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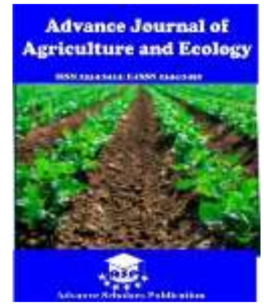

COMPARATIVE EFFECTS OF MAIZE AND NAPIER GRASS SILAGE SUPPLEMENTED WITH DOLICHOS LABLAB ON FEED INTAKE, GROWTH, AND CARCASS TRAITS IN HORRO LAMBS

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Key words: *Doritos lablab, Horro lambs, Silage, Feed Intake, Carcass traits*

Abstract: *This study investigated the effects of ensiling maize and Napier grass with 40% Dolichos lablab on feed intake, nutrient digestibility, growth performance, and carcass traits of Horro lambs at Bako Agricultural Research Center. Twenty male yearling Horro lambs with an average initial weight of 21.35 ± 2.66 kg were allocated to four dietary treatments in a randomized complete block design with five replications. Experimental diets consisted of Napier grass silage (T1), maize silage (T2), Napier grass ensiled with 40% Dolichos lablab (T3), and maize ensiled with 40% Dolichos lablab (T4), all supplemented with 1.5% body weight of wheat bran. Following a 90-day feeding trial and a 7-day digestibility trial, feed intake, apparent nutrient digestibility, growth rate, and carcass parameters were measured.*

Results showed that silages containing Dolichos lablab significantly improved dry matter (DM), crude protein (CP), organic matter (OM), neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) intakes ($P < 0.05$), with lambs on T4 performing the best. CP digestibility was also higher ($P < 0.05$) for lambs on T4 compared to those on T1 and T2. Lambs fed T4 achieved superior final body weight and average daily weight gain, leading to enhanced carcass yield and higher edible offal components ($P < 0.05$). Silages containing Dolichos lablab generally enhanced the nutritional value of Napier grass and maize, increased feed utilization, and promoted better lamb productivity.

Overall, ensiling maize and Napier grass with 40% Dolichos lablab improves nutrient intake, body weight gain, and carcass characteristics of Horro lambs. This can serve as an effective strategy to enhance ruminant productivity and overcome seasonal feed shortages in tropical smallholder systems.

Introduction

In Ethiopia and other tropical countries, sheep production plays a vital role in supporting rural

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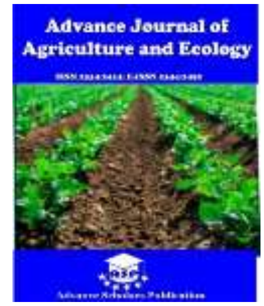

livelihoods and agricultural sustainability. Sheep serve as a source of meat, milk, hides, and income for millions of smallholder farmers (Tessema, 2005). However, despite the large numbers of sheep distributed across the diverse agroecological zones of the country, their productivity remains extremely low under both smallholder and intensive livestock production systems (Alemayehu, 2004). Feed shortages and poor feed quality are major factors constraining productivity and limiting the full utilization of the country's sheep genetic potential.

Livestock feed production is highly seasonal in Ethiopia. Rapid growth of natural pastures and forages during the rainy season is often followed by extreme scarcity in the dry season, resulting in fluctuating feed supply that affects both growth rates and reproductive performance of animals. Poor-quality crop residues and low-protein roughages that form the staple dry-season diet contribute to malnutrition and body weight losses in sheep, which leads to low birth rates, poor carcass yields, and increased mortality rates. To enhance sustainable sheep production, it is imperative to improve the quality and year-round availability of forages.

One proven strategy to overcome feed shortages and optimize livestock productivity is forage conservation. Ensiling surplus green forages as silage during the rainy season can provide a stable, palatable, and high-energy feed source during the dry period (Wong, 2000). Silage is fermented feed produced by the anaerobic preservation of moist green forages under airtight conditions. Properly made silage retains most of its nutritional value, supports microbial fermentation that enhances its storability, and provides a continuous and consistent source of feed that can help to bridge seasonal deficits. The silage-making process reduces the challenges of harvest timing and nutrient losses that typically occur during hay-making (Titterton & Bareeba, 1999). Furthermore, it offers a means to conserve feed that might otherwise be wasted due to trampling, shattering, and unfavorable weather for drying.

