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Effect of management practices on milk yield and live weight changes of indigenous breeds of goats supplemented with groundnut haulms and concentrate in sub humid zone of Nigeria

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Abstract
These studies were carried out at the Research farm of National Animal Production Research Institute, Shika to investigate the effect of management practices on the milk yield and live weight changes of grazing Red Sokoto and Sahelian goats as influenced by supplementation with groundnut haulms and concentrate. Experiment 1 involved 5 Red Sokoto goats with average weight of 27.3 ± 1.37Kg kept either on-farm or on-station and fed groundnut haulms or concentrate. The result showed that management had significant effect on average daily gain (ADG) of kid at 146.7± 0.62g (P<0.01) and dam weight loss of -24.7±1.26g (P<0.05). Milk yield was less sustained on farm. Week of lactation affected milk yield (P<0.01). In experiment 2, five goats of each of Red Sokoto or Sahelian breeds were randomly assigned to either groundnut haulms or concentrate as supplement. The results, showed that there were significant effect of breed (P<0.0001) and week (P<0.001) on milk yield, mean dam and kid weights respectively. The Red Sokoto dams had higher milk yield (414.1±47.19ml) than the Sahelian dams (203.2±46.61ml). Similarly, breed and type of supplementation fed showed significant difference (P<0.005) on milk yield. Red Sokoto dams fed concentrate produced more milk (555.1±64.92ml) than Sahelian fed concentrate (295.2±69.51ml) or groundnut haulms (111.4±69.51ml). Also in comparing the kid growth performance between on-farm and on-station, The average daily gain of kids was 112.9g± 0.53 was significantly influenced by week of lactation, while dam lost an average of 11.7±0.65g indicating that kids managed on farm were heavier than those on station. However dam on-station lost less weight than those on-farms. The result showed that supplementation of grazing does with diets of protein source irrespective of management will improve milk yield and that heavier dams supported better kid growth.

Keywords: On-farm, On-station, Performance, Red Sokoto, Sahelian..
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Introduction

Goats account for 30% of Africa's ruminant livestock and the population of goats in sub-Saharan Africa (SSA) is estimated at 147 million (Lebbie, 2004). Sixty-four percent of the goats are found in the arid and semi-arid zones, sub-humid, humid and high lands (Bogoro *et al.,* 1999). There are 102 recognised breeds of goats throughout the world with live weights ranging from 9 to 13kg for small tropical breeds to over 100kg for large improved dairy breeds (Dhanda *et al.*, 2003). The differences in size are in the form of the long-legged breeds to the stocky improved and short-legged West African Dwarf. The Red Sokoto (Maradi) is the most important breed that is widely distributed in Northern Nigeria (Makun *et al.,* 2005) and is estimated to be half of the total goat population in the country. It inhabits the sub humid and semi-arid regions of the country. The Sahelian breed of goat is

a long – legged, large breed. It is sparsely distributed along the semi-arid and arid regions of Nigeria, but most abundant in the Republic of Niger, a country bordering Nigeria to the North. They are either raised in a communal farming system or allowed to roam in search of feed (Mahanjana & Cronje, 2000). The communal system is found in the sub-humid and Sahelian regions and individuals own between 3 – 10 goats which are combined and herded as a community; this may total up to a thousand goats. Free range goat production is the predominant system. Unlike the communal farming, this system allows the goats to roam throughout the non-cropping season. In the night and during cropping season, goats are tethered in the home-stead and forage feed is cut and carried to them. Goats in this system invariably are kept along with cropping of food and cash crops in a crop-livestock production system. This system is characterized by inadequate feed, particularly during the growing season (Devendra, 1997). In Nigeria, indeed in most African countries, goats are kept for meat, and rarely for milk. However, sometimes these goats are milked periodically and fed to children, thereby improving the protein intake of these children consequently combating malnutrition status of infants in the community (Lebbie, 2004; Makun *et al.,* 2005). The present study was aimed at evaluating the milk yield and weight changes of two breed of does and their kids in 2 different management systems.

Materials and methods

Study location

The study conducted on-station trial was at the Small Ruminant Research Programme farm of the National Animal Production Research Institute Ahmadu Bello University, Shika in Giwa Local Government Area and on-farm trial was at Dogarawa and Hanwa villages, in Sabon Gari Local Government Area, in Kaduna State, Nigeria.

