Full Length Research Paper

Evaluation of pure and crossbred progenies of Red Sokoto and West African Dwarf goats in the Rainforest Zone of South Eastern Nigeria

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A total of 56 kids produced from four breeding goat units consisting of pure Red Sokoto (RS ×RS), pure West African Dwarf (WAD × WAD), main cross (RS × WAD), and reciprocal cross (WAD × RS) were used to investigate performance and cost benefit of producing progenies of these indigenous goat breeds in a rain forest zone of South Eastern Nigeria. The experimental design was a completely randomized design with genetic group as the factor of interest. Data obtained showed that at birth, the male RS × RS kids weighed significantly (P<0.05) highest (1840.0 ± 230.98 g), followed by WAD × RS (1430 ± 144.36 g), RS × WAD (1371.00 ± 56.54 g) while the WAD x WAD kids had the lowest birth weight (1150.00 ± 39.36 g). However, the RS × AD female kids, at birth weighed significantly highest (1500 ± 54.10 g), followed by the RS × RS (1328.50 ± 98.69g), WAD × RS (1312.50 ± 17.81 g) and WAD × WAD (1087.50 ± 106.80 g). The male and female kids of the RS × WAD had improved body weight and the linear body measurements such as body length, height-at-withers and heart girth. They also had a higher average daily gain (46.03 ± 1.41 g/day) and better feed conversion ratio (5.38 ± 0.27) than the RS x WAD and WAD x WAD goats. This genetic group had the lowest cost of production (₦953.40 ± 10.21) and as such the highest gross margin (₦2111.06 ± 21.7). They appear more promising hybrid goats for commercial meat goat production in the rainforest zone of South Eastern Nigeria.

Key words: Red Sokoto goats, West African Dwarf (WAD) goats, crossbreeding, conformation traits, cost benefit, rainforest zone.

INTRODUCTION

Goats constitute a very important part of the rural economy in Nigeria, with more than 95% of the rural households keeping goats (Ukpabi et al., 2000). As a multipurpose animal, goats provide meat, milk, hides and

Table 1. Percentage Composition of concentrate ration fed to breeding goats

Feed ingredients	
Maize offal	50.00
Wheat offal	6.50
Palm kernel cake	39.00
Bone meal	2.00
Periwinkle	1.00
Minerals – vitamin premix	0.25
Salt	1.25
Total	**100**
% Crude protein (%)	13.9
ME (kcal/kg)	2980

skin and manure.

They rank next to cattle in income generation and their meat (chevon) is quite popular and well relished (Ladele et al., 1996).

The need to develop productive and adaptive goat breed for the rainforest zone is desirable. Multiplication and distribution of such high quality hybrid goat definitely would increase small ruminant animal production and animal protein supply in South East and South-South Nigeria; where the level of livestock production is quite low. These geopolitical zones correspond to the agro-ecological area described as the rainforest zone where tse-tse fly infestation and typanosomiasis infection are serious menace to livestock production. The use of well adapted West African Dwarf (WAD) and highly productive indigenous Red Sokoto (RS) goat in 'new breed' formation is an appropriate breeding plan especially from the view point of utilizing local animal genetic resources (AnGR) in realizing local needs (Nwosu, 2005).

It is a common knowledge that not every mating scheme yields satisfactory result. To overcome some suspected growth and reproductive problems associated with crossbreeding in goats e.g. low birth weight, poor kids survival rate, insufficient milk supply to the young and dystocia (Malik et al., 1980); mating of unproductive local males to improved productive females has been suggested in sheep (Dickerson, 1992). Mating of WAD goats with Red Sokoto breed has been carried out to determine growth and reproductive potentials of the offsprings (Taiwo et al., 2005). Result of that study revealed that present breeding plan would be feasible and beneficial.

The objective of this study was therefore, to evaluate growth performance and cost benefit of producing pure and crossbred lines of meat goats in a rainforest zone of Nigeria.

MATERIALS AND METHODS

Location of study

The investigation was carried out in the Goat Unit of the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The study area lies within the rainforest zone of South East Nigeria with a bimodal rainfall pattern. Total annual rainfall ranges from 1700 to 2100 mm with temperature range of 27 to 38°C during the dry season (November to April) and 18 to 26°C during rainy season (May to October). This agro-ecological zone has been described as warm-wet humid tropics.

