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HETEROSIS OF EXOTIC AND INDIGENOUS LIVESTOCK CROSSES IN NIGERIA: A REVIEW.

Data from Zebu, South

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Abstract

Devon and their reciprocal F_1 were utilized to estimate heterosis for calving percentage, birth weight, weaning weight, calf survival and pre-weaning average daily gain. Results showed that heterosis for these

KEYWORDS:
Heterosis, Crossbreeding, Offsprings, Traits, Exotic, Local.

INTRODUCTION

Heterosis or hybrid vigour is the name given to the increased vigour of the offspring over that of the parents when unrelated individuals are mated (Franke, 1980). It refers to the tendency of crossbred individuals to show qualities superior to the average of those of the two parental populations. Crossbreeding schemes based on heterosis exploit superiority of the offspring over mid parent values (Gosey, 2005). Heterosis or hybrid vigour is achieved through crossbreeding. Heterosis is a powerful and

traits were 6.6, 10.1, 12.1, 9.5 and 14.3% respectively. In swine, data on body weight at 4 weeks, 8 weeks and post weaning gain showed that there was a direct heterosis which was positive and accounted for 4.8 - 7.80% of the mid-parent value. In poultry, crosses between local (LC) and Arbor Acre (AA) for body weight heterosis at 0 – 10 weeks of age showed that AA x LC have negative heterosis at hatch, highest heterosis of 27.45% was observed at week 6. LC x AA started with high and significant heterosis at hatch. Combined heterosis was significant at 4 and 10 weeks. The review indicates the ability of local and exotic breeds to nick well for meat and other productive performance and has shown that local and exotic crosses which have considerable heterosis in desired traits can be utilized to meet the short-term animal protein shortages in Nigeria.

valuable tool for commercial beef producers, especially cowcalf operations (Hoffelt, 2010). Heterosis can produce animals with enhanced reproductive, survival, longevity (Dhuyvetter, 1998), fertility, growth, meat quality (Peck, 2009), and even disease resistance traits (O'Neill, *et al.,* 1998; Dandapat, 2009). The benefits of heterosis on livestock quality and consequently profitability are very well documented (Anderson, 1990). Technically, heterosis can either be positive or negative. It is positive if the offsprings are better than the mean of both parents and negative if the offspring are worse than the mean of both parents. It is important that the genetic differences between parents should be wide to get heterosis (Franke, 1980).

In measuring heterosis, all the animals, both the parents and offspring should be compared in the same environment. For heterosis to occur, two conditions must be satisfied. First, there must be certain type of gene action; secondly, the parent must be genetically diverged. Gene action includes the effects of dominance, over-dominance and epistasis; genetic divergence may result from genetic drift, mutation and selection (Greiner, 2010). Heterosis is inexpensive and takes very little time to implement. Before starting a crossbreeding program a Livestock producer must establish needs and set genetic goals (CattleNetwork, 2008) which will lead to herd improvement and increased profitability.

Some Heterosis Fundamentals

There are some fundamentals of heterosis that producers should know before putting heterosis into practice:

1) Normally, crosses of animals that are the most unrelated, for example *Bos indicus* and *Bos taurus* types, exhibit higher levels of heterosis than do crosses of two more related cattle, like the British breeds, Angus and Hereford.

2) Normally, lowly heritable traits show the greatest improvement from heterosis like maternal ability, reproduction, health, longevity, and overall productivity. Moderately heritable traits show moderate improvements. Highly heritable traits show little or no improvement (Weaber, 2007) (Table 1).

Table1. Heritability and Heterosis (Hybrid Vigor) Comparison

Traits	Heritability	Heterosis
Fertility, mothering ability, calf survival	Low	High
Birth and weaning weight, milking ability and feedlot gain	Medium	Medium
Mature weight, carcass quality	High	Low

Source: Handley, 2010

REVIEW OBJECTIVE

The paper review results of heterosis in breeds of livestock in Nigeria and suggest possible ways of improving the programme.