The National Animal Production Research Institute, Shika, Ahmadu Bello University, Zaria, Nigeria. Shika is situated in the Northern Guinea Savannah between latitudes 11^{o} and 12^{0} N, and between longitudes 7^{o} and 8^{0} E; at an altitude of 650m; with a mean annual rainfall of 1150mm. The climate of the site is sub humid; rainfall is well distributed during the rainy season, with about 70% of the rain occurring during the months of July and August. The average temperature and humidity during the wet season are 24.7^{o} C and 72% respectively. The early dry season commences from October with a period of cold dry weather known as harmattan lasting until February. This is followed by the hot weather when temperatures fluctuate during day (14-34^{o}C) with a relative humidity of between 10-20% (Amodu *et al.,* 2001). Sabon Gari Local Government is also situated in the Northern Guinea Savannah between latitudes 11^{o} and 4^{o} and between the longitudes 7^{o} and 42^{o}. The average temperature, humidity and season are as reported for Shika.

Experiment animals

In experiment 1, five does of each breed of Red Sokoto or Sahelian were allocated to either groundnut haulms or concentrate supplements while in experiment 2, five Red Sokoto does were allocated to one supplements mentioned above. The two experiment on-station and on-farm were ran concurrently.

Goat management

On-station: The Red Sokoto and Sahelian goats were managed semi-intensively. They were allowed to graze during the day and kept in ventilated animal pens during the night. Animals grazed sown pastures of *Digitaria smutssi* hay during the day. They were supplemented prior to grazing with concentrated feed routinely in the institute. Routine healthcare includes, annual vaccinations against *peste des pestit ruminants* (PPR), Hemorrhagic septicaemia, deworming and ecto-parasitic controls were carried out regularly. Animals were allowed access to fresh drinking water *ad libitum.* Two weeks prior to kidding, does were fed on their experimental diet until the end of the trial.

On-farm: The Red Sokoto goats kept on-farm were managed extensively; they were left to roam in search for food and water. In the night and during the cropping season they were tethered inside the compound. The only medication they received was usually in response to any disease condition. The animals were treated against helminthes prior the commencement of trial. Two weeks prior to study they were fed experimental diets until the end of the experiment.

Experimental diets

The experimental diets consisted of groundnut haulms and concentrate. The concentrate was fed to the animals at 0800hrs and the animals were allowed to consume the entire supplement. Animals were fed concentrate at 2% of the combined dam

and kid weight. The average amount of concentrate fed was 500g/dam. The composition of the concentrate consisted of the following ingredients: maize (26.1%); wheat offal (27.8%); cottonseed cake (43.1%); bone meal (2%); and salt (1%). The diet was compounded to meet the 16% recommended crude protein requirement for maintenance and production in goats. Kids were allowed to suckle their dams for a week to allow for intake of colostrum before milk data were collected.

Data collection

The data collection was for a period of 11 weeks, weight changes of dams and kids were recorded weekly. Prior to milking, kids were separated from their dams for 12 hours overnight and then hand-milked the next morning. Dams were milked twice a week with a 3 day interval between milking.

Data Analysis

The partial milk yield, weight changes of does and kids were analysed using the general linear model (GLM) procedures in the Statistical Analysis System (SAS, 2000). Mixed procedures (SAS 2000) were used for the repeated measures analysis of the milk yield data. The difference between treatments means were tested using pair-wise difference, PDIFF. All differences were considered significant at P<0.05.

Results

In the 1st study, management had significant effect (P<0.01) on milk yield, mean dam weight (P<0.05) and mean kid weight (P<0.05) Table 1. Although goats that were managed on-station had higher milk yield (295.3±42.37ml) than those managed on-farm (206.9±43.68ml), the mean dam weight of the goats kept on-farm (27.3±1.37Kg) was higher than those maintained on-station (21.9±1.93Kg). Similarly, the mean of kids managed on-farm (9.7±0.62Kg) was higher than those managed on-station (6.6±0.85Kg). In Table 3 the weeks of study also had significant effect (P<0.005) on mean dam weight. and kid weight. Dams body weight were heaviest at the first week (26.4±1.28Kg) of study and lowest at week 6 (23.6±1.25Kg), on the contrary the mean kid weight was lowest in week 1 (2.2±0.62Kg) of the study and highest in the last week (13.5±0.62Kg) of the study Table 3.