Management of breeding stock

A total of 34 mature goats with an average age of 10 months and consisting of 16 West African Dwarf (WAD) and 18 Red Sokoto (RS) goats were the breeding stock. They were housed in a conventional dwarf walled pen structured house. The sex ratio was 1:8 for the WAD and 3:6 for the RS. The animals were quarantined for 28 days during which vaccination against pest des petit ruminant (PPR) disease was administered.

The breeding stock was maintained on a daily feed allowance of 25% concentrate ration and 75% fresh fodder made up of *Panicum maximum* and a mixture of other browse plants. The composition of the concentrate ration fed to breeding WAD and RS goats is shown in Table 1.

Mating scheme

Mating schemes adopted to generate progenies for the study were pure line, main cross and reciprocal crossing as shown below:

Pure line mating   - RS × RS
                            - WAD × WAD
Main crossing   - RS × WAD
Reciprocal crossing - WAD × RS

Management of pure and crossbred kids

A total of 56 kids were produced by the breeding herd. Kids were allowed with their dams in nursing pens for 4 months before weaning. Apart from a feeding allowance of 300 g/doe/day, additional 150 g/kid/day was added for the number of kids each doe nursed. Protection against ecto- and endo-parasites among kids was achieved using Ivomectin, while vaccination against *PPR* disease was carried out at 3 months of age.

Data collection

Data collected on pure and crossbred kids were weekly body weight changes, body length, heart girth and height-at-withers in both sexes as well as scrotal length and scrotal circumference in the buck kids only. The body length was measured as the distance from the pole of the animal to the base of the tail. Heart girth was taken as the circumference of the chest close to the forelegs, while height-at-withers was measured as the distance from the withers to the base of the hoof while the animal stood erect on a platform. The

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Table 2. Body weight changes and linear body dimensions of male progenies of pure and crossbred lines of Red Sokoto and West African Dwarf goats.

Parameter	Genetic group			
	RS X RS	RS X WAD	WAD X RS	WAD X WAD
BWT at week 1 (g)	1840[a].00 ± 230.98	1371.43[b] ± 56.54	1430[b].00 ± 144.56	1150[b].00 ± 35.36
BWT at week 18 (g)	9820.00[a] ± 794.45	8340.00[ab] ± 852.08	7610.00[b] ± 126.51	7510.00[b] ± 606.28
BL at week 18 (cm)	67.60[a] ± 3.07	59.86[b] ± 0.10	57.16[b] ± 1.19	57.02[b] ± 0.75
HW at week 18(cm)	52.72[a] ± 2.28	46.16[b] ± 0.94	42.86[c] ± 0.76	40.24[c] ± 0.76
HG at week 18 (cm)	53.20[a] ± 1.45	47.26[ab] ± 1.91	47.30[b] ± 1.62	46.98[b] ± 2.16
SL at week 18 (cm)	8.82[a] ± 0.29	7.53[a] ± 0.31	6.97[ab] ± 0.43	5.85[b] ± 0.27
SΘ at week 18 (cm)	17.08[a] ± 1.74	16.05[a] ± 1.52	13.83[b] ± 1.62	12.55[c] ± 1.02

[ab c] Means on the same row bearing different superscripts are significantly different (P<0.05); BWT = Body weight; BL = body length; HW = height at withers; HG = heart girth; SL = scrotal length; SΘ = scrotal circumference.

Table 3. Body weight changes and some linear body dimensions of female progenies of pure and crossbred lines of Red Sokoto and West African Dwarf Goats.

Parameter	Genetic group			
	RS X RS	RS X WAD	WAD X RS	WAD X WAD
BWT at week1 (g)	1328.50[b] ± 98.69	1500.00[a] ± 54.01	1312.50[b] ± 71.81	1087.50[c] ± 106.80
BWT at week 18 (g)	6875.00[a] ± 852.08	7637.50[a] ± 521.37	5242.50[b] ± 368.47	5112.00[b] ± 308.47
BL at week 18 (cm)	58.85[a] ± 3.00	56.35[a] ± 1.00	53.65[ab] ± 0.25	50.10[b] ± 1.14
HW at week 18 (cm)	51.38[a] ± 2.78	44.55[b] ± 0.36	42.38[b] ± 0.75	42.2[b] ± 0.60
HG at week 18 (cm)	44.78[a] ± 2.02	42.45[ab] ± 0.34	41.33[b] ± 0.81	39.28[b] ± 0.36