Cereal crops and tropical grasses such as maize and Napier grass have long been recognized as suitable for silage making due to their high water-soluble carbohydrate content and good packing characteristics. Silage prepared from these crops is energy-dense and well accepted by livestock, making them important components of basal diets for ruminants. However, cereals and grasses alone often produce silage that is low in crude protein. This protein deficiency can severely limit rumen microbial activity and reduce nutrient utilization, feed intake, and animal performance, unless these forages are supplemented with protein-rich feeds. Purchased concentrates offer one solution but their rising cost can make them less accessible, especially to resource-poor farmers in developing countries.

One promising alternative to improve the protein content of grass and cereal silages is the inclusion of legumes during ensiling. Improved forage legumes like Dolichos lablab (Lablab purpureus) are highly palatable and well adapted to a broad range of tropical climates. Dolichos lablab is rich

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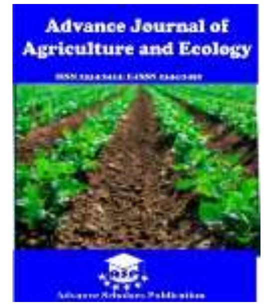

in protein, minerals, and fiber, making it a useful feedstuff for small ruminants. Its vines and pods provide nutritious biomass that can enhance the nutritional value of silages produced from low-protein tropical grasses and cereals. Studies in Ethiopia and elsewhere in Africa (Solomon et al., 2004; Ajebu et al., 2008; Adegun, 2014) have shown that legumes can improve rumen microbial protein synthesis, fiber digestibility, and feed efficiency when included in ruminant diets. However, utilizing legumes as a green feed or hay has its drawbacks due to their susceptibility to trampling, preferential grazing, seasonal availability, and high losses during hay-making due to leaf shatter.

Conserving legumes as silage reduces these losses and provides a stable protein source in mixed-silage diets. Importantly, legumes also enhance the fermentation process by increasing the nitrogen content of the silage, which supports better microbial growth in the rumen. Incorporating legumes into cereal or grass silage thus improves the fermentation profile, nutritional value, dry matter recovery, and palatability of the silage. However, despite its potential as a dual-purpose grain and forage legume, Dolichos lablab is underutilized as a feed ingredient in Ethiopia. Many smallholder farmers and pastoralists have limited knowledge of its agronomic potential and use as conserved feed for ruminants.

Feeding silage prepared from cereal or grass mixed with Dolichos lablab can address the feed quality and quantity constraints that limit sheep productivity. Sheep are selective grazers with a relatively high nutrient demand for maintenance and production of meat. Experimental research elsewhere has shown that supplementing ruminants with silages containing legumes improves feed intake, nutrient digestibility, and average daily weight gain, which are key drivers of carcass development and meat yield. Carcass traits such as dressing percentage, rib-eye area, and edible offal components also tend to improve with increased protein and energy availability in the diet.

In Ethiopia, while conservation of tropical forages as silage is being increasingly adopted by commercial dairy farms, its application for smallholder sheep fattening is still at an infant stage. Information on mixed grass–legume silage production, especially with underutilized legumes like Dolichos lablab, is very limited. Given this knowledge gap and the need to improve year-round nutrition for sheep, investigating the effects of silages prepared from maize and Napier grass ensiled with Dolichos lablab is important. Such silages could help boost sheep productivity and enable smallholder farmers to achieve better weight gains, higher carcass yields, and increased profitability.

Therefore, this study was undertaken to evaluate the effects of maize and Napier grass ensiled with Dolichos lablab on feed intake, apparent nutrient digestibility, growth performance, and carcass traits of Horro lambs under controlled feeding conditions. This will contribute to the development of practical feeding strategies that enhance small ruminant productivity and sustainable utilization of local feed resources.

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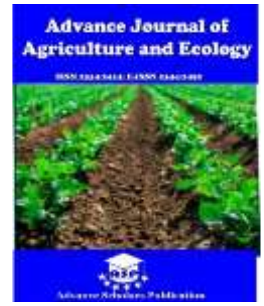

MATERIALS AND METHODS

Location of the Study Area

The study was conducted at Bako Agricultural Research

Centre (BARC) belonging to Oromia Regional State, Ethiopia at about 258 km from Addis Ababa to the west on the main road to Nekemte town, located at geographical coordinates$9^{o}6$’N latitude and $37^{o}9$’E longitude at an altitude range of 1579 to 1789 m.a.s.l. It lies between The area receives an average annual rainfall of about 1238 mm and a hot humid weather of minimum 13.3^{o}C and a maximum of 34^{o}C temperature.

Forage Production and Preservation

Preexisting Napier grass Bako-01 Variety established on 0.5 ha was used. While, Dolichos lablaband Maize waseach sown on 0.5 ha. Napier grass Bako-01 Variety was harvested at 1.5m height. Whereas, Maize and Dolichos lablabharvested at dough and 50% blooming stage respectively for silage making. All forages was separately chopped in to smaller pieces, mixed according to treatment combinations and ensiled.