In the 2nd study of breed difference on supplement type, the results showed that there were significant effect of breed (P<0.01) milk yield, mean dam and kid weights (Table2). The Red Sokoto goats had higher milk yield (414.1±47.19ml) than the Sahelian does (203.2±46.61ml). Although the type of supplementation significantly influenced milk yield, hence the interaction between breed and type of supplement had significant effect on milk yield (P<0.01). Hence Red Sokoto does on concentrate produce the highest milk of 555.1±64.92ml as compared to the Sahelian fed groundnut haulms (111.4±69.51ml).

The effect of week (P<0.05) of lactation was significant on mean dam weight (Table 4), Dams were at their heaviest (25.1±0.98kg) at the first week of lactation, while their lightest mean weight was at the 6th week of lactation. Also the highest milk yield was recorded in week 5 (395.8±52.16ml) while the lowest was recorded in week 11 (234.9±41.29ml). Breed and week of lactation affected the mean kid weight, Sahelian kids had higher mean kid weight (7.9±0.38kg) than the Red Sokoto kids (6.3±0.38kg). In Table 4, the highest weight been recorded in week 11 (11.6±0.53Kg) while the lowest was in week 1(2.9±0.16Kg).

Table 1: Mean partial milk yield, dam weight and kid weights of goats fed concentrate and groundnut haulms

	On-Farm			On-station		
	Mean	Haulms.	Conc.	Mean	Haulms	Conc.
Milk Yield (ml)	206±30.68^{c}	184±42.74^{d}	229.8±45.51^{c}	295.3±42.47^{b}	249.6±58.99^{c}	343.1±59.40^{a}
Dam Weight (Kg)	27.3±1.37^{a}	27.7±1.93^{a}	27.5±1.92^{a}	22.0±1.92^{b}	22.4±2.71^{b}	21.6±2.71^{b}
Kid Weight (Kg)	9.7±0.62^{a}	10.1±0.87^{a}	9.4±0.91^{a}	6.5±0.85^{b}	5.9±1.19^{b}	7.2±1.19^{b}

^{abcd} Means in the same row having different superscript are significantly different (P<0.05)

Table 2: Mean partial milk yield, dam weight and kid weights of goats fed concentrate and groundnut haulms

		Red Sokoto			Sahelian	
	Mean	Haulms	Conc.	Mean	Haulms	Conc.
Milk Yield (ml)	414.1±47.19[a]	273.2±67.35[b]	555.1±64.94[a]	203.2±46.61[c]	111.4±69.51[d]	295.1±69.51[b]
Dam Weight (Kg)	23.5±0.90[a]	23.7±1.29[a]	23.3±1.27[a]	23.30±0.85[b]	23.9±1.27[b]	22.8±1.13[a]
Kid Weight (Kg)	6.3±0.38[b]	6.1±0.54[b]	6.4±0.57[b]	7.9±0.38[ab]	7.3±0.57[b]	8.6±0.53[a]

[abcd] Means in the same row having different superscript are significantly different (P<0.05)

Table 3: Mean partial daily milk yield , dam weight and kid weight of goats as influenced by week of lactation for does kept on-farm or on-station.

Week	Milk Yield(ml)	Dam Weight (Kg)	Kid Weight (Kg)
1	277.6±31.10[a]	26.4±1.27[a]	2.2±0.62[d]
2	262.3±31.50[a]	25.3±1.26[a]	3.3±0.62[d]
3	269.9±31.56[a]	23.2±1.26[b]	4.8±0.62[c d]
4	249.9±31.92[a]	24.7±1.26[ab]	5.8±0.62[c]
5	280.4±30.71[a]	24.8±1.26[ab]	6.5±0.62[c]
6	266.8±31.06[a]	23.5±1.26[b]	7.4±0.62[c]
7	269.2±30.81[a]	23.9±1.26[b]	9.7±0.62[b]
8	225.5±30.81[b]	24.8±1.26[ab]	11.1±0.62[a b]
9	256.4±30.82[ab]	24.3±1.26[ab]	12.3±0.62[a]
10	219.5±31.27[b]	23.5±1.26[b]	12.8±0.62[a]
11	184.0±31.24[b]	24.5±1.26[ab]	13.5±0.62[a]

[abcd] Means in the same column having different superscript are significantly different (P<0.05)

Table 4: Mean partial daily milk yield, dam weight and kid weight of breeds of goats as influenced by week of lactation.

