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Efficiency and Cost-Benefits of Fattening Goats on Varying Levels of Maize Bran with Groundnut Haulms as Basal Diet

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ABSTRACT

Efficiency and cost-benefits of feeding varying levels of Maize bran with Groundnut haulms as basal diet were determined. Twelve (12) West African Dwarf bucks aged 12 months and average live weights of 14Kg were fed for 70 days experimental period. Parameters determined were daily feed intakes, daily weight changes, and daily costs of labour, drugs feeds and water, revenue was generated from sales of fattened animals and dung. Data obtained were subjected to net farm income (NFI) analysis. The efficiency of feed utilization was measured by the dry matter intakes, weight changes, feed intakes as a percentage of live weight, feed efficiency, cost per weight gain, net return on investment and return per investment. The findings revealed that dry matter intakes for treatments T_1, T_2, T_3, and T_4 were 488g, 475g, 618g and 427g with dry matter intakes as a percentage of the live weight of 3.38, 3.35, 3.76 and 2.56 in that order. Average daily weight gains per treatment were 63g, 76g, 88g, and 95g for T_1, T_2, T_3, and T_4 respectively. This gave the feed efficiencies of 12.96, 16.00, 14.30 and 22.23 for all the treatments in that order. While returns per unit investment were found to be 1.29, 1.23, 1.22 and 1.23 for treatments T_1, T2, T_3 and T_4 respectively. The economic analysis of the research showed a net farm income of N1227.83 per head of the animals which implies that the experiment was a profitable venture. The analysis also indicated that for every one Naira invested into the research a profit of 30 kobo was made. The highest turnover was obtained with the control diet being groundnut haulms only. However, the economic efficiency of production was found to decrease with an increase in the level of maize bran inclusion in the diet. It is concluded that groundnut haulms alone could be economically used in feeding fattening of goats, especially in **lean periods to check dry season weight losses.**

Keywords: **Goats, Fattening, Efficiency, Cost-benefit, Analysis**

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INTRODUCTION

There are 674.1 million goats in the world. About 26.2% (176.64 million) were found in Africa (Adugna et al., 2000). Oni (2002) reported that the population of goats in Nigeria was estimated to be at 34.5 million. Out of these, about 3 million were found in Adamawa State (Tukur and Ardo, 1999).

Goats play important roles in a subsistence economy where poor farmers raise them. They are numerically and economically very important and promising resources (Hossain et al., 2003). The importance of goats is strongly emphasized for their versatile production profile and valuable contributions in the form of meat, milk, and manure. They play important socio-economic relevance as security for income generation and in human nutrition.

Their small sizes, early maturity and low capital investment per head make them suitable for low-income

owners. Goats offer an alternative to utilizing forage and vegetation, which is otherwise, wasted, while producing useful, marketable products (Luginbuhl et al., 1998). Adu and Brinkman (1981) stated that provision of adequate feeds in the dry season is the major factor limiting the production of these animals in the Sudan-Sahel zone of this country. Umoh et al. (1981) reported that supplementary feeding of protein rations during the dry season increases the average daily gains of the animals. However, the slight increase in gain due to supplemental protein may not be economical, particularly in a situation where protein sources are scarce or expensive.

Lakpini (2002) suggested that every effort should be made to make the optimum use of all feed resources, particularly those that are regarded as unsuitable for human consumption and those parts of products which are highly underutilized or not used at all but could be used for fattening programmes.

Mdoe et al. (2009) emphasized that whatever may be the strength when animals are reared with business intention; economy should be taken care of on priority basis. That economical rearing of an animal is essential for the continuation of production enterprise. Therefore, knowledge of animal production, cost and economics become obligatory. This is because; the goal of an animal feeding is to maximize economic returns. This involves identifying the management and ensuring that the difference between values of products and costs are at maximum. That profitability of smallholder livestock production can, therefore, be increased if farmers could use low-cost feed resources that provide the required nutrients. This study was therefore carried out with the objectives of determining the nutrients compositions of maize bran and groundnut haulms, effects of feeding varying levels of maize bran with groundnut haulms as basal diet on the efficiency and cost-benefits of fattening goats.

