Journal of Fisheries & Livestock Production

Research Article Open Access

Supplementary Effect of Sensel (*Justicia Schemperiana*) on Growing Lambs Fed on Desho Grass (*Pennisetum Pedicellatum*) in Doyogena, Southern Ethiopia

Deribe Gemiyu Talore*, Tesfaye Abiso

Department of Animal Science, Southern Agricultural Research Institute (SARI), Hawassa, Ethiopia

Abstract

Feed shortage both in quantity and quality is one of the major constraints of Livestock production in Southern Ethiopia. Sources of protein feed supplement is particularly too expensive and inaccessible. The experiment was conducted to evaluate intake, weight gain and carcass characteristics of growing lambs (4-6 months) at Doyogena, southern Ethiopia. Graded levels of sensel (*Justicia schemperiana*), and WB and noug cake (*Guizotia abyssinica*) and 380 g/ DM WB, 210 g DM noug cake and 0.5% salt were mixed as concentrate ration (CR) for control group while wheat bran and salt were included in the diets for experimental animals. 24 growing lambs were allocated to four treatments in completely randomized block design: T1= grazing + 380 g DM wheat bran /head/day + 210 g noug cake +10 g salt as a control; T2= grazing + 380 g DM wheat bran /head/day + 250 g sensel/head/day), T3= grazing + 380 g DM wheat bran /head/day + 200 g sensel /head/day) and T4= grazing + 380 g DM wheat bran /head/day + 350 g sensel /head/day. The results indicated that lambs supplemented with sensel at 150 g per head/day showed significantly ($p<0.05$) higher feed conversion efficiency. Likewise, lambs supplemented with sensel leaf at 150 g/ head/day had significantly higher FCE compared to lambs supplemented with 250 and 350 g sensel leaf per head/ day. The overall mean daily gain of 44.2 g/head/day in 6-8 weeks. The partial budget analysis suggested economic feasibility of strategic supplementation. Sensel is rich in protein content (29%) but as amount increases it might limit intake and digestibility that warrants a research for the future.

Keywords: Growth; Average Daily Gain; Doyogena Sheep; Fattening; Profit

Introduction

Sheep production is an integral part of crop-livestock mixed farming systems of Ethiopia. High human population pressure along with urbanization and climate changes are threatening the benefit gained from production and utilization of sheep. Body weight gain and carcass yield of majority of the local sheep breeds/types (Menz, Arsi-Bale, & Black head Somali) are often reported to be low [1]. Efforts were done to import exotic breeds with high dressing capacity to improve meat in terms of yield, dressing percentage and quality aspects. However, exotic breeds such as Awassi and Corriedale had hardly been adapted to Ethiopian management (housing, feeding, and healthcare) and climatic conditions [2]. Despite the efforts, demands for mutton have been increased considerably in the last five to ten years and accordingly mutton price has increased. This necessitates improvement of plane of nutrition through supplementation of concentrates and/ or forage legumes which could promote faster daily weight gain and attainment of acceptable market at earlier age [3, 4]. Indigenous sheep have their own merits but have genetic limits need to be addressed by either selection, crossbreeding or improved managements. The government organizations engaged in rural agricultural activities advocated community-based breed selection from indigenous sheep as a sustainable tool to improve local, adapted breeds to poor nutrition, disease and parasites [2]. All male sheep culled from community based ram selection need to be either castrated or culled from the flock. However, appropriate feed formation for faster growth and finishing animals has not been studied previously, particularly with combination local energy-protein rich rations, except few reports on indigenous browse and energy feeds a protein source [5]. Doyogena sheep is currently identified as one of the potential breeds/types that could be improved through community-based participatory selection since 2012. It is one of the sheep flocks with better reproductive and growth capacity reported in the central south region [4].

However, similar to other highland areas of the region, problems associated to small landholdings and high human population are the typical characteristics of the district, which results in prolonged fattening and reduced profits [3, 4]. Among others, feed shortage is one of the bottlenecks threatening breed improvement in the area. *Sensel* is locally available shrub, climate resilient and high food/fodder value in central south regions of Ethiopia. Strategic supplementation of locally available protein rich browses such as Wanza (*Corida Africana)*, sensel (*Justicia schemperiana*) are usually used for sheep feeding to replace costly protein sources which are either not affordable or accessible to smallholder farmers. However, those few studies reported [5-7], the utilization methods and level of inclusion in a ration, particularly use of *sensel* leaf in animal diet has not been well investigated and documented. Accelerating growth and then fattening culled sheep from the flocks during selection, using protein rich local feed sources could improve community breed selection practices and productivity in general [3, 8]. The study was aimed at evaluating supplementary effect of sensel leaf for growing sheep to shorten period at which lambs reach marketable weight.

