Sheep Fattening with Groundnut Haulms and Millet Bran in the West African Sahel

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Keywords

Sheep – Fattening – Crop residue – Animal nutrition – Animal production – Mixed farming – Sahel – Niger.

Summary

Sheep fattening is economically important in mixed crop-livestock systems in the West African Sahel. It is particularly attractive to poor farmers including women because of the low investment and rapid turnover. A feeding trial was conducted for 56 days to determine the optimal feeding levels of groundnut haulms and millet bran for profitable sheep fattening. Forty-eight Peul Oudah rams, bought from a livestock market, about 12-15 months old, with an average initial live weight of 20.3 kg (standard deviation = 1.7) were randomly divided into groups of six animals and allotted to eight treatment groups defined by a factorial combination of four feeding levels of groundnut haulms (0, 300, 600 and 900 g per animal per day) and two levels of millet bran (0 and 400 g per animal per day). Bush hay was offered *ad libitum* at 40 g/kg live weight as basal feed. Total dry matter intake and digestible organic matter intake were linearly related to the level of groundnut haulms and millet bran offered. Average daily gains (ADGs) of sheep offered 0, 300, 600 and 900 g/day of groundnut haulms without millet bran were -27.5, 10.4, 30.8 and 35.7 g/day, respectively. With 400 g millet bran per day, ADGs were 40.3, 59.5, 91.7 and 63.4 g/day, for the four levels of groundnut haulms, respectively. Supplementation with 600 g/day of groundnut haulms and 400 g/day of millet bran gave the highest net return.

■ INTRODUCTION

Sheep fattening is an important economic activity in the West African Sahel, especially towards the Islamic festival of Eid-al-Kabir, called Tabaski in the region (1, 3). It is particularly attractive to poor farmers including women because of the low initial investment, rapid rate of turnover and social acceptance. The main strategy is to fatten young, lean male sheep obtained either from the farmer's own flock or, more often, purchased on the open market, over a two- to three-month period, with each farmer fattening between one and five animals. The sheep are usually tethered or kept in a small sheltered enclosure at the homestead, and often fed and watered individually. Basal feeds used for sheep fattening, such as bush hay and millet straw, are commonly supplemented with cowpea hay, groundnut haulms, and millet bran which is derived from the household processing of millet grains (10). The rapid growth and good condition required within a short time make feeding the appropriate quantity and quality critical for the profitability of the activity (10).

In traditional sheep fattening, feeds are always provided ad hoc and in an unregulated fashion. In other words, farmers often give the animals whatever is available, leading to waste when feed availability is high, and underfeeding when feed availability is low (2, 8). The result of such practice is that the growth rates in traditional sheep fattening remain below the genetic potential of the animals (10). This combination of low growth rates and long fattening period makes traditional sheep fattening largely unprofitable. Alternative feeding strategies are pertinent to make sheep fattening profitable.

Previous on-station and on-farm sheep fattening experiments conducted by the International Livestock Research Institute (ILRI) in Niger (2, 3) revealed that a daily supplement of 300 to 600 g cowpea hay and 400 g of millet bran along with bush hay or millet straw fattened sheep most profitably. Farmers, however, also

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have access to groundnut residues, and optimal levels of feeding have yet to be established for this resource. Hence, this study was carried out to establish the optimum feeding levels of groundnut haulms for sheep fattening in the region. The specific objective was to determine the effect of different levels of groundnut haulms and millet bran on the feed intake, water consumption, live weight changes of rams and the economic return.

■ MATERIALS AND METHODS

Study site, treatments, feeds and animals

The experiment was carried out during the dry season (November to December 2006) at the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT Sahelian Center) in Sadore (13° 14' N, 2° 16' E), Niger.