MATERIALS AND METHODS

Study site

The research was carried out in Yola, Adamawa State, Nigeria. The town is located at latitude 90^{o} 14^{l} North and longitude 120^{o} 281^{l} East of the Greenwich meridian. This area has the Tropical type of climate marked by dry and rainy seasons. Rainy season starts in April and ends late October. Dry season commences late October and ends in March. The average rainfall is 700mm with wettest months being August and September. Maximum and minimum temperatures are 40^{o}C and 18^{o}C. Mean relative humidity ranges between 20-30% (Adebayo and Tukur, 1999).

Housing and management

The housing was of a concrete building having two leopposite windows, thus allowing cross-ventilation. The floor was of concrete covered with wood shavings to absorb moisture from the animal urines. It was divided into 12 pens of $1.5m^2$ each and total housing capacity of $18m^2$. Each animal occupied a pen. The height of each pen was 1.5m to prevent the animals jumping from one pen to another.

During the adaptation period, the animals received antibiotic injections (Long acting Oxy-tetracycline) and were dewormed to get rid of internal worms. They were given the feed *ad libitum* during a five day adaptation period, then tagged, weighed and randomly allocated to the treatment diets.

The groundnut haulms were purchased from local farmers in bags and weighed to determine the costs per kilogram.

While the supplemental diet was given once a day on graded levels, the basal diet was fed ad *libitum* twice a day. The first dose was given in the morning while the second dose was administered in the afternoon. After every 24 hours, the leftover of feed for each animal in each treatment was weighed to determine daily feed intakes. This was done every day throughout the 70 days experimental period. Every week, each animal in each treatment was weighed to determine weekly weight changes. Each of the weekly weight changes was divided by seven to obtain daily weight changes. Daily, all expenses incurred were recorded. At the end of the experiment, revenues realized from sales of animals were taken for each treatment. These were used in calculating daily dry matter intake (DMI), dry matter intake as a percentage of live weight, feed efficiencies, cost per weight gain and net return on investment.

Treatments and experimental design

Randomized Complete Block Design (RCBD) was employed (Akindele, 1996). Twelve West African Dwarf bucks were randomly allocated to four treatments with each treatment replicated three times making three animals per treatment. These treatments were T_1 (control) groundnut haulms only, T_2 (groundnut haulms plus 100g of Maize bran), T_3 (groundnut haulms plus 200g of maize bran) and T_4 (groundnut haulms plus 300g of maize bran) (Table 1). While the groundnut haulms served as basal diet, the maize bran served as supplemental diet.

Parameters measured

Parameters measured were daily feed consumption, daily weight changes, daily running costs in the form of man hour labour charges, drugs, revenue, transportation and other charges. Other parameters determined were revenues generated from the sales of fattened animals, used equipment and dung. Proximate composition of the experimental diets was determined by using the method

Table 1. Composition of the experimental diets.

	Treatments			
EXPERIMENTAL DIETS	**T_1**	**T_2**	**T_3**	**T_4**
Groundnut haulms	*ad lib*	*ad lib*	*ad lib*	*ad lib*
Maize bran (g)	0	100	100	100

Table 2: Proximate composition of experimental diets.

	Nutrients							
Feeds	DM	CP	CF	EE	ASH	NFE	Ca	P
G nut haulms(%)	90.89	13.58	35.88	1.56	6.69	45.68	1.45	0.83
Maize bran (%)	92.78	10.19	20.10	13.53	6.09	46.70	0.05	0.25

DM=Dry matter, **CP**=Crude protein, **CF**=Crude fiber, **EE**=Ether extract, **NFE**=Nitrogen free extract, Ca=Calcium, P=Phosphorus.

of analysis as described by the Association of Official Analytical Chemists (AOAC, 1980). Nutrients determined were dry matter (DM), crude protein (CP), crude fiber (CF), Ether extract (EE), nitrogen-free extract (NFE), total ash, calcium (Ca) and Phosphorus (P).