***Corresponding author:** Deribe Gemiyu Talore, Department of Animal Science, Southern Agricultural Research Institute (SARI), Hawassa, Ethiopia, Tel: +251 (0) 924441256, E-mail: deribeg2000@yahoo.com

Received: 08-Feb-2022, Manuscript No: jflp-22-53842; **Editor assigned:** 09-Feb-2022, Pre QC No. jlp-22-53842 (PQ); **Reviewed:** 23-Feb-2022, QC No. jflp-22-53842; **Revised:** 26-Feb-2022, Manuscript No. jflp-22-53842 (R); **Published:** 05-Mar-2022, DOI: 10.4172/2332-2608.1000330

Citation: Talore DG, Abiso T (2022) Supplementary Effect of Sensel (*Justicia Schemperiana*) on Growing Lambs Fed on Desho Grass (*Pennisetum Pedicellatum*) in Doyogena, Southern Ethiopia. J Fisheries Livest Prod 10: 330.

Materials and Methods

Description of the study site

This experiment was conducted at Doyogena research sub-station, Areka Agricultural research center in 2019. The site is located at 254 kms south of Addis Ababa with an altitude of 2530 m.a.s.l, longitude N 07˚ 06'42.2" and latitude E 37˚41'6.32". The long term (10 years) rainfall of the site ranged between 900 and 1600 mm. The rainfall pattern is bimodal with the highest rainfall from July to September and the lowest from December to February. Although the rainfall amount of the site is not very low, due to high atmospheric water demand of the site is reported to have higher evapo-transpiration rate. The mean annual temperature ranged between 6˚C and 16˚C. Animals graze tethered about 6-8 hours on *oat (Avena sativa)* planted in the experimental site.

Experimental feeds and feeding management

Experimental animals were allowed to graze on oat *(Avena sativa)* from 09:00 AM to 04:00 PM at Doyogena research sub-station. Total mixed ration (TMR) composed of concentrates such as wheat bran, noug cake, salt were offered a positive control for all experimental groups. Sensel *(Justicia schemperiana)* was offered as a protein supplement using different levels. Sensel wilted for about a day and chopped before offering them to the fattening sheep. The treatments consisted of supplementing three different levels of concentrate mix (CM) on dry matter (DM) basis to experimental sheep fed tethered on desho grass field. The proportion of the CM was formulated based on TDN for maintenance and growth requirements by considering initial average body weight of 20-25 kg of experimental animals with expected 50 g weight gain per day at the medium level of supplementation [3]. The treatments were: T1= oat hay + 380 g DM wheat bran /head/day + 210 g noug cake +10 g salt as a control; T2= oat hay + 380 g DM wheat bran /head/day + 150 g sensel /head/day), T3= oat hay + 380 g DM wheat bran /head/day + 250 g sensel /head/day) and T4= oat hay+ 380 g DM wheat bran /head/day + 350 g sensel /head/day.

Source and management of experimental animals

24 growing male lambs with mean 18.50 ± 0.86 kg were selected from Doyogena community-based sheep breed improvement scheme. The rams were those left (3rd ranked) after selection of elite rams as breeding males for improvement of next generations. Experimental animals were identified using ear tags. The animals were de-wormed against internal parasites and sprayed against external parasites. After 14 days of adaptation period to feeds and pens, 6 animals were randomly assigned to each treatment using a completely randomized block design. Weekly weights of the animals were calculated to estimate feed supplement that were offered in the following week. The diets offered and refusals were weighed and recorded daily. Animal weights were recorded at the beginning, fortnightly and at the end of experimental period. Animals are allowed to free grazing for 8:00 hours on desho grass and water was available on *ad libtum* basis. Half of the experimental diet (*sensel* leaf) was offered on DM basis in the morning and half in the afternoon (09:00 am and 4:00 pm). The experiment lasted 90 days targeting Ethiopian festive season, Easter.