Forty-eight Peul Oudah rams bought from a livestock market in Balleyara (about 100 km east of Niamey) of about 12-15 months of age with an average initial live weight (LW) of 20.3 kg (standard deviation = 1.7) were randomly allotted to eight treatments defined by a factorial combination of four feeding levels of groundnut haulms (0, 300, 600 and 900 g per animal per day) and two levels of millet bran (0 and 400 g per animal per day), in groups of six. The millet bran used for the study was purchased at a local market in Niamey and it mainly originated from domestic millet processing for household consumption. The sheep were placed in individual metabolic cages that allowed for urine collection. They were fed individually during 56 days, following a two-week adaptation period.

Bush hay was offered *ad libitum* at 40 g/kg LW as basal feed. To determine the proportion by weight of different herbaceous species in bush hay, three bales of bush hay were randomly selected, weighed and separated by species. The dominant species by weight were *Zornia glochidiata, Ctenium elegans, Schizachyrium exile,* and *Borreria stachydea*. The average weight of a bale of bush hay used during the study was 6345 g (standard deviation = 345). The chemical composition of bush hay, groundnut haulms and millet bran offered during the feeding trial is shown in Table I. Each animal had free access to water throughout the experiment.

Table I

Chemical composition (g/kg of dry matter; mean ± standard error) of bush hay, groundnut haulms and millet bran offered during the feeding trial

Parameter	Bush hay	Groundnut haulms	Millet bran
Organic matter	888 ± 4	839 ± 8	892 ± 2
Nitrogen	9.6 ± 0.2	12.9 ± 0.2	18.0 ± 0.2
Phosphorus	1.0 ± 0.1	2.1 ± 0.3	8.4 ± 0.8
In vitro organic matter digestibility	514 ± 5	739 ± 8	624 ± 4
Estimated digestible organic matter	457 ± 5	621 ± 9	557 ± 3
Neutral detergent fiber	722 ± 2	472 ± 4	370 ± 2
Acid detergent fiber	593 ± 5	365 ± 5	140 ± 4
Lignin	170 ± 6	63 ± 3	26 ± 2
Cellulose	129 ± 5	107 ± 3	230 ± 4
Hemicellulose	423 ± 8	302 ± 4	113 ± 4

Measurements

The study included a nine-day period of collection of feces and urine, which started in week 5 of the experiment. The sheep were accustomed to carrying canvas bags for fecal collection during the last week before the data collection started. Fecal output was weighed daily, and a 10% subsample was taken from each animal and frozen for subsequent analysis. During the collection periods, the volume of urine collected in a plastic bucket, containing 100 mL of 10% sulfuric acid as preservative to prevent nitrogen volatilization, was measured every morning. The volume of urine excreted was standardized to three liters by adding distilled water, and a subsample of 50 mL was taken for laboratory analysis. Feed refusals were weighed every morning to determine voluntary intake of groundnut haulms, millet bran and bush hay. Two samples per treatment of feed offered (groundnut haulms, millet bran and bush hay) were taken daily during each nine-day data collection period. Water intake was also measured in week 5 of the experiment. Sheep were weighed for three consecutive days at the beginning, every two weeks afterwards and at the end of the study. The average daily gain (ADG) was estimated by regression of individual live weight data over time.

Laboratory analyses

Samples of feed offered (groundnut haulms, millet bran and bush hay) were analyzed for dry matter (DM), organic matter (OM), nitrogen (N), phosphorus (P) and fiber components [neutral detergent fiber (NDF), acid detergent fiber (ADF) and lignin]. Fiber analysis was determined according to procedures by Van Soest et al. (11). Hemicellulose and cellulose were calculated as the differences NDF – ADF and ADF – lignin, respectively. Organic matter digestibility (OMD) was determined by the *in vitro* gas production technique calibrated with standards obtained *in vivo* (5). Fecal samples collected during the collection period were analyzed for DM, OM, N and P, while urine samples were analyzed for N concentration.