Week	Milk Yield(ml)	Dam Weight (Kg)	Kid Weight (Kg)
1	333.7±40.72[a b]	25.1±0.98[a]	2.9±0.16[d]
2	313.7±40.27[a b]	23.9±1.04[b]	3.6±0.31[d]
3	298.6±37.03[b]	23.4±0.81[b]	4.7±0.42[d]
4	278.5±38.54[b]	23.7±0.72[b]	5.4±0.53[d]
5	395.8±58.59[a]	22.5±0.66[c]	5.9±0.42[c d]
6	393.5±52.16[a]	21.2±1.22[c]	7.0±0.39[c]
7	307.6±42.66[b]	22.1±0.67[c]	7.7±0.43[b c]
8	301.7±42.92[b]	23.9±0.54[b]	8.9±0.42[a b]
9	284.6±43.33[b]	23.7±0.57[b]	9.9±0.51[a]
10	252.6±44.76[c]	23.7±0.71[b]	10.3±0.49[a]
11	234.9±41.29[c]	24.2±0.65[a]	11.6±0.53[a]

[abcd] Means in the same column having different superscript are significantly different (P<0.05)

Discussion

The Red Sokoto goats produced more milk than their Sahelian counterparts when fed concentrate as supplement, a similar result was obtained in the same ecological zone between the Red Sokoto and Sahelian breeds which was reported in an earlier study by Makun *et al.* (2008). Breed (Sangare & Pandey, 2000), management (Soryal *et al.*, 2003) and feed (Tendonkeng-Pamo *et al*. 2006) are some of the factors that influence the production performance of animals, therefore the difference in the mean dam weight observed in this study might have been due to the difference in the genetic potentials between the 2 breeds and supplements feeds. The result obtained in this study is not in agreement with the report of Zarrahadeen *et al.*, (2009) which reported that the Sahelian goats produced more milk than the Red Sokoto goats. The Sahelian does were in their

natural habitat and thus were able to produce optimally.

Also management influenced the milk yield; does kept on-station produced more milk than those kept *on – farm.* This is in agreement with the works of El-Abid and Nikhaila (2010) as well as Greyling *et al*. (2004) where does kept under extensive management system produced less milk (0.8 litres) than those kept under intensive management (3 litres). Body weight of the dam is the most important source of variation in milk yield, although, there was no difference in the mean dam weight between breeds. This further shows that the dam weight is not the only factor required to sustain milk yield, the consumption of the kid can play a role in the excess milk yield. This is evident by the fact that dams on – farm, supported heavier kids (Pfeffer & Rodehutscord 1998) throughout their pre-weaning period hence producing lower milk yield.

Supplementation of roughages or crop-residues have included the use of oil seed cakes (Otaru *et al.,* 2011) leguminous forages (Longo *et al*. 2008), agro-industrial by- products and browses (Mekasha *et al.* 2011). Feed supplements are used either to provide rumen degradable nitrogen as in the case of leguminous plants like groundnut haulms and browses, or supply rumen undegradable nitrogen which by-passes the rumen to be utilized in the abomasums as in the case of concentrates. In the two studies the response to concentrate was better than for groundnut haulms, goats fed concentrate had higher milk yield and kid weight than those fed groundnut haulms.

Similarly in both studies the peak milk yield was observed in the 5^{th} week of lactation, different authors have reported peak milk yield at variable periods of lactation. For example Sangare and Pandey (2000) reported a peak milk yield of Sahelian goats in the first week of lactation before declining while that reported by Zahraddeen *et al.* (2009) was in the third week of lactation when they studied the milk yield of the 3 breeds of goats predominant in Nigeria.

This milk yield has a direct consequence on the dam weight, since at the beginning of lactation dams were at their heaviest weight. As lactation progresses however, they mobilize body fat reserve to produce the milk required for their off-spring (Ekneas *et al.,* 2006). This is evident by a decrease in maternal live weight. In this study it was observed that dams were at the heaviest weight at the first week of lactation, progressively decreasing up to the 6^{th} week of lactation before recovery. Unlike the dams, the mean kid weight is usually lowest at birth, as expected and observed in this study, the kid weight linearly increased thereafter to the end of the study.

In conclusion management and type of supplement obviously showed significant influence on milk yield in this study, suggesting that farm animals can benefit from adequate semi-intensive management and concentrate supplementation as well as annual vaccination and seasonal helminth control.

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