Chemical composition of experimental feeds

Feed samples were analyzed for DM by drying the samples at 105˚C for 24 h, ash by ignition in muffle furnace in 600˚C for 6 h, and CP by the Kjeldahl procedure. Standard procedures described by Van Soest were followed to analyze chemical composition and *in vitro* dry matter digestibility of the experimental feeds[9]. Chemical composition and *in-vitro digestibility* of the feeds is presented in Table 1.

Partial budget analysis

All fixed and variable costs were recorded during the experimental period. Partial budget analysis of experimental treatments was calculated using the formula: Net return= GR (sale price of sheet) - TVC (total cost of feed consumed + medicinal cost + labor cost).

Statistical analysis

Dry matter intake, average daily gain, and carcass yield parameters were analyzed using general linear model (GLM) of Statistical Analysis System version 9.2 for least square analysis of variance. Means separation were done using the Tukey's test at $P<0.05$. The statistical model for the analysis was:

$$Y_{ij}=\mu+a_i+b_j+e_{ij}$$

Where, Y_{ij} is the response variable (feed intake, total weight changes, average daily gain, weekly weight changes, feed conversion efficiency, edible and non-edible carcass yields), μ is the overall mean, a_j is the effect of sensel leaf (j=1=control; 2=150 g sensel/head/day; 3=250 g sensel/head/day, 4= 350 g sensel/head/day), b_j is the j^{th} block effect, and e_{ij} is the random variation/error.

Results

Feed chemical composition

Chemical composition, in-vitro digestibility and energy content of the experimental feed is presented in Table 1. The DM content of sensel, concentrate mixture and oat hay was 90.1, 91.5 and 91.3%, respectively. The sensel had higher CP (29%) values compared to concentrate mixture (14.8%) while oat hay had the lowest (3.5%). Sensel, concentrate mixture and oat had in-vitro digestibility of 67.1, 69.1 and 67.1%, respectively while they possessed the corresponding energy values of 6.65, 11.1 and 5.66%, respectively. Concentrate mixture had the highest energy values while oat hay had the least. On contrary, oat hay had the highest NDF (71%) compared to sensel (42.5%) and concentrate mixture (38%).

Weight changes and feed conversion efficiency

Initial and final weight, weight changes, average daily gain (ADG) and feed conversion efficiency (FCE) of experimental sheep over the experimental period is presented in Table 2. The mean initial weight of the experimental sheep was 18.5 kg while the final weight was 22.78 kg. The mean weight change over 90 day's period across the treatments was 3.97 kg. Lambs fed on 150 and 350 g sensel diets gained 4.3 kg over the 90 days period, which was significantly ($p<0.05$) higher compared to

Table 1: Chemical composition and in-vitro digestibility of sensel leaves, and natural pasture in Doyogena research sub-station, southern Ethiopia.

Feed types	Chemical composition and in-vitro digestibility (%)						Energy (MJ/Kg DM)
	DM	OM	CP	ADF	NDF	IVOMD	
Sensel (Justicia schemperiana)	90.05	9.54	29	15.74	42.48	67.11	6.65
Concentrate mixture	91.5	93	14.8	23.9	38	69.14	11.06
Oat (Avena sativa)	91.3	8.8	3.5	46.4	71.2	67.12	5.66

DM: Dry Matter; OM: Organic Matter; CP: Crude Protein; NDF: Neutral Detergent Fiber; IVOMD: In- Vitro Organic Matter Digestibility; MJ: Mega Joule

Table 2: Average daily gain, total weight changes and feed conversion efficiency of yearling Doyogena growing lambs fed tethered on oat and supplemented with sensel leaf at Doyogena research sub-station.

Parameters	Treatment				Mean	SEM	SL
	T1	T2	T3	T4			
Initial weight (g/head)	17.8	18.3	18.4	19.5	18.5	0.86	NS
Final weight (kg/head)	21.9	22.6	21.38	23.8	22.78	1.13	NS
Weight changes (kg, 90 days)	4.10^{ab}	4.30^{a}	3.00^{b}	4.30^{a}	3.97	0.37	*
Average daily gain (g/head/day)	45.56	47.78	33.33	47.78	44.15	4.12	NS
Feed conversion efficiency	7.60^{ab}	8.85^{a}	5.21^{c}	6.46^{bc}	7.15	0.66	*

Mean values in a row having different superscripts differ significantly each other; *p<0.05, NS: Non-Significant; SEM: Standard Error Mean; T1=380 g wheat bran (WB) + 210 g noug cake/head/day and 0.5% salt supplement; T1=150 g sensel leaf supplement/head/day; T1=250 g sensel leaf supplement/head/day, T4=350 g sensel per day

Table 3: Weight (kg) pattern of yearling Doyogena fattening ram fed tethered on desho and supplemented with sensel at Doyogena research sub-station.

