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Effect of Supplementation Dried Sesbania Sesban (L.) Leaf on Performance of Abergelle Rams

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Abstract
The study was undertaken with an objective to evaluate the effect of supplementation of dried *Sesbania sesban* leaf (SSL) on feed intake, body weight gain and cost benefit analysis of the feeding regimes for Abergelle rams under farmer's management system in Tigray region, northern Ethiopia. The experiment was carried out using 21 yearling intact Abergelle rams with initial body weight of 22.83 ± 3.11 Kg (mean ± standard deviation). The experiment comprised 90 days of feeding trial following 14 days of adaption period. Farmers having 3 yearling intact rams were first purposively identified and 7 farmers were randomly selected. Randomized complete block design with 4 treatments and 7 replications was applied. The treatments were local feeding practices (T1), local feeding practices + 250 g/day dried SSL (T2) and local feeding practices + 300 g/day dried SSL (T3). The OM, CP and NDF contents of dried SSL were 89.70%, 23.34% and 25.90%, respectively. The DM, OM, CP, NDF, ADF and ADL intake of dried SSL supplemented rams were significantly higher ($p< 0.0001$) for T3 than T2. The average daily gain (ADG) of Abergelle rams in T2 and T3 were significantly higher ($p<0.0001$) than T1 but, similar in T2 and T3. The ADG were 28.98 g, 67.96 g and 75.71 g for T1, T2 and T3, respectively. Supplementation of dried SSL for Abergelle rams provided more profit compared to unsupplemented rams. Though T2 and T3 given comparable results in terms of body weight gain, the marginal rate of return suggested that supplementation of dried SSL with 250 g/day than 300 g/day for Abergelle rams provided better economic gain and therefore, T2 is recommended as biological and economical sufficient supplementary regime for Abergelle rams.
Keywords: Ethiopia, Intake, Partial budget, Weight gain

1. Introduction

Shortage of feed is the main constraint to livestock productivity in the arid and semiarid zones. A large proportion of the rift valleys grazing lands have dry seasons lasting from six to eight months each year (Lema et al., 1999). In Ethiopia crop residues are the main feed resource for ruminants during the dry season. Animal performance on crop residues can be improved by chemical treatment and by supplementation. *Sesbania sesban* and *Leucaena leucocephala* are tropical forage legumes which are rich in protein and which have consequently become important in the world of research as a protein supplement for ruminants fed poor quality roughages such as maize Stover (Devendra, 1984). Sesbania foliage crude protein (CP) content is generally above 22 % Dry matter (DM) and it can be higher than 30 % DM. Sesbania foliage (stem + leaves) has also moderate to low cell wall content (NDF < 30% of DM) in most cases. It is one of the less tanniniferous forage tree legumes though some accessions are reported to have higher tannins (Kaitho et al., 1998a). **Kaitho** et al. (1998b) reported that the optimum levels of *Sesbania sesban* supplementation in terms of live weight gain per gram supplement is 30% DM of total ration. Furthermore, Mekoya (2008) indicated supplementation of *Sesbania sesban* at 30% of the ration (0.98% of body weight) improved basal and total feed intake and digestibility, growth rate and the overall reproductive performance of sheep. Tibebu et al. (2009) noted that sheep that were fed the diet containing 300 g/kg sesbania foliage showed higher ADG (103 g/day) than the unsupplemented control group (75.6 g/day). *Sesbania sesban* could also substitute a concentrate when it accounted for up to 33% of the mix (Wondwosen et al., 2013).

Therefore, in order to utilize effectively the cereal crop residues as well as natural pasture which constitutes the principal sources of fodder in Ethiopian in general and in Tigray region in particular there is a need of research to improve the nutritional value of those feeds through supplementation. The objective of this study was to evaluate the effect of dried *Sesbania sesban* leaf (SSL) supplementation on feed intake, body weight gain and cost benefit analysis of the feeding regimes for Abergelle rams under farmer's management system in Tigray region, northern Ethiopia.

2. Materials and Methods

2.1. Study area

The study was conducted on farm level at Tabia Shika -Tekli in Tanqua Abergelle wereda, Tigray region, northern Ethiopia. The wereda is located at 13° 14' 06" N latitude and 38° 58' 50" E longitude. It is categorized as hot to warm sub-moist lowland (SM1-4) sub-agro ecological zone of the region with an altitude of 1300 to 1800 m above sea level and its mean annual rainfall ranges from 400 to 650 mm and the mean annual temperature

ranges from 21 to 41°C.

