0.00ns
		Feed efficiency	0.50 ± 0.10	20.00**	80.00**
3	x±S.E (%Heterosis)	Body weight	5.10 ± 0.10	-11.76ns	9.80*
		Weight gain	1.30 ± 0.50	0.0ns	-22.30ns
		Feed in take	0.91 ± 0.20	4.39ns	5.49ns
		Feed efficiency	1.50 ± 0.30	0.00ns	20.00**
4	x±S.E (%Heterosis)	Body weight	6.03 ± 0.40	-0.49 ns	12.76
		Weight gain	1.50 ± 0.30	10.67*	13.33*
		Feed in take	1.00 ± 0.40	5.00ns	6.00ns
		Feed efficiency	1.60 ± 0.50	-6.25ns	6.25ns
5	x±S.E (%Heterosis)	Body weight	7.50 ± 0.50	1.33ns	12.00*
		Weight gain	1.60 ± 0.35	3.33ns	6.25ns
		Feed in take	1.10 ± 0.20	10.00ns	30.00**
		Feed efficiency	1.60 ± 0.40	-6.25ns	-15.0ns
6	x±S.E (%Heterosis)	Body weight	8.3 ± 0.40	0.00ns	8.24ns
		Weight gain	0.90 ± 0.10	0.00ns	-11.11ns
		Feed in take	1.25 ± 0.40	-13.6ns	04.00ns
		Feed efficiency	0.80 ± 0.10	7.50ns	-06.25ns
7	x±S.E (%Heterosis)	Body weight	10.0 ± 1.0	15.00*	30.00**
		Weight gain	1.70 ± 0.10	47.05**	82.35**
		Feed in take	1.00 ± 0.10	20.00**	30.00**
		Feed efficiency	1.50 ± 0.10	33.33**	58.67**
8	x±S.E (%Heterosis)	Body weight	13.00 ± 0.50	9.23*	23.08**
		Weight gain	20.00 ± 0.10	40.50**	45.00**
		Feed in take	1.30 ± 0.40	7.69	15.38*
		Feed efficiency	1.50 ± 0.20	33.33**	28.67**

** P< 0.01, *P<0.05 ns P>0.05

reciprocal crossbreds. However, highly significant heterotic (P< 0.01) performances were observed in all the growth parameters between 7th and 8th weeks of age Generally, percentage heterosis was higher in the reciprocal than among the main crossbreds.

This improvement again reflects the effects of dominance resulting in greater heterosis due to maternal impact. The lower additive merit from the native sire coupled with higher additive merit of the exotic landrace sow gave rise to higher heterosis than the main crossbreds. (13), had observed maternal effect on growth performance traits which waned as soon as the animals were weaned. This sort of effect is important for traits which appear early in life like early growth traits. No wonder why(14), stated that the maternal influences can be important for the offspring at the time of birth, and perhaps up to the time of weaning. They also noted that the importance of the maternal effect usually becomes less after that, but sometimes never disappears completely.

The reason for needing to know how much heterosis arises from crossing particular breeds, is that the answers matter for the economics of choosing the best breeding strategy. If heterosis is absent or negligible as was observed among the crossbreds in (weight gain, feed intake and feed efficiency), a breed combination which meets the requirements of the farmers can readily be maintained by interbreeding the crosses. If there is no heterosis, there should be no loss in productivity from such interbreeding.

If heterosis is a large component contributing to the merit of a first cross (such as occurred in the linear body parameters) Table 5; the interbreeding of the crosses would lead to loss of heterosis; instead reciprocal crossing will exploit the heterosis desired.

Table 5:- Mean +S.E statistics of percentage Heterosis of the Body Linear measurements of different strains of piglets

Age (weeks)	Statistics	Parameters	Mid-parent	Main cross (LXN)	Reciprocal cross (NxLR)
1	x±S.E (%Heterosis)	Body length	15.00±0.20	11.33*	20.00**
(preweaning)		Heart girth	11.00±0.50	28.18**	19.09**
		Height at withers	9.00±0.30	0.45^{ns}	13.60*
8 (weaning)	x±S.E (%Heterosis)	Body length	53.00±2.50	13.20*	22.64**
		Heart girth	34.10±4,50	2.94^{ns}	5.88^{ns}
		Height at withers	27.10±1.50	11.11*	22.22**

** P<0.01* P<0.05ns P>0.05

However, it also follows that, if heterosis is a major component in the performance level of the reciprocal cross, it then means that simply introducing more exotic blood will not lead to further improvements in productivity. This is because, gains from extra exotic blood will not make up for loss of heterosis.

CONCLUSIONS AND APPLICATION

The crossbreeding effects have resulted in rapid genetic change for growth and increased vigor characteristics of crossbred association with complimentary effect of favorable dominant genes brought into the cross from all parents. The genetic variability therefore suggest that fast weaning performance could be improved through crossbreeding. The present study has shown that the native strains have great potentials for growth although the body size is generally smaller than the exotic strain. This research has proved that within its limits of genetic body size they can still perform creditably especially in the areas of body weight gain, feed intake and feed efficiency.

Heterosis was found to be small or negligible among these traits and therefore, interbreeding the F1 crossbreds may not reduce productivity.

The linear body parameters are endowed with large chunk of heterosis; therefore, reciprocal crossing using our native sire and exotic landrace sow could lead to further improvement in these traits.

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