Statistical analysis

Data analysis was performed with SAS (9) using the general linear model (GLM) procedure for variance analysis. An analysis of variance model including the level of groundnut haulms and millet bran and its interactions was used to analyze data on fecal and urinary output, feed and water intake, live weight changes and net benefit of sheep fattening. Orthogonal contrasts were used to partition the sums of squares of groundnut haulms levels into linear, quadratic and cubic effects. Multiple comparison of treatment means was performed by contrast statement using the GLM procedure. Unless otherwise specified the level of significance was declared at $p < 0.05$.

■ RESULTS

Feed and water intake

Total dry matter intake (TDMI) and digestible organic matter intake (DOMI) were linearly related to the level of groundnut haulms and millet bran offered (Table II). The highest DOMI was recorded for sheep supplemented with 600 g/day of groundnut haulms and 400 g/day of millet bran. Supplementation with millet bran increased both TDMI and DOMI for all levels of groundnut haulms offered. Dry matter intake (DMI; g/kg $LW^{0.75}$) of bush hay was significantly depressed by supplementation with groundnut haulms (GH) and millet bran (MB), and 84% of the variation in DMI was explained by these two variables according to the following equation (s.e. = standard error):

DMI = 62.494 (s.e. 3.01) – 0.152 (s.e. 0.036) GH + 0.0003 (s.e. 0.0001) GH^2 – 0.059 (s.e. 0.011) MB $p < 0.05$; $R^2 = 0.84$

The response of DOMI (g/kg $LW^{0.75}$) to levels of groundnut haulms and millet bran is described by the equation below (only variables that were significant at $p < 0.05$ were included in the equation):

DOMI = 29.68 (s.e. 2.00) + 0.0020 (s.e. 0.0023) GH + 0.022 (s.e. 0.006) MB ($p < 0.05$; $R^2 = 0.75$)

The supplementation with millet bran had a significant effect on the sheep water intake (WI; mL/day), whereas groundnut haulms had no effect (Table III). The sheep consumed 2.89 mL/g of dry matter ingested. The WI response to levels of groundnut haulms and millet bran is described by the following equation (only variables that were significant were included):

WI = 1372 (s.e. 152) + 2.89 (s.e. 0.52) MB $R^2 = 0.60$

Nitrogen intake and excretion

Nitrogen intake (N_i; g/day) increased linearly with increasing levels of both groundnut haulms and millet bran (Table IV). With only bush hay, N_i was 5.4 g/day. Sheep supplemented with groundnut haulms and millet bran had significantly higher N_i than those supplemented with groundnut haulms only (Table IV). The N_i response to different levels of groundnut haulms and millet bran is described by the equation:

N_i (g/day) = 5.439 (s.e. 0.472) + 0.0059 (s.e. 0.0008) GH + 0.0145 (s.e. 0.0016) MB – 0.000064 (s.e. 0.000015) GH*MB ($p < 0.05$; $R^2 = 0.83$)

The nitrogen excreted in feces and urine accounted for 39 – 84% and 11 – 24%, respectively, of the amount ingested. The proportion

Table III

Effect of levels of groundnut haulms and millet bran on the water consumption by sheep

GH level (g/day)	MB level (g/day)	Water consumption		
		mL	mL/LW	mL/DMI
0	0	1372	69.5	2.4
300	0	1887	97.5	3.1
600	0	2222	102.7	2.9
900	0	2310	109.2	2.8
0	400	2387	115.9	3.3
300	400	2480	119.7	2.9
600	400	2741	122.2	2.9
900	400	2473	116.2	2.8
Standard error		139	6.3	0.2
p-values				
GH[a]		0.292	0.0591	0.030
MB		< 0.0001	< 0.0001	0.002
Interaction (GH*MB)		0.294	0.193	0.028

GH: groundnut haulms; MB: millet bran; LW: live weight; DMI: dry matter intake
[a] Quadratic and cubic effects of ground haulms levels were not significant for all variables ($P > 0.05$).