2.2. Experimental feeds preparation and feeding

The SSL was collected from Agbe and Sele irrigation sites in wereda Tanqua Abergelle of Tigray region, northern Ethiopia. After collection, SSL was air dried under shed, packed in sacks and properly stored until feeding. The experimental rams were fed a basal feed on natural pasture and crop residues. The SSL was weighed based on the required amounts and then supplemented to the experimental rams according to the respective treatments. The experimental rams were allowed 14 days of adaptation period and the feeding trial was taken 90 days. The supplement was offered twice per day in equal portions at 8:00 and 16:00 hrs.

2.3. Experimental Animals and their managements

A total of 21 yearling intact Abergelle rams with similar body weights were randomly selected from farmers with each farmer provided three sheep. The experimental rams were ear tagged for identification and treated with Albendozole bolus 600 mg/head and Vetazinon 60% EC against internal and external parasites, respectively before commencement of the experiment.

2.4. Experimental design and treatments

In this experiment, randomized complete block design (RCBD) experimental design was employed. Farmers were considered as block and the experimental rams were assigned to the dietary treatments randomly within the block. Each treatment was replicated seven times. The dietary treatments were:

T_1 = Local feeding practices
T2 = Local feeding practices + 250 g dried SSL
T_3= Local feeding practices + 300 g dried SSL

2.5. Data collection

The quantities of daily offered and refused supplements were recorded, and then the supplements' DM and nutrients intakes were calculated.

Supplement nutrient intake = nutrient content of supplement offered – nutrient content of supplement refusal.

The initial body weight, bi week body weight and final body of the experimental rams were taken. The body weight change was determined as difference between final and initial body weights and the ADG was calculated using the following formula:

$$\text{ADG (g/d)} = \frac{\text{Final body weight (g)} - \text{Initial body weight (g)}}{\text{Number of feeding days}}$$

The costs of air dried SSL, estimated purchasing and selling prices of the experimental rams were also documented for the determination of economic feasibility using partial budget analysis.

2.6. Laboratory analysis

From representative samples of the dried SSL offer and refusal DM, Ash and N content were analyzed using the procedures outlined by AOAC (2005). The CP was determined by N content multiplied by 6.25. The NDF, ADF and ADL of the samples were analyzed according to detergent method of analysis (Van Soest et al., 1991). The chemical analysis was done at Animal nutrition laboratory in Haramaya University.

2.7. Data analysis

The collected data were analyzed using the general linear model procedure of SAS version release 9.2 (SAS, 2008) and mean separation was done by Tukey`s Studentized range (HSD) test. The statistical model used for the analysis of the data was:

$$Yij = \mu + ti + bj + eij$$

Where: Yij = response variable
μ = over all mean
ti = i^{th} treatment effect
bj = j^{th} block effect
eij = random error

3. Results and Discussion

3.1. Chemical composition of supplements

The dried SSL in the present study had higher CP and lower fiber fractions but, the SSL refusals had comparatively lower CP and higher cell wall components than the supplemented form. The DM of SSL in the

present study is similar to the result reported by Hagos (2014) and the OM is comparable to the value reported by Etana et al. (2011). The CP in this study is lower than the value reported for SSL by Alemayehu et al. (2015). The NDF, ADF and ADL of SSL in this study are higher than the results reported by Etana et al. (2011) but lower than the values indicated by Alemayehu et al. (2015). The difference observed for chemical composition of SSL between the present study and other studies might be due to variations in stage of harvesting, drying process, season and environment.

Table 1. Chemical composition of dried *Sesbania sesban* leaf

Parameter	DM%	OM (% DM)	CP (% DM)	NDF (% DM)	ADF (% DM)	ADL (% DM)
Offered dried SSL	93.41	89.68	23.34	25.85	17.47	5.52
Refusal dried SSL	93.43	89.73	21.27	29.13	20.64	7.45

SSL= *Sesbania sesban* leaf; DM= dry matter; OM= organic matter; CP= crude protein; NDF= neutral detergent fiber; ADF= acid detergent fiber; ADL= acid detergent lignin and %= percentage.

3.2. Dry matter and nutrient intake from supplements

The DM, OM, CP, NDF, ADF and ADL intakes of supplemented SSL were higher ($p< 0.0001$) in T3 rams than T2 rams. The difference for DM, OM, CP, NDF, ADF and ADL intakes from supplements between T2 and T3 might be due to the higher level of dried SSL offered for Abergelle rams in T3 which consequently resulted greater DM and nutrients intakes compared to T2.