Data Analysis

Data obtained were subjected to net farm income (NFI) analysis as described by Jabo et al., (2010) and Mohammed et al. (2010) to carry out the cost-benefit analysis which is specified by Aderinola and Akinrinola (2005) as cited by Mohammed et al. (2010) as follows.
NI=TR-(TVC+TFC), where
NI=Net Income (Profit of the product in Naira/Kg.
TR=Total Revenue of the ith product in Naira/Kg
TVC= Total Variable Costs of the ith product in Naira/Kg
TFC=Total Fixed Costs of the ith product in Naira/Kg.
Some economic indicators were also applied to ascertain the economic viability of the study. Hence Operating ratio, gross ratio and fixed ration were calculated by Olukosi and Erhabor (1988) as below;
OR =TOC/GI
Where OR= operating ratio TOC = Total operating cost GI = Gross income
GR = TFC/GI
Where GR = Gross ratio TFC = Total fixed expenses GI = Gross income
FR = TFC/GI
Where FR = Fixed ratio TFC = Total fixed cost GI = Gross income
Feed conversion ratio, being total feed intake per unit weight gain was also calculated for each goat in each treatment.

RESULTS AND DISCUSSIONS

Proximate composition of the experimental diets

The proximate composition of the experimental diets was as presented in Table 2.

Dry matter

Results showed that the dry matter content of the Maize bran was 92.78%. This is higher than 89.41% reported by Ogundipe (2002), 60% by Kankengi et al. (1996) and Yahaya et al. (2001a). The dry matter of the groundnut haulms was 90.89%. This is lower than the 94.50% reported by Yahaya et al. (20010), but higher than those reported by Ikhatua and Adu (1981) 85.37%, Devendra and Mcleroy (1987) 85.1%. The differences may be attributed to processing and moisture contents of the feed ingredients resulting from weather conditions at the time of processing or analysis as stated by McDonald et al. (1998) that weather condition and method of processing influence moisture contents of the feed.

Crude Protein

The crude protein of the Maize bran was 10.19%. This is higher than that reported by Yahaya et al. (2001a) 9.25, (2001b) 10.13% but lower than those reported by Ogundipe et al. (2002) 11.0% and Kankengi et al. (1996) 12.84%. The crude protein content of groundnut haulms was 13.58%, which is higher than that reported by Yahaya et al. (2001) 12.6%. The differences in crude protein contents could be due to the stage of harvest and the ratio of stems to leaves. Yahaya et al. (2001) and Devendra and Mcleroy (1987) had earlier reported that protein contents of roughages are higher when harvested young and when there are higher levels of leaves compared to stems.

Crude fiber

Crude fiber is the fraction of carbohydrate after subtraction of nitrogen-free extract (McDonald et al., 1998) which occur in forms of cellulose, lignin, and hemicelluloses. The crude fiber content of maize bran

Table 3: Efficiency of fattening goats on varying levels of maize bran with groundnut haulms as basal diet.

	Treatments					
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**	**Level**
L. O/goat (Kg)	40.00^a	40.00^a	40.00^a	40.00^a	0.321	**
L.C/goat (Kg)	34.18^a	30.22^a	29.26^b	8.86^c	0.412	**
MBR. O/goat (Kg)	0	7.00^c	14.00^b	21.00^a	0.632	**
MBR. C/goat (Kg)	0	7.00^c	14.00^b	21.00^a	1.213	**
C. L/goat (N)	786.14^a	695.06^b	672.98^c	203.78^d	8.221	**
C. MBR/goat (N)	0	490^c	980^b	14.70^a	15.321	**
T.F.C./goat (Kg)	34.18^c	37.22^b	43.26^a	29.86^d	5.412	**
D.F.I/goat (Kg)	0.488^b	0.475^b	0.618^a	0.427^c	0.012	*
LVW goat (Kg)	14.40^b	14.20^b	16.45^a	16.70^a	5.221	*
DMI as % of LW	3.38^a	3.35^a	3.76^a	2.56^b	0.145	*
TCFC (N)	786.14^c	905.00^b	1652.98^a	1673.78^a	14.123	**
DWG/goat (g)	63.33^d	76.00^c	88.31^b	94.94^a	8.322	**
WG in 10 weeks (Kg)	4.43^c	5.32^b	6.18^a	6.65^a	0.331	*
CGO/ goat (N/Kg)	177.46^c	170.12^d	267.47^a	251.70^b	11.21	*
FE (%)	12.98^d	16.00^b	14.30^c	22.23^a	4.341	*