RESULTS OF EXPLOITATION OF HETEROSIS IN NIGERIA

Data collection under commercial beef cattle ranching conditions in Obudu, Southeastern Nigeria from Zebu, South Devon and their reciprocal F_1 crosses were utilized to estimate heterosis and results are presented in Table 2. The estimates of heterosis were expressed as percentage deviation from parental means, while the data for the F_1 represent the mean values obtained from both reciprocal crosses. Result showed that heterosis for calving percentage, birth weight, weaning weight, calf survival and pre-weaning average daily gain were 6.6, 10.1, 12.1, 9.5 and 14.3% respectively. Heterosis was high for birth and weaning weight and calf survival, showing an increase in heterosis level for growth with increasing age. In swine, data on body weight at 4 weeks, 8 weeks and post weaning gain showed that there was a direct heterosis which was positive and accounted for 4.8 -7.80% of the mid-parent value (Table 3). In poultry, crosses between local (LC) and Arbor Acre (AA) for body weight heterosis at 0 - 10 weeks of age showed that AA x LC have negative heterosis at hatch, highest heterosis of 27.45% was observed at week 6. LC x AA started with high and significant heterosis at hatch. Combined heterosis was significant at 4 and 10 weeks. This indicates the ability of local and exotic breeds to nick well for broiler production.

CONCLUSION

There is significant heterosis in most traits of cattle, pigs and poultry in F1 crosses. In most cases, secondary crosses showed reduced heterosis or hybrid breakdown. Therefore any comparison of indigenous and its crossbred as beef, pork or broiler animals should be based on their reproductive efficiency and growth rate of their progeny.

Nigeria is endowed with raw genetic materials from which we can source. Livestock breeding programmes involving local breeds crossed with selected imported strains will help Nigeria to be self sufficient in stock formation for many years to come. Careful and systematic crossbreeding programme involving the use of local and exotic breeds which have shown considerable heterosis in desired traits is a short term solution to animal protein shortage in Nigeria. General review of livestock breeding programs through deliberate funding of research in livestock breeding is necessary.

Table 2: Percentage Heterosis and Least Squares means for Fertility and Calf Performance

Trait	South Devon	Zebu	Reciprocal F1	Heterosis %
Calving%	84.7±1.8	74.2±1.5	82.6±1.8	6.6
Birth wt. (kg)	39.4±0.2	28.3±0.6	37.3±0.6	10.1
Weaning wt. (kg)	182.5±3.5	143.9±2.7	182.4±1.8	12.1
Calf survival %	86.8±0.3	75.4±0.3	88.8±0.4	9.5
Pre-weaning ADG (Kg/day)	0.77±0.04	0.63±0.02	0.81±0.2	14.3

Source: Iloeje, 1985

Table 3: Differences in Average Direct Genetic (ADG), Average Maternal Genetic (AMG) and Direct Heterosis (DH) effects between control (B1 and B2) and selected (LW and D) populations in swine expressed as percentage of parental Means (PM)

Component	WK4	Wk8	PWG
½ (B1+ B2)%	7.94	16.64	8.86
PM(B1 – B2)%	15.24	2.52	2.60
ADG(B1-B2)%	2.39	2.52	2.60

AMG(B1- B2)%	12.85	5.23	-1.69
DH (BB1-B2)%	6.68	4.18	0.06
½ (LW+D)%	9.93	20.10	10.17
PM(LW+D)%	20.44	12.38	4.52
ADG(LW-D)%	23.96	13.28	2.85
AMG(LW-D)%	-3.52	-0.90	1.67
DH (LW-D)%	7.80	4.28	0.84

Source: lloeje, 1984

Table 4: Mean Deviation and percent Heterosis in Body Weights of Poultry

Age	Mean body weight		F. Heterosis		
	PB	CB	AA x LC	LC x AA	CB
0	37.01	35.43	-21.80_{NS}	13.27*	-4.27_{NS}
2	79.62	84.01	9.84_{NS}	1.82_{NS}	5.51
4	237.01	270.34	27.02*	1.11_{NS}	8.68_{NS}
			(64.03)	(2.64)	(33.33)
6	372.01	404.37	27.45*	-10.11_{NS}	8.68_{NS}
			(102.15)	(-37.6)	(32.28)
8	58891	690.10	27.45*	-10.11_{NS}	17.18_{NS}
			(159.32)	(3.05)	(101.19)
10	766.63	939.44	25.97*	61.51*	21.24*

Source: Nwagu *et al*. 2001.

*P<0.05, PB = Means body weight of two parents. CB = mean body weight of cross bred ( ) = deviation in grammes. Ns = not significant

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