Table 2. Dry matter and nutrient intakes of Abergelle rams supplememnted with *Sasbania sesban* leaf

Intake (g/day/head)	Treatments			SEM	P- value
	T1	T2	T3		
Supplement DM	-	227.66[b]	268.78[a]	0.148	0.0001
OM	-	204.16[b]	241.03[a]	0.133	0.0001
CP	-	53.26[b]	62.97[a]	0.031	0.0001
NDF	-	58.66[b]	69.10[a]	0.043	0.0001
ADF	-	39.59[b]	46.59[a]	0.031	0.0001
ADL	-	12.45[b]	14.61[a]	0.011	0.0001

[a, b] Mean in the same row with different superscript differ significantly ($P<0.0001$); DM= dry matter; OM= organic matter; CP= crude protein; NDF= neutral detergent fibre; ADF= acid detergent fibre; ADL= acid detergent lignin; SEM= standard error mean and P-value= Probability value.

3.3. Body weight gain

The total weight gain and ADG of Abergelle rams supplemented with T2 and T3 were higher ($p<0.0001$) than rams allowed to graze in T1. Moreover, T3 had higher final body weight than T1. Though higher DM and nutrients intake in T3 than T2 was observed in this study, the body weight gain parameters were the same in T3 and T2. The ADG for Abergelle rams supplemented with dried SSL in this study is higher than ADG of 42 g for local sheep supplemented with 280 g/day DM SSL (Hagos, 2014) but lower than ADG of 103 g for sheep fed diet containing 300 g/kg sesbania foliage (Tibebu et al., 2009) and 86.11 g for Kaffa sheep supplemented with 300 g/day DM SSL (Alemayehu et al., 2015).

Table 3. Body weight gain of Abergelle rams suplemented on dried *Sesbania sesban* leaf

Parameters	Treatments			SEM	P Value
	T1	T2	T3		
IBW (kg)	22.69	22.86	22.96	0.943	0.979
FBW (kg)	25.29[b]	28.97[ab]	29.77[a]	1.029	0.021
TWG (g)	2.61[b]	6.12[a]	6.81[a]	0.450	0.0001
ADG (g)	28.98[b]	67.96[a]	75.71[a]	5.005	0.0001

[a, b] Mean in the same row with different superscript differ significantly ($P<0.05$) or ($P<0.0001$); IBW= initial body weight; FBW= Final weight body; TWG= total weight gain; ADG = average daily gain; SEM= standard error mean and P value= Probability value.

3.4. Cost benefit analysis

The partial budget analysis showed that supplementation of dried SSL for Abergelle rams provided higher economic return compared to grazing rams. The supplement (variable) costs and change of variable costs were greater in T3 than T2. The gross income, total return, net return and change of net return were in the order of T3, T2 and T1 from higher to lower values, respectively. However, the marginal rate of return was superior for T2 compared to T3.

Table 4. Cost benefit analysis of supplementation of dried *Sesbania sesba*n leaf for Abergelle rams

Description	Treatments		
	T1	T2	T3
Number of rams	7	7	7
Average purchasing price of rams(ETB/head)	720 .00	720.00	720.00
Dried SSL consumed (kg/head)	0	21.94	25.90
Cost for SSL (ETB/head)	0	219.40	259.00
Total variable (feed) costs (TVC) (ETB/head)	0	219.40	259.00
Gross income(ETB/head)	892.85	1364.28	1428.60
Total return (TR), (ETB/head)	172.85	644.28	708.60
Net return (NR), (ETB/head)	172.85	424.88	449.60
Change of total return (ΔTR)	0	471.43	535.75
Change of total variable costs (ΔTVC)	0	219.40	259.00
Change of net return, ΔNR (ΔTR-ΔTVC)	0	252.03	276.75
Marginal rate of return, MRR (Ratio)	-	1.15	1.07
Marginal rate of return, MRR (%)	-	115	107

Figure 1. Some of the beneficiaries' of supplementation of dried *Sesbania sesban* leaf

4. Conclusion

Supplementation of Abergelle rams with 250 g/day (T2) and 300 g/day (T3) dried SSL provided higher ADG than grazing rams but, similar in T2 and T3. Though T2 and T3 given comparable results in terms of body weight gain, the marginal rate of return suggested that supplementation of dried SSL with 250 g/day than 300 g/day for Abergelle rams provided better economic gain and therefore, T2 is recommended as biological and economical sufficient supplementary regime for Abergelle rams.

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