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Comparative Reproductive Improvement of F_i and F_{ibc} Progeny of West African Dwarf and White Bornu Goats Due to Backcrossing in Humid Nigeria

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ABSTRACT: A two phase breeding programme was conducted to assess the use of White Bornu (WB) breed of goat as an improver gene source to upgrade productivity of West Africa Dwarf (WAD) goat. Phase one was the breeding of adapted stock of both breeds within and between breeds to produce F_1 while selected F_1 progeny at sexual maturity based on performance characteristics and visual appraisal were mated back (backcrossed) to their pure bred parents to produce F_{ibc} progeny. Improvement due to backcrossing revealed values of 1.67 and 1.53kg to 1.47 and 1.91kg in birth weight, 4.28 and 5.14kg to 6.04 and 6.07kg in weaning weight, 22.76 and 27.25 to 34.43 and 38.78kg in body weight at sexual maturity and 85.71 and 61.11 to 71.43 and 61.11 percentage weaning for F_1 and F_{ibc} of WAD to WB X WAD crossbred respectively. However heterosis in F_1 and F_{ibc} of crossbred showed that weaning weight and body weight at sexual maturity had 72.63 and 21.72% for F_1 while 27.78, 10.02 and 35.21% were record for birth weight, weaning weight and body weight at sexual maturity respectively for F_{ibc}. From the result of the study goat farmers in humid environment should use white Bornu (WB) male goat to cross their West African Dwarf (WAD) females for improved productivity up to F_{ibc}.

Key Words: Reproductive improvement; Heterosis; Goats; Backcrossing; Humid; Nigeria.

Introduction

The small ruminants generally complement other farm activities although there are few instances in which the farmers keep the small ruminants exclusive of other farm activities. Crop farmers keep a few animals to utilize crop residue and wastes while the traditional livestock people rarely keep “pure” flocks of sheep and goats. This fact influence the kind of management accorded to the small ruminants (Legattes and Warwick, 1990). The arable farmers would either confine/tether the animals during cropping season to prevent damage to their crops or allow them to roam around and scavenge after harvest (Odubote and Akinokun, 1992). The livestock herdsmen accord them no special care except to herd them along with the more important cattle. This lack of prime of place to the small ruminant results in uncontrolled breeding, poor record keeping, poor selection and consequent lack of genetic improvement with time (Ngere *et al*, 1984). The ability of the small ruminant to bridge the protein deficiency gap will depend on the remover or

at least ameliorating some of the factors militating against realizing more from this group of livestock than at present. Genetic development of the breed is one of the main ways of attaining this objective (FAO, 1998 and FAO, 2001).

Therefore this work is designed to asses the comparative reproductive performance of F_1 (first fillia Generation) and F_{ibc} (First fillia generation backcross) progeny from within and between breed crossing of West African Dwarf (WAD) and White Bornu (WB) goats in humid environment of Nigeria.

Materials and Methods

Experimental Site

The experiment was carried out in phases in a private goat ranch located at Afuze-Emai, Owan East Local Government Area of Edo State, Nigeria. It is situated approximately latitude 6^0N and 7^0N of the equator with an average temperature of 32^oC in peak dry season and $28\text{-}30^0C$ in wet or raining season and annual rainfall ranging from 2000mm to 4000mm in mid raining season.

Phase One: Within and between breed crossing to produce F_1 progeny:
Phase Two: Backcrossing of F_1 progeny to produce $F_{ibc.}$

Source of Experimental Animals

Thirty Six (36) goats consisting of WAD females and 20 WAD females, and 2 WAD males and 4 WB males and 10 WB females of adapted breeds after 6 weeks of adaptation period based on adaptability performance and visual appraisal, were sourced for each stage of the experiments. The White Bornu (WB) breed were sourced from direct from farmers in Borno State of Nigeria to avoid the purchase of unproductive stock from the open market since most sellers brings unproductive ones for sales.

Management of experimental animals

Animals were managed under semi-intensive system such that the animals are let out to graze on the paddock at certain hours of the day between 10.00am and return to the pens at 5.00pm were their feeding was supplemented with whole maize and dry grass forage supplied by Hausa/Fulani herds-men to make up for their nutrient requirement. Fresh water and supplements were given *ad-libitum* in the pens. At the peak of rainy season in August, they were kept in confinement within the pen and zero-grazed.

Housing of experimental animals

The pens though partitioned into smaller pens of dimensions 90 cm by 150cm for individual pen or 360cm by 360cm for grouped pen large enough to occupy a ewe and a buck in the grouped pen during breeding. There is a service corridor between every row of pen. The roof of the pen was made of corrugated iron sheet supported on teak poles with half walls around. This provides adequate ventilation. The floor is said filled to ease waste disposal. Attached to the pen is a 7,500cm by 9,00cm fenced paddock, with expanded wire quartz, which served as grazing paddock for the experimental period.