Chemical Analysis

After the representative samples were prepared; The N, DM, OM and ash content was analyzed according to AOAC (1990). The CP content was calculated by multiplying N content with a factor of 6.25. NDF, ADF, and ADL were analyzed based on the method of (Van Soest and Robertson, 1985). Hemi-cellulose and cellulose contents were calculated as NDF minus ADF and ADF minus ADL, respectively.

Experimental Design and Treatments

A total of 20 uncastrated male yearling Horro sheep with average initial body weight of 21.35 ± 2.66 kg were used in the trial. From the acquisition of the animals and during the experimental period, experimental animals received all routine health treatments and control of endo-and ectoparasites. All animals were individually identified, through a numbered ear tags. Randomized complete block design (RCBD) was used. The experimental animals were grouped into five blocks of four animals each based on their initial body weight. Animals in blocks were assigned to one of the four treatments and all experimental animals in the treatments were supplemented with wheat bran at 1.5% of their body weight. The body weight of the animal was determined by taking the average of two consecutive weights after overnight fasting at the end of the quarantine period. The supplement was prepared following the recommendations for nutritional requirements of small ruminants according to the

National Research Council (1981), in order to meet the nutritional requirements. The dietary treatments were arranged as follows;

T1: Napier grass ensiled alone + 1.5% body weight wheat bran

T2: Napier grass ensiled with 40% Dolichos Lablab

(60:40) + 1.5% body weight wheat bran

T3: Maize ensiled alone + 1.5% body weight wheat bran

T4: Maize ensiled with 40% Dolichos Lablab (60:40) +

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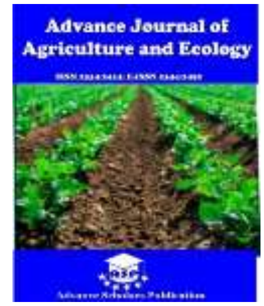

1.5% body weight wheat bran

Feeding Trial

The actual feeding trial was conducted for 90 days following 14 days of adaptation period. The amount of feed offered and the corresponding refusal was weighed and recorded for each experimental animal to determine feed intake. Representative samples of feeds offered and refused for each animal were collected and pooled per treatment and dried in an oven at 65°C for 72 hours. The partially dried sample of the feed offered and refusals were ground to pass through a 1mm sieve screen using Wiley mill and stored in plastic bags pending chemical analysis. The amount of silage offered was adjusted daily based on the amount of refusal left from previous day intake and water was provided as free access for each animal. Mean daily dry matter and nutrient intake was determined as a difference of offered and that of refused. The daily DM intake expressed as percent of body weight and metabolic body weight of an animal were calculated by dividing the mean daily DM intake during 90 days of experimental period with respective body weight of sheep taken in the same period by employing the following formula (McDonald et al. (2002):

Total DM intake (Percent BW (g)=(DM intake (g))/(BW (kg))×100

Total DM intake (Metabolic BW (g/kg $W^{0.75}$)=(DM intake (g))/($BW^{0.75}$ (kg))

Digestibility Trial

Following the feeding trial, the digestibility trial was conducted with the same animals used in the feeding trial. All experimental animals were harnessed with the fecal collection bags for three days of adaptation period before the resumption of actual collection of fecal for seven days for the determination of digestibility. During the 7 days of the trial, daily total fecal output of each animal was weighed individually and recorded daily each morning before offering feed. The feces were then be mixed thoroughly and 20% of the daily fecal output taken and bulk across the experimental period to form a weekly fecal composite sample for each animal and kept in dip freezer at -20°C. On the last day of the collection period, the composite fecal samples will thaw and thoroughly mixed and a representative subsample was taken. Samples of feed offered and feed refused were also be collected every day and sub-sampled at the end of the experiment. The composite sub-samples dried in an oven at 65°C for 72 hours to a constant weight. Partially dried fecal samples will be ground to pass through a 1 mm sieve screen using Wiley mill and stored in airtight plastic bags pending chemical analysis. Samples of experimental feeds, refusals and fecal had taken to Laboratory for chemical analysis. The digestibility of DM and nutrients were determined as the difference between nutrients intake and that recovered in feces expressed as a proportion of nutrient intake. The total amounts of nutrient apparent digestibility were calculated by using the following equation according to (Ranjihan, 2001).

