

PERFORMANCE CHARACTERISTICS OF LACTATING DJALLONKÉ EWES FED RICE STRAW BASAL DIETS SUPPLEMENTED WITH *STYLOSANTHES HAMATA*

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ABSTRACT

A 7-week feed intake and growth performance study involving thirty lactating Djallonké ewes and their lambs was conducted. The ewes were randomly assigned to 3 dietary treatment groups resulting in 10 replications. The ewes were individually housed and offered 1000 g rice straw basal diet daily; *Stylosanthes hamata* given as a supplement at one of the 3 rates, which formed the treatments; i.e. 180 g/d [T₁₈₀], 240 g/d [T₂₄₀] or 360 g/d [T₃₆₀]. Feed intake of the ewes and liveweight changes of the ewes and their lambs were recorded. Intake of rice straw was similar amongst the ewes on the different treatments ($P>0.05$). However, the ewes consumed more supplement as the amount offered increased resulting in a significant improvement in total feed intake as the supplement offered increased ($P<0.01$). There was no significant difference ($P>0.05$) in the body weights of the ewes that could be attributable to treatment effects. The average daily gains (ADG) at day 49 for the lambs were, 47.5 [T₁₈₀], 63.4 [T₂₄₀] and 76 g [T₃₆₀]. This result suggest that supplementation of ewes had a significant effect ($P<0.01$) on the ADG of lambs as the level of supplementation increased. The results further indicate that supplementation of a basal rice straw diet with 360 g per day of *Stylosanthes hamata* enabled ewes to maintain their body weight in the dry season.

Keywords: supplementation, *Stylosanthes hamata*, rice straw, Djallonké ewes, lambs.

INTRODUCTION

The feed resources available to farmers in Ghana to feed the more than 3 million sheep (SRID, 2005) consist primarily of undeveloped communal pasture forages and crop residues (Siaw *et al.*, 1993). Both feed resources are highly seasonal with quality and quantity decreasing as the dry season progresses. There is usually a correspond-

ing lowering of the crude protein content, increase in dietary fibre and subsequent decrease in digestibility and intake, as the forage matures (Olson *et al.*, 1994). Furthermore the major lambing occurs during the dry season (September-February) when feed resources are inadequate and of poor quality. This problem of inadequate feeding may lead to poor milk production by the ewe and subsequent

starvation and death of lambs resulting in the high pre-weaning mortality noted among Ghanaian lambs (Buadu and Osafo, 1994). There is therefore the need to develop packages for dry season feeding to alleviate this problem.

Rice straw, as an alternative feed resource, could be used for stall-feeding of small ruminants, particularly lactating ewes in Ghana during the dry season. The current Government of Ghana policy of promoting local rice production and consumption implies that rice straw would be a feed resource that would be available to feed ruminants. Given the grain to straw ratio of 1: 1 (Udo and El-Harith, 1985), it is estimated that 240,000 metric tonnes of rice straw would be available annually from the 240,000 metric tonnes of rice grains produced. Rice straw, however, contains only 4% crude protein (CP) (Ngwa and Tawah, 1991) and feeding rice straw alone would thus not be enough to meet maintenance and production requirements of lactating sheep and their lambs. There is therefore the need to identify a protein source that should be cheap and be able to increase the intake and digestibility in sheep fed rice straw and meet the nutrient requirements of lactating ewes.

Amongst the most promising forage supplements that could improve utilisation of roughage on small holder ruminant farms by providing nitrogen in the rumen are the *Stylosanthes* species. The most important is the accession *Stylosanthes hamata*, which has proved to be resistant to the fungal disease called Anthracnose that affects most accessions notably, *Stylosanthes guianensis* (Humphreys, 1991).

In order to sustain the productivity of small ruminant livestock in Ghana, there is the need to develop a feeding system based on a low cost basal diet. Rice straw supplementation with *S. hamata* seems to be a promising combination to address this.

The objectives of this work were to determine the effects of the supplementation of a rice straw basal diet with *Stylosanthes hamata* on the feed

intake and liveweight changes of lactating ewes, feed conversion ratio as well as the implications of these effects on the suckling lambs.

MATERIALS AND METHODS

Location of study

The study was carried out at the Sheep Breeding Farm of the Ministry of Food and Agriculture (MOFA), at Bonyon, Ejura, in the Ejura-Sekyere-Dumasi District of the Ashanti Region. Ejura is situated at latitude 7°, 23'N and longitude 1°, 21'W. The study was carried out from December 2001 to March 2002.