Breeding of experimental animals

Three lines of breeding plans were observed, each serving as a treatment.

LINE A: Involved the mating of two White Bornu (WB) male to ten West Africa Dwarf (WAD) females (WB_M X WAD_F).

LINE B: Two white Bornu (WB) male goats were mated to ten White Bornu (WB) females (WB_M X WB_F).

LINE C: Two West African Dwarf male (WAD) goats were mated to ten West African Dwarf females (WAD_M X WAD_F).

Experimental design

The design used for the study was the Completely Randomized Design (CRD) with three treatments and five replicates.

Parameters measured

Parameter measured includes, Birth Weight (BWT),Weaning Weight (WWT), Body Weight at Sexual Maturity (BWTSM) and Percentage Weaning (PW).

Statistical analysis

Data Collected were subjected to various statistical methods as provided in the SAS (2000) and SPSS (1998) Computer Software.

Results

Results show that percentage improvement due to backcrossing of the purebred to their parents had positive response with values of 12.54% in BWT of WB goats, 20.01 and 117.26% in weaning weight (WWT) of WAD and WB breeds respectively, and 3.34% in PW of WB breed (Table 1). Negative response was observed in BWT and PW of WAD breed and in BWTSM of WB with corresponding values of –7.92, -28.70 and –10.92% respectively. While WAD breed had values of 19.71% improvement on BWTSM. The results therefore implies that within breed crossing in WAD, WWT and BWTSM showed improvement thus suggesting that selection for improved weaning weight (WWT) can be sustained to market weight or sexual maturity, while in WB breed improvement was better in traits that would affect percentage weaning. The improvement observed in birth weight (BWT) had tremendous influence on the weaning weight (WWT), which improved astronomically with value of 117.26%. It was also observed that the reduction in birth weight (BWT) from F_1 to F_{ibc} (-7.92%) in WAD breed did not affect weaning and body weight at sexual maturity but did had a negative influence on percentage weaning (PW).

Estimated heterosis from crossing WAD and WB breeds and subsequent backcross to WB breed revealed that crossing between WB male and WAD females had negative heterosis on birth weight (-0.68%) and percentage weaning (-15.49%). However, the results were different in F_{ibc} progeny with only negative heterosis observed for percentage weaning (-16.98%). This showed that the improvement on pre-weaning traits did not influence percentage weaning. Other traits considered showed positive heterosis with weaning weight having values of 72.63 and 10.02% for F_1 and F_{ibc} and body weight at sexual maturity had values of 21.72 and 35.21% for F_1 and F_{ibc} respectively. Birth weight only showed positive heterosis of 27.78% at F_{ibc} and percentage weaning was negative at F_1 and F_{ibc}. Although better improvement was observed for WWT at F_1 stage, BWT and BWTSM improved better at the F_{ibc} stage were the progeny had more of the WB blood.

Discussion

There was no much increase in all measurements at the F_{ibc} stage since maximum improvement would have be made at the F_1 state for the measurements. The result of this study has elicited the role of dominance if once achieved contribute little to further improvement as the progeny cannot to beyond the homozygous dominant (Falcona 1986) which is in line with Odubote oru Akinokun 1992) who observed similar trend in WAD goats. At F_{ibc}, the progeny had already attained the weight and size of the improver genotype (WB). But where some motherly ability such as percentage weaning is considered F_1 cross will be advocated.

Table 1. Comparative performance of F_1 and F_{ibc} Progeny

VARIABLES	**MEAN PERFORMANCE**									
	WAD			WB			WB X WAD			
	F_1	F_{ibc}	% improve due to backcrossing	F_1	F_{ibc}	% Improve due to backcrossing	F_1	F_{ibc}	F_1H%	F_{ibc} H%
BWT	1.67	1.53	-7.92	1.29	1.45	12.54	1.47	1.91	-0.68	27.78
WWT	4.28	5.14	20.01	2.72	5.90	117.26	6.04	6.07	72.63	10.02
BWTSM	22.76	27.25	19.17	33.81	30.12	-10.92	34.43	38.78	21.22	35.21
PW	85.71	61.11	-28.70	83.33	86.11	3.34	71.43	61.11	-15.49	-16.98

BWT= Birth Wight, WWT = Weaning Weight, BWTSM= Body weight at sexual maturity, PW = percentage waning and H%= Percentage Heterosis.

Conclusion

From the results of the study the following conclusions can be drawn: Since crossbred of White Bornu (WB) and West African Dwarf (WAD) goats were superior to purebred of West African Dwarf (WAD) goats, farmers in sub-humid environment should used white Bornu (WB) male goat to cross their West African Dwarf (WAD) female goats for improve productivity up to F_{ibc}.

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