Table II

Effect of levels of groundnut haulms and millet bran on the dry matter intake of bush hay, total dry matter intake and digestible organic matter intake by sheep

GH level (g/day)	MB level (g/day)	bhDMI (g/kg $LW^{0.75}$)	tDMI (g/kg $LW^{0.75}$)	DOMI (g/kg $LW^{0.75}$)
0	0	62.5	62.5	29.7
300	0	35.7	65.7	35.6
600	0	30.2	77.9	45.0
900	0	21.0	83.2	48.0
0	400	38.7	76.4	38.5
300	400	22.5	87.6	48.4
600	400	16.9	91.9	51.2
900	400	15.0	90.5	48.9
Standard error		2.7	3.5	1.8
p-values				
GH[a]		0.0001	0.045	0.0487
MB		< 0.0001	0.011	0.0022
Interaction (GH*MB)		0.156	0.278	0.193

GH: groundnut haulms; MB: millet bran; bhDMI: dry matter intake of bush hay; tDMI: total dry matter intake; DOMI: digestible organic matter intake
[a] Quadratic and cubic effects of ground haulms levels were not significant for all variables except for the significant quadratic effect of dry matter intake of bush hay ($p = 0.019$).

Table IV

Nitrogen intake, fecal nitrogen, urinary nitrogen and nitrogen retained during the balance trial of different levels of groundnut haulms and millet bran given to sheep

GH level (g/day)	MB level (g/day)	N_i (g/day)	N_f (g/day)	N_u (g/day)	N_r (g/day)
0	0	5.40	4.55	0.61	0.24
300	0	6.80	4.19	1.12	1.48
600	0	9.85	4.73	2.24	2.88
900	0	10.26	4.87	2.51	2.86
0	400	10.36	6.37	2.35	1.64
300	400	12.98	5.83	2.80	4.35
600	400	14.65	5.68	2.22	6.75
900	400	13.16	5.38	2.53	5.52
Standard error		0.41	0.33	0.27	0.43
p-values					
GH[a]		< 0.0001	0.284	< 0.0001	0.006
MB		< 0.0001	< 0.0001	< 0.0001	0.005
Interaction (GH*MB)		0.0332	0.028	< 0.0001	0.159

GH: groundnut haulms; MB: millet bran
N_i: nitrogen intake; N_f: fecal nitrogen; N_u: urinary nitrogen; N_r: nitrogen retained
[a] Quadratic and cubic effects of ground haulms levels were not significant for all variables ($P > 0.05$).

of nitrogen ingested which was excreted in feces decreased linearly with increasing levels of both groundnut haulms and millet bran in the diet. Supplementation with millet bran led to less nitrogen excreted in feces and more nitrogen excreted in urine. The nitrogen retained (N_r) increased linearly with increasing levels of both groundnut haulms and millet bran. The relationship between N_r and the levels of groundnut haulms and millet bran is best described by the equation:

N_r (g/day) = 0.509 (s.e. 0.474) + 0.00304 (s.e. 0.00083) GH + 0.00486 (s.e. 0.00163) MB ($p < 0.05$; $R^2 = 0.82$)

Live weight changes

The average daily gains for sheep offered 0, 300, 600 and 900 g/day of groundnut haulms without millet bran were -27.5, 10.4, 30.8 and 35.7 g/day (s.e. 4.7), respectively. With 400 g millet bran per day, ADGs were 40.3, 59.5, 91.7 and 63.4 g/day (s.e. 4.7) for the four levels of groundnut haulms, respectively (Figure 1). Increasing levels of groundnut haulms and millet bran had a linear effect on ADGs. The following regression equation described the relationship between ADG (g/day), the amount of groundnut haulms (g/day) and millet bran (g/day) offered.