Weeks	Treatments				Mean	SEM	SL
	T1 (kg)	T2 (kg)	T3 (kg)	T4 (kg)			
IW	17.8	18.3	18.4	19.5	18.5	0.86	0.5714
Thirty	19.97	20.4	20.34	21.2	20.46	0.92	0.8042
Forty five	21.12	21.46	21.2	22.62	21.6	0.84	0.5723
Sixty	21.88	22.14	21.83	23.4	22.32	0.75	0.4375
Seventy five	22.5	21.8	21.5	22.9	22.23	1.27	0.8348
Ninety	22.67	22.4	22.13	23.7	22.75	1.16	0.7848
Final weight	21.9	22.6	21.38	23.8	22.78	1.13	0.8298

SEM= Standard Error Mean; SL= Significance Level, IW= Initial Weight

Table 4: Least-square (Mean ± SE) of carcass components as influenced by replacement effects of wheat bran with sensel leaf on growth performance of Doyogena sheep, Southern Ethiopia.

Parameters	Treatments				SEM	SE	SL
	T1	T2	T3	T4			
SW (kg)	18.50^{b}	23.50^{ab}	24.75^{a}	23.25^{ab}	22.5	0.59	<0.01
EBW (kg)	14.33^{c}	19.39^{b}	20.42^{a}	18.80^{b}	18.23	0.54	<0.01
HCW (kg)	6.35	7.75	7.55	7.2	7.21	0.34	NS
Dressing percentage (%)	44.22	40.15	36.99	38.29	39.9	1.76	NS
Hind quarter weight (kg)	3.00^{b}	4.10^{a}	3.50^{ab}	3.25^{ab}	3.46	0.23	<0.05
Fore quarter weight (kg)	3.35^{b}	4.10^{a}	4.00^{ab}	3.88^{ab}	3.83	0.16	<0.05

Mean values in a row having different superscripts differ significantly each other; *p<0.05; **p< 0.01; NS: Non-Significant; SEM: Standard Error Of Mean; SW: Slaughter Weight; EBW = Empty Body Weight (SW-V. full); HCW = Hot Carcass Weight

those supplemented with 250 g sensel diets. Over the 90 days, the mean average daily gain (ADG) of the growing lambs was 44.15 g /head/day. Sheep fed on 250 g sensel diet had significantly (p<0.05) lower feed conversion efficiency compared to those supplemented with the control diet, 150 g and 350 g sensel diets.

The weight change trend over 9 weeks is presented in Table 3. Generally, sheep weight increased from 18.5 to 22.78 kg over 90 days of experimental period. The mean weights of the experimental sheep on sixty, seventy five and ninety days were 22.32, 22.23 and 23.67 kg, respectively.

Carcass characteristics

Carcass characteristics of sheep fed on a basal diet of oat grass hay and supplemented with different levels of sensel leaf to replace noug cake is presented in Table 4. The slaughter weight (SW) of sheep supplemented with 150, 250 and 350 g *sensel* diets were significantly (p<0.01) higher compared to the control diet. Likewise, sheep feed on *sensel* diet of 150 (T2) and 250 g (T3) were significantly higher EBW compared to those supplemented with 350 g *sensel* diet. Likewise, sheep supplemented with 350 g sensel diet was significantly (p<0.01) higher EBW compared to the control (T1). The mean dressing percentage was 39.9%. The dressing percentage ranged between 37% and 44.2% for sheep supplemented with different levels of *sensel* and concentrate mixture diets.

Non-carcass components

The edible non-carcass components of Doyogena sheep fed a basal diet of oat grass hay supplemented with sensel leaf to replace commercial concentrate, noug cake, is presented in Table 5 and 6. Sheep supplemented with sensel diet of 350 g had the least head and tongue while those supplemented with 250 g *sensel* diet had the highest. The mean testicle weight of the experimental sheep was 216.8 g. Sheep supplemented with 150 g and 250 g *sensel* diets had higher (p<0.01) testicle weight compared with those supplemented with 350 g *sensel* diet while those fed on the control diet had the least. Sheep supplemented with 350 g sensel diets had heavier (p<0.05) abdominal fat content than those supplemented with 250 sensel diets. Likewise, sheep supplemented with 250 g sensel diets had heavier (p<0.01) abdominal fat content that those supplemented with 150 g sensel diets and the control. Sheep supplemented with 150 g sensel diets had higher (p<0.05) tail weight compared to other diets. Likewise, sheep supplemented with 250 g sensel diets was heavier (p<0.05) compared to those supplemented with 350 g sensel diets and the control.