Source of Feeds

The rice straw of the November (2001) to February (2002) harvesting season was obtained from smallholder rice farms in and around Ejura after the harvest of the grains. The straw was baled using a mechanical baler and transported to the Sheep Breeding Farm and stored under a shed.

Experimental Design

Thirty (30) lactating Djallonké ewes in their fourth week of lactation were used in a completely randomised design (CRD) feeding trial over a 7-week period. The ewes were ranked according to body weight and randomly allocated to three dietary treatments namely T₁₈₀, T₂₄₀ and T₃₆₀ with ten replicates per treatment. Rice straw constituted the basal diet and was offered at 50 g/kg liveweight (LWT)/day while the *Stylosanthes hamata* provided as a supplement at the rate of 180 (T₁₈₀); 240 (T₂₄₀) or 360 (T₃₆₀) g/day. The *S. hamata* used was harvested from the fields of the Sheep Breeding Farm, Ejura.

The three dietary treatments therefore were as follows:

T₁₈₀ = 50 g /kg LWT/day rice straw + 180 g/day *Stylosanthes hamata*.

T₂₄₀ = 50 g /kg LWT/day rice straw + 240 g/day *Stylosanthes hamata*.

T₃₆₀ = 50 g /kg LWT/day rice straw + 360 g/day *Stylosanthes hamata*.

Animals and Management

The ewes and their lambs were identified by plastic ear tags and housed in individual well-ventilated pens measuring (3 x 1 m). The pens were cleaned and disinfected for a week before the commencement of the study. Albendazole¹ 10%, a broad-spectrum antihelminthic, was administered as a drench for the control of internal parasites. 'Deadline' "Pour-on,"² an acaricide, was used for the control of external parasites following the manufacturer's instructions.

Diet Preparation and Feeding

The *Stylosanthes* was harvested and sun dried on concrete floors for 2 - 3 days before being fed to the experimental animals. The basal diet, rice straw, was chopped into about 8 -10cm in length, weighed and offered to the sheep. The lactating ewes were individually offered 1000 g rice straw and *Stylosanthes hamata* was given at one of the three levels (i.e. 180 g/d or 240 g/d or 360 g/d) according to the treatment assigned. The diets were offered in wooden feeding troughs and water was supplied in 10 litre plastic bowls. Mineral salt lick³ was supplied *ad libitum*. The straw ration for the day was offered as two equal meals at 9.00 a.m. and 4.00 p.m. The supplement was also divided into two and offered twice daily, an hour before the provision of the rice straw. The basal diet was only offered on complete consumption of the supplement.

Data collection

Feed offered and refusals were recorded daily, for the 49-day duration of the experiment at 8.00 a.m from which daily feed intake was subsequently calculated. Samples of the rice straw and *Stylosanthes* and refusals per pen were bulked per pen over a 7-day period and sub-samples taken for chemical analysis. No attempt was made at estimating milk consumed by the lambs or water

consumption by the ewes because of the lack of labour. Feed conversion ratios were calculated as feed intake divided by weight gain.

Growth Measurements

The ewes were weighed at the beginning and the end of the experiment to establish the initial and final live weights respectively. Feed and water were withdrawn twelve hours before weighing. The lambs on the other hand were weighed every ten days.

Chemical Analyses

The samples were thoroughly mixed and sub-samples taken for milling prior to chemical analysis. Samples of the feed ingredients and feed refusals were ground using a hammer mill (Cyclotec 1093 Sample Mill) with a 1 mm screen. The samples were then analysed for dry matter (DM), crude protein (CP) and ash contents based on the procedures of the AOAC (1990). Acid detergent fibre (ADF) and neutral detergent fibre (NDF) were analysed using the methods of Goering and van Soest (1970). Hemicellulose levels in the feed stuffs were determined as the difference between NDF and ADF values.

RESULTS

The ewes remained in good health throughout the trial. There was however an outbreak of ovine pneumonia one and a half months into the trial and 5 lambs and a ewe succumbed to the disease even though treatment was initiated. The deaths were spread across all the treatment groups two died in treatments T₁₈₀ and T₂₄₀ and one lamb in T₃₆₀.

