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Short communication

Pure and reciprocal crossing of Nigerian goats: Effects and correlation of the leather properties of resultant progenies

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ABSTRACT

Exploration of value-added possibilities is important to ensuring sustainable livestock industry. The present study compares the properties of vegetable-tanned leathers of four goat genotypes using a total of ninety-six skins obtained from yearling bucks produced by pure and reciprocal crossing of Red Sokoto (RS) and West African Dwarf (WAD) breeds, and labelled as WADxWAD, RSxRS, WADxRS and RSxWAD. Leather properties considered are percentage elongation (PE), thickness (TN), load at crack (LC), load at tear (LT), distention at crack (DC) and distention at tear (DT). Data obtained were subjected to analysis of variance and Pearson's correlation using MINITAB statistical package. The result revealed significant ($P < 0.05$) difference among the genotypes in all the examined parameters. Leather of RSxRS was significantly ($P < 0.05$) higher in PE(87.9%) than that of WADxWAD (61.8%) and WADxRS cross (60.4%). RSxWAD genotype was significantly ($P < 0.05$) higher in TN(1.16 mm), DC(7.52 mm) and DT(7.46 mm) than other genotypes. LC exhibited by the leather of WADxWAD and the reciprocal crosses were significantly ($P < 0.05$) heavier than that of RSxRS. Negative correlations were mostly observed between some of the leather properties of WADxWAD and RSxRS. Highly significant ($P < 0.01$) and positive correlations were observed between LT and all other grain properties for WADxRS (LC: $\rho = 0.670$; DC: $\rho = 0.755$; DT: $\rho = 0.765$) and for RSxWAD (DC: $\rho = 0.605$; DT: $\rho = 0.608$). The results therefore suggest that RSxWAD and WADxRS crosses had relatively better leather properties than RSxRS and WADxWAD genotypes. It is therefore concluded that crossbreeding yielded improvement in the grain properties of WAD and RS leathers.

1. Introduction

The knowledge of the relative merits of numerous goat breeds in Nigeria and its appropriate utilization are important tools for achieving genetic improvement and national development. The West African Dwarf (WAD) goat is recognized for its high kidding rate (Osuaghwu and Akpokodje, 1984) and better disease resistance (Ademosun, 1988) which makes it more predominantly distributed in areas with higher rainfall distributions and humidity. Red Sokoto (RS) goat is widely distributed in the northern savannah belts of Nigeria (Ngere et al., 1984) and is globally reputed for its leather quality. The exploitation of these potentials has however not been well harnessed. For instance, flaying of slaughtered animals, to obtain skin, is a rare process in the southern part of Nigeria where WAD goat abound and thus, the potential of this breed for leather production is largely untapped. Some qualitative leather traits of WAD goat has however been recently reported (Yusuff et al., 2013).

Crossbreeding is one of the methods of improving the genetic potential of animals, as it sometimes results into hybrid vigor. Relevance of crossbreeding in ruminant production has been extensively demonstrated in cattle and sheep but with little emphasis on Nigerian goat breeds, particularly on leather traits. However, there is a possibility that the crossbred progenies perform better than the average parental output (William and Pollack 1985; Ibe 1998; Salako 2013). Therefore, it is imperative to examine the relevance of crossbreeding for the improvement of leather properties among Nigerian breeds of goat.

2. Materials and methods

2.1. Skin sources

A total of ninety six (96) skins were obtained from yearling male goats which were progenies produced from selective breeding of red Sokoto (RS) and West African Dwarf (WAD). The yearling goats were made up of four genotypes labelled as WADxWAD, RSxRS, RSxWAD and WADxRS, and were managed in a fixed environment at College of

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2.2. Tanning of the skins

The skins obtained from the slaughtered bucks were cured using salt after flaying. The slaughtering of the bucks followed ethical standards of the University of Ilorin. The skins were processed into leather using vegetable tanning approach at Nigerian Institute of Leather and Science Technology (NILEST), Samaru, Zaria, Kaduna state.

2.3. Leather assessment

Assessment of the physical properties of the leather was done in the Quality Control Laboratory of NILEST. Samples for the test were collected according to official sampling position on all the tanned leathers (ISO, 2002). The physical properties measured are percentage elongation, thickness and grain properties. The grain properties focused are load at crack, distention at crack, load at tear and distention at tear.

2.4. Thickness

Thickness of all the leathers was measured using standard type thickness gauge (Model: REF S 4/9) at three different locations on the cut leather samples.

2.5. Percentage elongation

This was obtained using tensometer (Model: 9019 GAF 2620) which operates on the principle of two directional pull of the leather samples in two opposite directions. The tensometer has two jaws for clamping the cut leather samples. When the machine is on, the two jaws move in two opposite directions at equal speed until the leather samples break. The distances between the jaws at initial stage and break of the leather sample were then used to calculate percentage elongation as indicated below.