Sheep supplemented with 150 g and 250 g *sensel* diets were heavier (p<0.01) skin weight factors treatments. There is a marginal difference in spleen and gut content weights among the treatments (Table 6).

Table 5: Least-square (Mean ± SE) of edible non-carcass components as influenced by wheat bran replaced with sensel leaf on growth performance of Doyogena sheep, Southern Ethiopia.

Edible offal	Treatments				SEM	SE	SL
	T1	T2	T3	T4			
Head and Tongue (kg)	1.51	1.68	1.83	1.77	1.7	0.1	NS
Heart (g)	100.5	118.5	114	102.5	108.9	15.74	NS
Kidney wt (g)	70	78.5	72	69	72.4	4.6	NS
Testicles weight (g)	113.5^{c}	257.5^{a}	255.0^{a}	241.0^{b}	216.8	24.84	<0.01
Liver and bile (g)	352.5	319.5	302.5	339	328.4	34.83	NS
Kidney fat	15	11	17	14.5	14.38	3.41	NS
Abdominal wt (g)	9.50^{c}	13.00^{c}	33.50^{b}	53.50^{a}	27.38	7.88	<0.05
Intestinal weight (kg)	2.44	2.06	1.97	2.07	2.13	0.1	0.05*M
Tail weight (g)	175.0^{c}	380.0^{a}	240^{b}	155.0^{c}	237.5	45.12	<0.05

Mean values in a row having different superscripts differ significantly each other; *p<0.05, **p< 0.01; NS: Non-Significant; MS: Marginal Significance; SEM: Standard error mean

Table 6: Least-square (Mean ± SE) of non-edible non-carcass components as influenced by replacement effects of wheat bran with sensel leaf on growth performance of Doyogena sheep, Southern Ethiopia.

Non edible offal non-carcass components	Treatments				SEM	SE	SL
	T1	T2	T3	T4			
Skin weight (kg)	1.19^{ab}	1.23^{a}	1.20^{a}	1.13^{b}	1.19	0.1	<0.01**
Lung and pancreas (g)	203.5	278	369	331	302.1	26.8	<0.05*
Spleen(g)	27	31.5	30.5	28.5	29.4	0.85	<0.05*
Gut content (kg)	4.18	4.12	4.33	4.45	4.27	0.23	NS

NS: Non-Significant; SEM: Standard Error Mean

Table 7: Partial budget estimation (Ethiopian Birr, ETB) of yearling Doyogena growing lambs supplemented with sensel and fed on oat hay at Doyogena research sub-station.

Items	T1	T2	T3	T4
Total feed consumed, Kg/head/experimental period	142	189.71	213.57	225.5
Labor cost (wage)	197.1	197.1	197.1	197.1
Medicine cost,	16.76	16.76	16.76	16.76
Purchase of sheep	1314.92	1314.92	1314.92	1314.92
Total variable costs, TVC (a + b + C + d)	1670.77	1751.43	1765.63	1741.77
Sale of sheep, ETB/head	2790.02	3101.28	2749.97	2819.84
Net return (Sale of sheep, profit-TVC)	1119.24	1349.85	984.34	1078.06

Partial budget estimation

Partial budget estimation of Doyogena sheep grown on different levels of sensel feed and concentrate mixture is presented in Table 7. Experimental sheep culled from Doyogena community based breeding scheme (CBBS) were considered for price estimation. The net profit per head was ranged from 984 ETB for sheep supplemented with 250 g of sensel diets and 1350 ETB for sheep supplemented with 150 g sensel diets. Sheep supplemented with 150 g *sensel* diets resulted in 37.2% & 25.2% more net return over those supplemented with 250 and 350 g sensel diets, respectively. A small-scale farmer, who could fatten 20 sheep over one experimental period could earn as low as 984 and as high as 1350 ETB. If a sheep owner repeats the exercise three times a year, he or she could earn the income up until 4050 ETB per head.