ADG = -27.170 (s.e. 5.631) + 0.1515 (s.e. 0.0288) GH + 0.1603 (s.e. 0.0191) MB – 0.0000906 (s.e. 0.0000221) GH^2 ($p < 0.05$; $R^2 = 0.87$)

Regressions of ADG over the digestible organic matter intake (g/kg $LW^{0.75}$) and nitrogen retained (g/day) are described by the following equations:

ADG = -291.76 (s.e. 97.95) + 12.73 (s.e. 4.82) DOMI – 0.11 (s.e. 0.06) $DOMI^2$ ($p < 0.05$; $R^2 = 0.60$)

ADG = -13.28 (s.e. 7.48) + 22.31 (s.e. 4.14) N_r – 1.29 (s.e. 0.49) N_r^2 ($p < 0.05$; $R^2 = 0.68$)

Costs and returns of sheep fattening

The rams for the experiment were bought from a local livestock market at the beginning of the study at 650 CFA francs (1 USD = 500 CFAF in November 2006) per kilogram live weight. The rams were sold at 850 CFAF per kilogram live weight at the end of the study in December 2006 which coincided with the Islamic festival of Eid-al-Kabir, called Tabaski in the region. The sheep sales price increased linearly with the levels of groundnut haulms and millet bran (Table V). The major cost for sheep fattening was the feed cost. Bush hay cost 25 CFAF/kg while groundnut haulms and millet bran cost 75 and 100 CFAF/kg, respectively. The gross return (sales price – purchase price) ranged from 2044 to 8393 CFAF per ram (Table V). When the feed and veterinary costs were removed from the gross return, the net return ranged from -131 to 2260 CFAF per ram. If the feed cost was not included, assuming the feed resources came from the household crop residues, which is often the case in rural communities, the net return ranged from 1844 to 8192 CFAF per ram. Supplementation with 600 g/day of

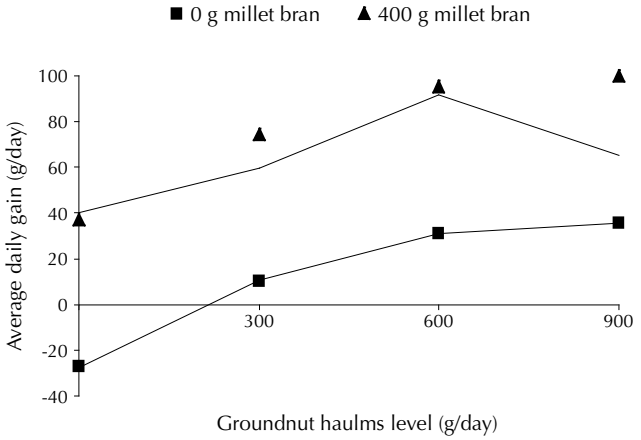

Figure 1: *Average daily gain (g/day) of sheep supplemented with groundnut haulms and millet bran with trend lines [standard error (s.e.) 4.7].*
ADG (g/day) = -27.170 (s.e. 5.631) + 0.1515 (s.e. 0.0288) GH + 0.1603 (s.e. 0.0191) MB – 0.0000906 (s.e. 0.0000221) GH^2 ($p < 0.05$; $R^2 = 0.87$)

Table V

Average costs and returns for different levels of groundnut haulms and millet bran in the diet per sheep for eight weeks of fattening (CFA francs[a])

Groundnut haulms level (g/day)	0	300	600	900	0	300	600	900	SE
Millet bran level (g/day)	0	0	0	0	400	400	400	400	
Variables									
Purchase price	13,368	13,083	13,336	13,283	13,184	12,923	13,173	13,429	465
Sales price[bc]	15,412	17,538	18,818	19,159	18,868	19,534	21,566	20,732	734
Gross return[bc]	2,044	4,455	5,482	5,921	5,684	6,611	8,393	7,302	357
Feed cost[bc]	1,101	2,356	3,701	4,961	3,394	4,597	5,933	7,234	54
Veterinary cost	200	200	200	200	200	200	200	200	0
Total cost[bc]	1,301	2,556	3,901	5,161	3,594	4,797	6,133	7,434	76
Net return[cd]	743	1,899	1,582	760	2,090	1,814	2,260	-131	320
Net return (without feed cost)[bc]	1,844	4,255	5,282	5,721	5,484	6,411	8,192	7,103	357

[a] 1 US$ = 500 CFAF in Nov. 2006; SE: standard error
[b] Linear effect of groundnut haulms ($p < 0.05$). Quadratic and cubic effects were not significant
[c] Linear effect of millet bran
[d] Linear effect of interaction between groundnut haulms and millet bran

groundnut haulms and 400 g/day of millet bran gave the highest net return, irrespective of the feed cost being included or not.