L.O.=Legume offered, L.C.=Legume consumed, **MBR.O**=Maize bran offered, **MBR. C**=Maize bran consumed, **C.L**.=Cost of legume, **C. MBR**=Cost of maize bran, **TFC**=Total feed consumed, **DFI**=Daily feed intake, **LVW**=Live weight, **TCFC**=Total cost of feed consumed, **DWG**=Daily weight gain, **WG**=Weight gain, **CGO**=Cost per gain, **FE**=Feed efficiency.
Note:Values with different superscript within a row differ significantly ($P<0.05$).

was 20.10%, which is far below that reported by Yahaya et al., (2001) 45.1%. That of the groundnut haulms was 35.88%, which is similar to that reported by Yahaya et al. (2001) 34.9% but higher than that reported by Devendra and Mcleroy (1987)27.1%. These differences could be attributed to the stages of the harvest of the roughage feed as reported by McDonald et al. (1998) that the higher level of crude fiber may be due to the level of maturity at which the forage crop was harvested and vice versa.

Total Ash

Total ash is the residual product of burning after the carbon has been removed (McDonald et al., 1998). The maize bran contained 6.09% total ash. This is higher than those reported by Yahaya et al., (2001) 2.4% and Ogundipe (2002) 1.9%. Groundnut haulms had 6.69% ash as compared to 2.5% and 2.6% reported by Yahaya et al., (2001) and Devendra and Mcleroy (1987) respectively. The differences in total ash contents of the feeds could be as a result of differences in their mineral contents which are influenced by the fertility of the soil on which they were grown and stage maturity at harvest.

Efficiency of fattening goats on maize bran and groundnut haulms

The dry matter intakes measure the efficiency, dry matter intake as a percentage of live weight, daily weight changes, feed efficiencies, cost per weight gain, the net return on investment and return per investment (Tables 3 and 4).

Economics Analysis of goats fattening on varying levels of maize bran with groundnut haulms as basal diet

Table 4 below shows the economic analysis of the experiment. The results revealed that the average total costs per head of a goat for the experiment was N3, 959.51 while the corresponding revenue per head of an animal was N5187.50 giving net farm returns of N1227.99 per head of the animal for the whole experiment. This implies that in addition to data collected from the research an appreciable profit was recorded over the animals. Further analysis of the table also shows that 94.1% of the costs incurred were as a result of operating cost while only 5.9% went for fixed costs. Table 4 also revealed that for every one Naira invested, a profit of 30 kobo was realized as profit.
More so, Table 4 showed various economic indices. The farm operating ratio of 0. 72 which means 72% of income from the animals went for variable costs. Olukosi and Erhabor (2008) reported that an operating ratio less than one is always desirable for farm business. The gross ratio and the fixed ratio were 76% and 38%, respectively, which implies that 76% of the gross income went for total costs while 38% of the gross income went for fixed costs expenses.

Dry matter intake (DMI)

Looking at Table 3, the average daily dry matter intakes are 488g, 475g, 618g and 427g for treatments T_1, T_2, T_3 and T_4 respectively. This shows that averagely, feed intake decreases with an increase in the level of maize bran fed. This is due to the high energy content of maize

Table 4. Economics Analysis of goats fattening on varying levels of maize bran with groundnut haulms as basal diet.