[a b c] Means on the same row bearing different superscripts are significantly different (P<0.05); BWT = Body weight; BL = body length; HW = height at withers; HG = heart girth.

scrotal length was taken as the distance from the base of the scrotum to the tip of the scrotal sac, while the scrotal circumference was measured as the region of largest scrotal expansion. All linear body measurements were taken with a tailor's tape in centimeters. Cost-benefit of raising each genetic group was computed based on feed consumed, other variable costs and prevailing market price of life goats in the environment. Average daily gain (ADG) and feed conversion ratio (FCR) of the various breeding groups were also computed.

Experimental design and data analysis

The experimental design was completely randomized design with genetic group as the factor of interest.

$$Y_{ij} = u + G_i + e_{ij}$$

Where, Y_{ij} = j^{th} individual in the ith genetic group; U = Overall mean G_i = Effect of the ith genetic group (I = 1,--,4); e_{ji} = Random error assumed to be independently identical and normally distributed with zero mean and constant variance.

Means and their associated standard deviations were computed for the measured parameters. Significant means were separated using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The performance of male and female progenies of pure and crossbred Red Sokoto and West African dwarf goats

are presented in Tables 2 and 3, respectively. Birth weight of the male kids was significantly (P< 0.05) highest with the RS × RS (1840.0 ± 230.98g), followed by WAD × RS kids (1430.0 ± 144.36 g); RS × WAD (1371.0 ± 56.54 g) while the WAD × WAD kids had the least birth especially between the two pure lines (RS × RS and WAD × WAD kids) since such difference in body weight is common knowledge and underscores the need for the upgrading programme. The RS × RS kids maintained their superiority in body weight and were only equaled by the RS × WAD kids. This indicates obvious improvement in body weight following crossbreeding for the RS × WAD individuals. Significant improvement in body weight and in some linear body parameters in half bred RS ×WAD goats have been reported by Ozoje and Herbert (1997) and in crossbred sheep by Wiener and Hayter (1974).

The body measurements namely body length, height-at-withers, heart girth, scrotal length and scrotal circum-ference followed similar pattern as body weight in the various genetic groups. This indicated strong influence of body weight on other body components. Indeed, strong and positive associations between body weight and most conformation traits in farm animal species have been well reported for goats (Ozoje and Herbert, 1997), Ayrshire cattle (Russel, 1975) and humpless indigenous cattle (Ibe and Ezekwe, 1994).

The performance of the female kids (Table 3) revealed

Table 4. Average daily gain (ADG), feed conversion ratio (FCR), cost of production (CP), revenue (R) and gross margin (GM) realized from pure and crossbred progenies of Red Sokoto and West African Dwarf goats.

Parameter	Genetic group			
	RS × RS	RS × WAD	WAD ×RS	WAD × WAD
ADG (g/d)	45.37[b] ± 1.34	46.03[a]± 1.41	43.45[b] ± 3.34	38.62[c] ± 3.04
FCR	7.97[a] ± 0.15	5.38[b] ± 0.27	6.64[b] ± 0.18	7.02[a] ± 0.21
CP (N)	1392.16[a] ± 13.64	953.40[c] ± 10.21	1110.76[ab] ± 12.32	1032.00[b]± 10.25
R (N)	3280.00[a] ± 24.01	3064.00[b] ± 20.43	2930.00[b] ± 26.01	2556.00[c] ± 19.06
GM (N)	1888.00[b] ± 13.22	2111.06[a] ± 21.71	1819.24[b] ± 15.01	1523.57[c] ± 18.74

[a, b, c] Means on the same row bearing different superscripts are significantly different ($P<0.05$).