Discussion

Intake is a function of feed type, texture, form of feed and environmental condition (temperature) of a given environment and presence of anti-nutritional feed ingredients [8-10]. Proportion of energy and protein feed is also important among others vitamins and minerals to a certain extent. The inclusion of sensel to certain amount might have resulted in higher FCE with however further studies need to be conducted to refine the findings. Similar to our findings, Bassa noted the importance of sensel leaf for growing oxen in south central zones of Ethiopia. It is noted local feeds and fodders with better protein value are affordable to smallholder farmers and are easily accessible [10,11]. Major energy rich local feed sources had also been identified for finishing in crop-livestock mixed farming system of southern Ethiopia [5]. On contrary, other scholar described some feed categories that are poor support for growing and or finishing [11].

Selecting and selling lambs better growth is a common practice among the rural communities, as prolonged feeding can increase production costs [4, 12, 13]. Improving animal weight by reducing labor and feed costs is one of the animal management strategies to improve productivity. Weight change (weight gain) is affected by the mode of feed (physical or chemical treatment, feed quality (energy and protein content), environmental temperature and health status of the experimental animals. There were no weight losses during experimental period. In our study, the initial weight had contributed to fast gaining over experimental period. Feeding with better grower ration might help the attainment of export market weight (25-30 kg) within few weeks (8-9 weeks), which is advantageous because of mainly feed cost inflations from time to time. It is also suggested that to shorten the period, the amount of supplement would be increased for finishing animals. Except local market, over-fattening is not required for export market because once a grower animals reach at better growth further

fattening is a deposition of fat and is not cost effective.

It could happen that animal weight changes over time, fluctuating sometimes up and sometimes down, depending on feed texture or health condition of animals. Trends in weight changes of fattening sheep supplemented with increasing levels of sensel supplementation resulted in consistently increasing weight over the experimental period. Across weeks sheep supplemented with higher levels of sensel leaf showed a decreasing trend over lower levels, which might indicate the presence of anti-nutritional effects of sensel leaves, which might imply further assessments [10].

In line with our findings, Bassa noted consistently increasing weight change for oxen fed on one of the local energy rich feeds, sensel (*Justicia schemperiana*). This trend might not always show direct relationship due to various factors: health condition of animals, the form of feed offered, environmental temperature [12].

Carcass yield and composition is a function of the type of feeds animals consume. The higher SW and EBW in sheep supplemented with T2 and T3 is might be due the higher level of protein released from the *sensel* but it declined as the level advanced. This might indicate that supplementation of the higher level might have limited DM intake, ME intake and digestibility of nutrients, dressing percentage however die not varied. Dressing percentage of animals increased as total DM and nutrient intake increased [10]. Moreover, ingested energy above the requirement deposits at different organs of the carcass, showed that growing sheep or goats had less deposited fat as growth is mainly in terms of muscle [5]. Moreover, the similarity in DP, HCW and abdominal fat among the sheep supplemented with sensel of all levels in the current study might be due to partitioning of the body weight gain obtained as a result of supplementation into carcass and non-carcass components that might have minimized the differences among the groups. Similar DP was observed among the Gaddi sheep at different planes of nutrition demonstrated that the plane of nutrition did not significantly affect DP which is corresponding to findings from the current study on carcass characteristics [3]. Generally, the DP values on EBW basis obtained from the current study is lower than the values of 41.34 % and 41.79%, respectively, for Somali and Mid-Rift Valley sheep raised on concentrate-based diets 3-4. Similarly, 45.5, 43.5, 45.4 and 45.2% DP were reported for grazing Afar, Long eared Somali, Arsi-Bale and Woyto-Guji sheep, respectively, which is higher than the current findings [3]. Higher DP values, 55.2–62.9% were reported for local Somali sheep under high planed nutrition [3]. The higher total edible fat of T2 than T3 is might be due to higher in gut content which has been expected to lower rate of digestion, which induced proportionally bigger gut content. Sheep supplemented with T1 and T4 diet had considerably heavier gut content than sheep fed on T2 and T3. This could be due to slower digestion of the feed consumed by the former group, which allowed the digesta to stay in the rumen for longer time than in the latter group of sheep. The similarity in total non-edible offal components among the experimental sheep might be due to similarity in gut contents.