Percentage Elongation = (Distance at Break − Initial Distance) × 100/ Initial Distance

2.6. Grain properties (Load and distension at crack and burst)

Circular leather samples were cuts to perform an experiment conventionally referred to as ball burst process in leather assessment. These samples were clamped on electronic lastometer (Model: 5077-ET-MUVER) which performs the test procedure via the application of force on the clamped leather through a steel ball (6.25 mm diameter). After the electronic lastometer is on, the grain surface of the leather sample would first crack and later, its steel ball would burst through the leather sample after additional distension. The extent of distension (mm) and the corresponding load (kg) before the notice of crack and that of burst (tear) of the clamped leather sample are recorded by the lastometer. The load and distension at grain crack and tear were taken as measurements of leather's grain layer strength under multidirectional stress.

2.7. Statistical design

The data generated were subjected to one way ANOVA using Completely Randomized Design to establish significant differences among the four genotypes.

Statistical Model: $y_{ij} = \mu + t_i + e_{ij}$

y_{ij} = observation of the leather from j-th progeny belonging to i-th genotype

μ = overall mean; t_i = effect of genotype i-th on its leather property

e_{ij} = random error components of leather from progeny i-th belonging to j-th genotype.

Table 1
Physical properties of leathers from pure and crossbred Nigerian goats.

Trait	Genotype				SEM	Prob.
	RSxRS	WADxWAD	WADxRS	RSxWAD		
Thickness, mm	0.93^b	1.01^b	1.01^b	1.16^a	0.019	0.002
Percent elongation, %	87.9^a	61.8^b	60.4^b	85.4^a	1.64	0.013
Load at crack, kg	18.4^b	22.2^a	24.9^a	23.3^a	0.571	0.014
Distention at crack, mm	4.12^d	5.18^c	6.38^b	7.52^a	0.209	0.001
Load at tear, kg	13.4^b	9.15^c	17.2^a	12.7^b	0.677	0.003
Distention at tear, mm	4.02^c	4.28^c	5.95^b	7.46^a	0.217	0.011

Values in the same row without common superscripts (letter) are different at $P < 0.05$. a and b superscripts are at 5% significance level.

3. Results

Average thickness (TN), percentage elongation (PE), load at crack (LC), distention at crack (DC), load at tear (LT) and distention at tear (DT) of vegetable tanned leathers of RS, WAD and their reciprocal crosses (WADxRS and RSxWAD) are presented in Table 1. Leather thickness of the four categories of goat (genotypes) used for this study were significantly ($P < 0.05$) different from one other. The leather of WADxWAD was numerically thicker than that of RSxRS with 0.08 mm, while the leather of RSxWAD was significantly ($P < 0.05$) thicker than the leather of WADxRS with 0.15 mm. Similarly, leather of RSxWAD was also observed to be significantly ($P < 0.05$) thicker than the leathers of the two purebreds (WADxWAD and RSxRS). Purebred RS leather (RSxRS) had the highest PE (87.9%) which was significantly ($P < 0.05$) higher than the values obtained for purebred WAD (WADxWAD) and WADxRS leather by 26.03% and 27.5% respectively. Leather of the reciprocal crosses were also significantly ($P < 0.05$) different in PE with RSxWAD leather being higher than WADxRS leather by 25.1%. PE of RSxRS and RSxWAD were however statistically comparable.

With respect to load at crack (LC) of the leathers (Table 1), a significant ($P < 0.05$) difference was also noticed between the genotypes of the goats. Leather of WADxWAD was observed to have a significantly ($P < 0.05$) heavier LC than that of RSxRS leather (22.2 kg versus 18.4 kg respectively). The leathers of the two reciprocal crosses required mean loads that were not statistically ($P > 0.05$) different from each other in order to crack. Similarly LC of reciprocal crosses were not different from the LC of WADxWAD leather. The distention at crack (DC) of WADxWAD and RSxRS leathers were significantly ($P < 0.05$) different from each other, and likewise the two reciprocal crosses (RSxWAD and WADxRS). However, DC of the reciprocal crosses were significantly ($P < 0.05$) higher than the values obtained on the leathers of the purebreds. Lowest DC (4.12 mm) was observed on leather of RSxRS while leather of RSxWAD had the highest DC (7.52 mm). Load at tear (LT) of the leathers were observed to show significant ($P < 0.05$) difference among the genotypes of the goats from which the leathers originated. Leather of RSxRS required significantly ($P < 0.05$) heavier LT than that of WADxWAD genotype. WADxRS leather similarly had a heavier LT than RSxWAD cross which were different by 4.57 kg. The WADxRS leather had significantly ($P < 0.05$) heavier LT than the leathers of RSxRS. However, leathers of pure RS (RSxRS) and RSxWAD cross were only numerically different from each other with respect to LT. The distension at tear (DT) across the genotypes was significantly ($P < 0.05$) different from one another.