that the main crossbred (RS × WAD) doe- kids had significantly higher birth weight (1500 ± 54.01g) than the RS × RS (1328.50 ± 98.69), WAD × RS (1312.50 ± 71.81) and WAD × WAD (1087.50 ± 106.50). Birth weight of a kid is a reproductive trait that could be influenced by such factors as body weight and condition score of dam, nutritional status, type of birth, sex and season of the year (Cassard et al., 1956). The WAD dams were well adapted to the rearing environment and may have utilized the concentrate – fodder based ration better. It could also be that the Red Sokoto bucks mated to the WAD does were able to stamp their superior genetic worth on their female progenies, thus resulting in the RS × WAD doe kids showing obvious improvement in body weight even above the RS × RS pure line. This superior-parent improvement in body weight in the females is desirable and is indeed, the essence of crossbreeding (Shrestha and Fahmy, 2007). Body weight attained by the pure and crossbred lines at 18 weeks (Table 3) showed that the RS × RS and RS × WAD female goats were not significantly different. However, the RS × WAD goats had numerically higher final body weight (7,637.50 ± 521.37 g) than even the RS × RS females (6,875 ± 852.08 g). The WAD goat is a known meat animal (Jean, 1993) and with improvement in its body weight, both male and female hybrid WAD goats could grow fast and mature early. This observation holds a good promise for the development of the RS × WAD hybrids as possible candidate meat goats especially in the rainforest zone which is a natural habitat for the West African Dwarf goats.

The performance of the WAD × RS hybrid males (Table 2) and females (Table 3) is noteworthy. This genetic group did not differ significantly in final body weight from the WAD × WAD individuals. This result indicated that there was no obvious improvement in body weight for both male and female WAD × RS kids. The practical implication of this finding is that the use of Red Sokoto was mated to WAD bucks to improve a goat herd as some uniformed goat keepers do would give disappointing results.

The production and economic performance indices of raising the pure and crossbred progenies of Red Sokoto

and West African dwarf goats are presented in Table 4. Average daily gain of 46.03 ± 1.41 g/day at 126 days (18 weeks) achieved by the RS × WAD was higher than that of the RS × RS individuals (45.37 ± 1.34g/day) and this, perhaps must have precipitated the higher final body weight attained especially by the female kids of this genotype (Table 3). This result indicated that the WAD dams and their RS crossbreds (RS × WAD) were well adapted to the nutrition and rearing environment they were subjected to, when compared to their supposedly superior RS × RS counterparts. The ADG value of 37g/day recorded for half bred WAD × RS goats fed legumes and fodders with concentrate supplementation for 150 days at Ibadan (Ebozoje, 1992) was even poorer than the value achieved by the RS × WAD hybrid individuals in this study. This seems to confirm further that main crossbreeding and the main crossbred goats are the most preferred mating system and most desirable genotype, respectively.

The feed conversion ratio (FCR) was significantly low and more efficient for the two crossbreds (RS × WAD and WAD × RS) with values of 5.38 ± 0.27 and 6.64 ± 0.18, respectively when compared to the RS × RS and WAD × WAD pure lines which had FCRs of 7.97 ± 0.15 and 7.02 ± 0.21 respectively at 18 weeks of age. Efficient feed conversion of the RS × WAD showed that the upgrading exercise was effective and, of course with improved weight gain, appetite and feed intake were expected to increase within this genotype. This finding also showed that the RS × WAD goat was able to utilize the local feed resources more efficiently than the parental RS and WAD lines. This potential of the RS × WAD individuals is desirable since good growth rate and efficient feed utilization are common attributes required for meat animals (Roge, 1992).

The RS × WAD hybrids which recorded the highest ADG and a better FCR also had significantly (P <0.05) least cost of production (₦953.40 ± 10.21) at 18 weeks of age. This observation is understandable, since these animals converted much of their feed resulting in higher final body weight. Gross margin which is an index of efficient production was also highest (₦2111.06 ± 21.71) for the main crossbred individuals. The performance of

this genetic group suggests that it is a promising genotype for the development of hybrid meat goat especially in the rainforest zone of Nigeria.

Conclusion

It is evident from the results of this study that the progenies of the main crossbred (RS × WAD) - males and females showed superiority in body weight and in most of the linear body measurements studied. Average daily gain, feed conversion ratio, revenue and gross margin were also better for the RS × WAD individuals compared to their reciprocal (WAD × RS) and pure (WAD × WAD) counterparts. The performance of these main crossbreds suggests that they are preferred goat genotype for the production of hybrid meat goat in the rainforest zone of South Eastern Nigeria.

ACKNOWLEDGEMENTS

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