Private enterprises as well as smallholder farmers need to make profit to proceed with the farming business. The importance of fattening enterprise has been well documented in mixed farming systems of central south region [12, 14]. It was noted that energy dense feeds are pre-requisite for accelerated fattening targeting festive seasons. Feeding energy rich feeds showed a fast finishing, saving labor and feed costs, indicator for profitability for those aiming at involving in sheep fattening. Legesse observed that in these areas farmers started establishing informal insurance scheme to increase the number of fattening animals while reducing risks of animals by death, losses and theft [13]. Credit institutions might also support farmers with sufficient feeding resources to be engaged in holiday's targeted fattening practice.

Conclusion

The overall mean daily gain of 44.15 g/day in 8-9 weeks is generally and reasonably better for growing lambs, i.e individuals or private organizations could obtain reasonable weight gain by rearing lambs using sensel (*Justicia schemperiana)*. The partial budget estimation has also suggested economic feasibility of strategic supplementation. The non-significant differences among the treatments indicate supplementation of sensel could replace noug cake meal, commercial concentrate with locally available protein rich sources for Doyogena sheep.

Acknowledgement

Southern Agricultural Research Institute (SARI) is dully acknowledged for financing the activity and following up at all steps of its implementation. The acknowledgment is also extended to Areka Agricultural Research Center because barn facilities and other logistics were provided by the center.

References

1. Weldegerima TM (2018) Characterization of productive and reproductive performances, morphometric and challenges and opportunities of indigenous cattle breeds of Ethiopia: A review. Int J Livest Prod 9: 29-41.
2. Gizaw S, Komen H, van Arendonk JA (2009) Optimal village breeding schemes under smallholder sheep farming systems. Livest Sci 124: 82-88.
3. Hailu A, Solomon M, Berhan T, Asaminew T (2011) Body weights and carcass characteristics of Washara sheep fed urea treated rice straw supplemented with graded level of concentrate mix. Livest Res Rural Dev: 23
4. Gemiyo D, Abebe G, Tegegne A (2014) Influences of non-genetic factors on early growth of Adilo lambs under smallholder management systems, southern Ethiopia. Trop Anim Health Prod 46: 323-329.
5. Hidosa D, Kibiret S (2020) Effects of Acacia tortilis Pod Feeding in Improving Performance of Goats Fed Grass Hay. Asian J Anim Vet Adv 15: 50-59.
6. Atumo TT, Kalsa GK, Dula MG (2021) Effect of Fertilizer Application and Variety on Yield of Napier Grass (Pennisetum purpureum) at Melokoza and Basketo Special Districts, Southern Ethiopia. J Agric Environ Sci 6: 32-39.
7. Belachew MT, Mersso BT, Yadeta AT (2020) Indigenous browse species and goats preferences in selected districts of Gamo Gofa and Wolayta zones, Ethiopia. Int J Livest Prod 11: 34-42.
8. Valente TNP, Detmann E, Valadares Filho SDC, Paulino MF, et al. (2011) Simulation of variations in the composition of samples in the evaluation of neutral detergent fiber contents by using cellulose standard in filter bags made from different textiles. Rev Bras de Zootec 40: 1596-1602.
9. McGrath JC, Drummond GB, McLachlan EM, Kilkenny C, Wainwright CL (2010) Guidelines for reporting experiments involving animals: the ARRIVE guidelines. Br J Pharmacol 160: 1573-1576.
10. Gemeda BS, Hassen A (2014) In vitro fermentation, digestibility and methane production of tropical perennial grass species. Crop Pasture Sci 65: 479-488.
11. Talore DG (2015) Evaluation of major feed resources in crop-livestock mixed farming systems, southern Ethiopia: Indigenous knowledge versus laboratory analysis results. J Agric Rural Dev Trop Subtrop 116: 157–166.
12. Bassa Z, Wolde S, Alemu T, Yilma M, Tera A, et al. (2016) Evaluation of locally available Energy source feeds on fattening performance of local oxen and carcass analysis in Wolaita, southern Ethiopia. Hydrol Curr Res 7: 1-5.
13. Legesse G, Abebe G, Siegmund-Schultze M, Zárate AV (2008) Small ruminant production in two mixed-farming systems of southern Ethiopia: status and prospects for improvement. Exp Agric 44: 399-412.
14. Asmare B, Solomon D, Taye T, Firew T, Jane W, et al. (2016) Evaluation of desho grass (Pennisetum glaucifolium) hay as a basal diet for growing local sheep in Ethiopia. Trop Anim Health Prod 48: 801-806.