Quality of rice straw and *Stylosanthes* used

The chemical composition of the feed offered the sheep is presented in Table 1. The results show that both the rice straw and *Stylosanthes* had DM

¹Albendazole 10 % -: Pyvet Holland. Contains 100 mg albendazole/ml

²Deadline "Pour-on": Bayer (Pty) Ltd., Animal Health Division, Namibia. Contains -: Flumethrine 1% w/v.

³Mineral salt lick, La Veterinary Hospital. Contains -: 2500 g magnesium; 1800 g iron; 380 g manganese; 280 g zinc; 110 g cobalt; 110 g iodine; and 3 g selenium /kg

levels of more than 960 g/kg. The crude protein content of the legume was higher, being nearly three times that of the rice straw but the fibre and ash contents of the rice straw were higher than the values for the *Stylosanthes*. Furthermore, the rice straw contained silica, which was not found in the legume

Liveweight change and feed intake of lactating ewes

Table 2 shows the liveweights and feed intake of the ewes. The results show that there were no differences in the liveweights due to treatment effects ($P>0.05$). However, there were marginal

increases in the final liveweight of the ewes over the period of the experiment, these being 1.3, 1.5 and 1.8 kg for treatments T₁₈₀, T₂₄₀, and T₃₆₀, respectively.

The daily rice straw intake by the ewes was similar for all treatments ($P>0.05$). However, intake of *Stylosanthes*, significantly increased ($P<0.01$) as the offer rate increased resulting in a significantly ($P<0.01$) higher total feed intake. Ewes offered 360 g *Stylosanthes* had the highest total feed intake. When total feed intake was expressed on metabolic weight basis, there were no differences due to treatment effects ($P>0.05$).

Table 1: Chemical composition of rice straw (*Oryza sativa*) and *Stylosanthes hamata*

Item	Rice Straw	SD	<i>Stylosanthes</i>	SD
Dry Matter (DM) (g/kg)	969.6	1.54	962.4	0.66
Crude Protein (g/kg DM)	36.4	0.17	114.8	0.26
NDF [#] (g/kg DM)	801.6	0.95	512.6	0.36
ADF [#] (g/kg DM)	505.1	0.53	395.9	0.79
Hemicellulose (g/kg DM)	296.5	0.66	116.7	0.36
Ash (g/kg DM)	122.2	0.44	71.1	0.35
Silica (g/kg DM)	104.5	0.26	-	-

NDF[#], neutral detergent fibre; ADF, acid detergent fibre; SD, standard deviation

Table 2: Live weight change and intake of straw and *Stylosanthes* by the ewes

	Treatments			SE	Sig
	T ₁₈₀	T ₂₄₀	T ₃₆₀		
Initial weight [M], kg.	19.4	19.7	21.7	0.89	NS
Final weight [M], kg.	20.7	21.2	23.5	1.03	NS
Initial metabolic weight M ^{0.75}	9.2	9.3	10.0	0.28	NS
Final metabolic weight M ^{0.75}	9.7	9.9	10.6	0.36	NS
Intake					
Straw (g DM/d)	808.8	832.8	820.3	23.76	NS
<i>Stylosanthes</i> (g DM/d)	166.3	222.9	323.7	4.12	***
Total (g DM/d)	975.1	1,055.7	1,144.0	24.46	**
Straw intake (g DM/M ^{0.75} /d)	88.0	88.9	83.2	3.60	NS
<i>Stylo</i> intake (g DM/M ^{0.75} /d)	18.1	24.1	32.9	1.09	***
Total (g DM/M ^{0.75} /d)	106.1	113.0	116.1	4.44	NS

NS, Non-significance; *, $P<0.05$; **, $P<0.01$; ***, $P<0.001$; SE, Standard error.

Live weight changes of lambs

Table 3 shows the lamb live weight changes over the period of the experiment. There were no significant differences in initial liveweights of the lambs ($P>0.05$). However, significant changes ($P<0.01$) had occurred in their liveweights by day 49 of the experiment with T₃₆₀ lambs being the heaviest and having significantly higher ($P<0.01$) ADG than the other treatment groups. The ADG during the period (49 days) were 47.5, 63.4, and 76.0 g per day for the lambs of the lactating ewes fed 180, 240 and 360 g *Stylosanthes*, respectively.