■ DISCUSSION

The values of the total dry matter intake and digestible organic matter intake found in this study agree with those reported by Dan-Gomma (1) and Savadogo (10) in their feeding trials involving supplementation with groundnut haulms. The depression of bush hay intake by the sheep with increasing levels of groundnut haulms and millet bran could be attributed to a much lower quality of the bush hay compared to the supplements. A similar observation was reported by Manyuchi et al. (4) as to the fact that supplementation with groundnut haulm depressed the intake of poor quality natural pasture hay by sheep. This shows that the quality of basal feed affects the nutritional benefits resulting from supplementation. Feeding millet bran, an energy-rich supplement, resulted in higher total dry matter intake for the same levels of groundnut haulms in the diet. These results confirm the observation by Minson (6) that energy-rich supplements generally increase the total food intake where available forage is of low or poor quality.

The results of ADGs in this study were similar to those reported by Fernandez-Rivera et al. (2), and Hiernaux and Ayantunde (3), for sheep supplemented with cowpea hay and millet bran. However, ADGs in this study were higher than those reported by Ngwa and Tawah (7) for sheep supplemented with groundnut haulms only. This difference might be attributable to the inclusion of millet bran in the present feeding trial. The results of this study confirm that combining an energy-rich with a protein rich supplement promotes high growth rate of rams being fattened (3). In addition, the results show that it is advisable to consider using the combination of these two supplements to achieve a profitable sheep fattening scheme. Addition of energy-rich supplement along with legume hay facilitates better utilization of feed nitrogen for microbial protein synthesis in the rumen as it makes sufficient energy available to rumen microbes for growth and microbial protein production (6).

The results on net returns (excluding feed cost) from sheep fattening in the present study are comparable to the net returns (also excluding feed cost) ranged between 2636 and 7099 CFAF reported by Hiernaux and Ayantunde (3) for sheep fattened with similar levels of cowpea hay and millet bran in the diet. The results also show that feeding 600 g of groundnut haulms and 400 g of millet bran along with bush hay as basal feed is the most profitable feed ration for sheep fattening, whether the feed cost is included or not. However, it will be necessary to carry out on-farm feeding trials with rural communities, especially with women responsible for management of small ruminants, to validate the profitability of fattening with groundnut haulms and millet bran. Apart from the feed cost, the profitability of sheep fattening also depends on the purchase and sales price of sheep. Minimizing the purchase price and feed cost, and maximizing the sales price will increase the profit margin. Under traditional sheep fattening, sheep to be fattened are often selected from the household flock thereby incurring no additional cost in procuring the animals (3). The feed cost is also reduced when farmers use crop residues (millet straw, cowpea hay and groundnut haulms) from their crop harvest and millet bran from processing of millet grains for household food. In spite of the low cost of feed and in procuring the animals, the profit margin in traditional sheep fattening is still low because of the low sales price (3). In periurban sheep fattening schemes, sheep are normally sold at a high price, especially towards the Islamic festival of Tabaski, but the profitability of urban sheep fattening is often undermined by higher feed costs in periurban areas. Improving access of rural producers to periurban livestock markets might be an option to consider to enhance the profitability of sheep fattening in rural communities.

■ CONCLUSION

This study revealed that sheep fattening was most profitable when sheep were fed 600 g/day of groundnut haulms and 400 g/day of millet bran along with the basal feed. For rural households with access to crop residues and millet bran from millet grains processed for food, the main challenge is to gain access to market outlets where they could sell their sheep at a higher price.