	Treatments			
Variables (Expenditure) (A)	**T_1**	**T_2**	**T_3**	**T_4**
Average initial cost of goat/Treat. (N)	1200	1150	1450	1400
Quant. of haulms cons/goat/Treat (Kg)	34.18	30.22	29.26	8.86
Av. cost of haulms cons/goat/Treat.@ 23/Kg)	786.14	695.06	672.98	203.78
Av.quant. of maize bran cons./goat/treat (Kg)	0	77	14	21
Av. cost of maize bran con/goat/treat @N70/Kg	0	490	980	1470
Av. Cost of water supply/goat/treat (N)	200.00	200.00	200.00	200.00
Av. Cost of medication/goat/treat (N)	160.00	160.00	160.00	160.00
Av. Cost of labour/goat/treat (N)	775.00	775.00	775.00	775.00
Depreciation of fixed assets/goat/treat (N)	200	200	200	200
Av total variable cost/goat/treat (N	3121.14	3470.16	4237.98	4208.78
Av. Total variable costs/ goat for the whole exp.(#)			**3759.51**	
Av. Total cost/goat/ treat	**3321.14**	**3670.16**	**4437.98**	**4408.78**
Av. Total cost/ goat for the whole expt			**3959.51**	
Revenue (B)				
Av. initial weight of goat/treat (Kg)	9.96	9.50	11.16	11.67
Av. Final weight of goat/treat (Kg)	14.40	14.20	16.45	16.70
Selling price/goat/treatment (N)	4100.00	4400.00	5500.00	5400.00
Av. Total revenue/goat/treat (N)	300.00	250.00	316.66	283.33
Av. Gross margin/goat/treat (N)	4400.00	4650.00	5816.65	5883.33
Av. total revenue for the whole exp. (N)		**5187.50**		
Av. Gross margin/goat/treat (N)	1278.86	1179.84	1378.68	1274.55
Av. Gross margin for the whole exp. (N)		**1227.83**		
Net farm income/goat/treat (N)	1078.86	979.84	1178.68	1274.55
Av. Net income/goat for the whole exp. (N)			**1227.83**	
Av. Net return on naira invested		**0.31**		
Farm operating ratio (OR)		**0.72**		
Gross farm ratio (GF)		**0.76**		
Fixed Ratio (FR)		**0.40**		

bran. The higher the energy contents of the feed, the lower the feed intake because energy determines the level of feed intake.

The dry matter intake as a percentage of the live weight of the animals in the treatments was 3.38, 3.35, 3.76 and 2.56 for the four treatments respectively. Prasad (2010) had earlier reported that meat type goats consume feed at 2.5-3.0% of live weight although these increases with an increase in feed digestibility. The values obtained in this experiment are also in line with those reported by Alaku (2010) that the dry matter intake of a goat on hay alone average 3% of body weight. Sastry and Thomas (2010) further reported that with *ad libitum* concentrate feeding, it can reach up to 4%. Therefore, dry matter intake of goats can be higher than 3% if good quality feed is offered.

Average Daily Weight gain

The average daily weight gains were 63g, 76g, 88g and 95g for treatments T_1, T_2, T_3, and T_4 respectively. Though the control treatment (T_1) had the lowest daily weight gain, it is higher than that obtained by Hossain et al. (2003) being 52.96g/day when they fed goats with high energy diets under grazing conditions. Therefore, groundnut haulms could be used alone to fatten goats, especially in the dry season when available pasture is of lower qualities.

Feed efficiency

The feed efficiencies were 12.98, 16.00, 14.30 and 22.23 for the four treatments respectively. The feed efficiencies were found to increase with an increase in the level of maize bran inclusion. This is because maize bran is less fibrous and more digestible. The body utilizes it more efficiently than that of groundnut haulms which had higher fiber content.

Conclusion

It can be concluded that a supplement of groundnut haulms with maize bran gives a better weight gain and hence gives a better profit. It can, therefore, be recommended as a feed supplement for commercial goats' production.

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