DISCUSSION

Feed intake and live weight changes in ewes

The high dry matter of both the rice straw and *Stylosanthes* indicate that the feed offered were quite dry. The low crude protein content of the rice straw used in this experiment is a typical value for rice straws (Tuen *et al.*, 1991; Vadiveloo, 1992) and therefore when such feed is offered, there is always the need to supplement so as to enable the animals meet their protein requirements for high levels of production (Leng, 1990). The *Stylosanthes* hay offered had a higher CP content. The value is similar to those observed by Rai *et al.* (1998), Rodriguez *et al.* (1998) and Cesar *et al.* (1999). The *Stylosanthes* was therefore a suitable protein supplement for the low protein rice straw basal diet.

The non-significant difference ($P>0.05$) observed in rice straw intake amongst the three treatments coupled with the increased intake of *S. hamata* as the supplements offer rate increased implies that there was no substitution effect. Therefore higher levels of the supplement could be fed. Values for the total dry matter intake (DMI) with *Stylosanthes* supplementation of straws obtained from this experiment were generally comparable to those reported by others for sheep (Ngwa and Tawah, 1991; Njwe and Kona, 1998; Arigbede *et al.*, 2004). Rodriguez *et al.* (1998) reported improved DMI as the level of inclusion of the supplement, *Stylosanthes*, increased. Similar observations were noted when weaned lambs were fattened on *Chloris gayana* hay with lablab (*Dolichos lablab*) meal as protein supplement where increasing the crude protein content of diet resulted in higher dry matter intakes (Mafwere and Mtenga, 1992).

This study suggests that, supplementation of a rice straw basal diet with 360 g/day of *S.hamata* resulted in increased total DMI thereby corroborating the observations of Arigbede *et al.* (2004) and Ngi *et al.* (2006). The increased intake is probably due to a reduction in the mean retention time and also an increase in the animals' state of N-balance (McManus *et al.*, 1972; Moran *et al.*, 1983). Van Soest (1982) also indicated that supplementation with protein, tends to have a positive effect of increasing microbial population with an increase

Table 3: The effect of *Stylosanthes* supplementation of Djallonké ewes on the preweaning live weight change of the lambs.

	Treatment			SE	Sig.
	T ₁₈₀	T ₂₄₀	T ₃₆₀		
Initial weight [M], kg	4.1	4.1	4.7	0.29	NS
Initial metabolic weight M ^{0.75}	2.9	2.9	3.2	0.15	NS
49 day weight [M], kg	6.2	7.5	8.9	0.38	*
49-day metabolic weight M ^{0.75}	4.0	4.4	5.0	0.21	**
49 day ADG, g/day	47.5	63.4	76.0	5.69	**

ADG, average daily gain; SE, standard error; NS; *, $P<0.05$; **, $P<0.01$; ***, $P<0.001$

in digesta breakdown and passage leading to increased feed intake. The *S. hamata* supplement had probably increased the nitrogen available to the rumen microbes and this could have resulted in a more favourable rumen environment for increased microbial yield and subsequently the amount of protein absorbed from the duodenum (Van Soest, 1982; Preston and Leng, 1987).

Although the treatments appeared not to have affected the liveweights of the ewes, the slight improvement in the liveweights of all ewes could also be attributed to the combined effects of residual rice grains in the rice straw, which provided energy and more importantly, the ability of the *S. hamata* supplement to provide sufficient nitrogen and other nutrients for microbial fermentation.

The non-significance of the differences in the final liveweight and the final metabolic weights among the treatments could suggest that the CP contents of all the diets were at optimal level for the best performance in the animals as any CP level above the optimal could not induce any significant body weight increase.

Treatment effects on pre-weaning lamb weights

The higher average daily gains of the lambs whose dams were on T₂₄₀ and T₃₆₀ could be attributed to the higher total DM intake by ewes on these two treatments. As observed earlier the increased intake of *S. hamata* supplement increased the CP intakes accordingly and this probably had positive effects on milk composition and yield of ewes on these treatments (T₂₄₀ and T₃₆₀). Consequently, lambs suckling ewes on these two treatments could translate the increased milk into superior liveweight gains. The average daily gains of the lambs were similar to values (35.18 - 48.39 g) obtained by Karbo and Alhassan, (1993) for lambs in Ghana. Rai *et al.* (1998) also reported an improvement in the weight of lambs after supplementing tropical grass hay with *Stylosanthes*.

CONCLUSION

The results of this study suggest that rice straw could be fed to lactating ewes as a dry season feed. However, there is the need to supplement with nitrogen sources such as *Stylosanthes hamata* at the rate of 240 - 360 g/d. Feeding of unused resources like rice straw with adequate supplementation in Ghana can increase the growth performance of lambs and maintain lactating ewes.

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