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Résumé

Ayantunde A.A., Fernandez-Rivera S., Dan-Gomma A. L'embouche ovine à base de fanes d'arachides et de son de mil dans le Sahel ouest africain

L'embouche ovine est économiquement importante dans les systèmes agriculture - élevage dans le Sahel ouest africain. Elle est particulièrement attrayante pour les paysans pauvres y compris les femmes en raison du faible investissement requis et de la rapidité de cycle. Un essai d'alimentation a été mené pendant 56 jours pour déterminer les niveaux optimums des fanes d'arachide et de son de mil pour un engraissement profitable des moutons. Quarante-huit béliers Peuls Oudah, achetés dans un marché de bétail, d'environ 12-15 mois d'âge et d'un poids initial moyen de 20,3 kg (écart-type = 1,7) ont été alloués aléatoirement, par groupes de six, à huit traitements définis par une combinaison factorielle de quatre niveaux de fanes d'arachide (0, 300, 600 et 900 g par animal par jour) et deux niveaux de son de mil (0 et 400 g par animal par jour). La paille de brousse a été offerte à volonté comme alimentation de base à 40 g/kg de poids vif. L'ingestion totale de matière sèche et l'ingestion de matière organique digestible ont été linéairement associées au niveau des fanes d'arachide et de son de mil offert. Les gains moyens quotidiens (gmq) de poids pour les moutons qui ont reçu 0, 300, 600 et 900 g/jour de fanes d'arachide sans son de mil ont été respectivement de -27,5, 10,4, 30,8 et 35,7 g/jour. Avec 400 g/jour de son de mil, les gmq ont été respectivement de 40,3, 59,5, 91,7 et 63,4 g/jour pour les quatre niveaux de fanes d'arachides. La complémentation avec 600 g/jour de fanes d'arachide et de 400 g/jour de son de mil a donné le bénéfice net le plus élevé.

Mots-clés : Ovin – Engraissement – Résidu de récolte – Nutrition animale – Production animale – Polyculture élevage – Sahel – Niger.

Resumen

Ayantunde A.A., Fernandez-Rivera S., Dan-Gomma A. Engorde de ovejas con tallos de maní y cereal de mijo en el Sahel del Oeste africano

El engorde de las ovejas es económicamente importante en sistemas mixtos de cultivo-crianza en el Sahel del Oeste africano y particularmente atractivo para los finqueros pobres, incluyendo mujeres, debido a la baja inversión y el rápido movimiento de capitales. Se llevó a cabo un experimento de alimentación durante 56 días con el fin de determinar los niveles óptimos de alimentación con semillas molidas de maní y mijo, para engorde de ovejas con beneficios financieros. Se compraron cuarenta y ocho machos Peul Oudah en un mercado de ganado, con aproximadamente 12-15 meses de edad, con un peso vivo inicial promedio de 20,3 kg (desviación estándar = 1.7) y se dividieron al azar en grupos de seis animales y divididos en ocho grupos de tratamientos, definidos por una combinación factorial de cuatro niveles de tallos de maní (0, 300, 600 y 900 g por animal por día) y dos niveles de mijo (0 y 400 g por animal por día). Paja de arbusto se dió ad libitum con 40 g/kg de peso vivo como alimento de base. El consumo total de materia seca y el de materia orgánica se relacionaron en forma linear con el nivel de tallos de maní y de cereal de mijo que se ofreció. La ganancia de peso promedio (GPP) de las ovejas a quién se dió 0, 300, 600 y 900 g/día de tallos de maní sin mijo fueron -27,5, 10,4, 30,8 y 35,7 g/día, respectivamente. Con 400 g de mijo por día, las GPP fueron de 40,3, 59,5, 91,7 y 63,4 g/día, respectivamente para los cuatro niveles de tallos de maní. La complementación con 600 g/día de tallos de maní y 400 g/día de mijo dieron el mejor rendimiento neto.

Palabras clave: Ovino – Engorde – Residuo de cosecha – Nutrición animal – Producción animal – Explotación agrícola combinada – Sahel – Níger.