Nutrient digestibility coefficient (%)=(Nutrient intake-

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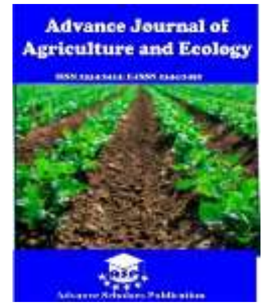

Nutrient excreted)/(Nutrient intake)×100

Digestible organic matter contents of treatment feeds were estimated by multiplying the OM content of feed by its digestibility coefficient.The estimated metabolizable energy intake of sheep from treatment feeds was calculated using the formula:

ME (MJ/Kg DM) = 0.016 X DOMD,

Where DOMD = is gram Digestible Organic Matter per kilogram Dry Matter.

Body Weight and Feed Conversion Efficiency

The initial body weight of each animal was taken at the beginning of the trial and every 15 days interval during the 90 days to determine body weight change during the experimental period of the feeding trial. All animals were weighed after they are denied access to feed by removing feed not consumed until 6:00 pm on the day before the weighing day using spring balance (sensitivity of 100 gm). Average daily body weight gain (ADG) and Feed conversion efficiency (FCE) was calculated according to Gulten et al. (2000) and Brown et al. (2001).

ADG=(Final weight gain (g)-Initial body weight gain
(g))/(Period of experiment (90days))

Feed conversion efficiency=(Daily body weight gain (g))/
(Daily feed intake (g))

Where: ADG is Average Daily Body Weight Gain

Carcass Trait Analysis

At the end of digestibility trial, all the experimental animals were slaughtered by severing the jugular vein using sharp knives after an overnight fasting. During slaughtering, the blood was drained and weighed. Weight of visceral organs like kidneys, liver with gall bladder, lungs with trachea, kidney fat, abdominal fat, omental fat, heart, spleen, genital organs, the entire alimentary canal (esophagus, reticulo-rumen, omasum and abomasums, small intestine and large intestine), full gut, empty gut, tail, tongue and head were recorded separately. The weight of the gut contents was measured by differences (full gut contents minus empty gut contents). Empty body weight was determined by subtracting the gut fill from slaughter body weight. Hot carcass weight was computed by excluding contents of thoracic, abdominal and pelvic cavities, head, skin with feet (cut off at the proximal end of cannon bone) and tail of the animal. Dressing percentage was calculated as a ratio of hot carcass weight to slaughter weight and empty body weight multiplied by 100. The rib-eye muscle area of each animal was determined by tracing the cross sectional areas of the 12th and 13th ribs after cutting perpendicular to the back bone. The left and right rib-eye muscle areas was traced on a transparent water proof paper and the area was calculated as recommended by Torell and Suverly (2004). The value for rib-eye muscle area is the average of the right and left sides on 12th rib.

Total edible offal (TEO) components was taken as the sum of blood, liver, kidney and kidney fat, heart, omental fat, abdominal fat, tongue,

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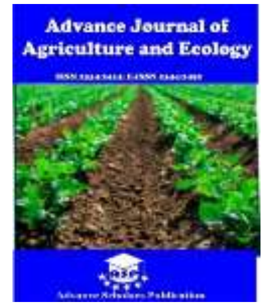

reticulo-rumen, omasum and abomasums, large and small intestine and tail. Total nonedible offal components (TNEO) compute as the sum of spleen, pancreas, head without tongue, skin and feet, genital organs (testis and penis), lung with trachea, and **Table 1:** Chemical composition of experimental feeds gut content. Useable product (UP) was taken as the sum of hot carcass weight, TEO and skin.

Statistical Data Analysis

Data obtained was subjected to Analysis of Variance (ANOVA) following the Linear Model procedure of R Programming. Differences among treatment mean were tested using LSD test.

RESULTS AND DISCUSSION

Chemical Composition of Experimental Feeds

lablab with Napier grass and maize was effective in improving nutrient values. In consistent to present study, Ferreira et al. (2017) reported that inclusion of 40% dehydrated barley in the murandu grass silage increased proportion of dry matter content from 24.13 to 43.9%. But, in the present study the DM content was slightly higher than the report of Olusola (2011) which was the DM of Napier grass silage increased from 18 to 30% with addition of 50% cassava peel in the mixture.

The CP content of ensiled material in the present study was ranged from 4.9 to 10.93%. The minimum CP required for microbial protein synthesis in the rumen that can support at least the maintenance requirement of ruminants should be above 7% (Van Soest, 1994). Therefore, based on the results of CP content supplementation of current diet containing Napier grass ensiled alone (T1) with concentrate feed is mandatory. Furthermore, silage with a high level of CP is beneficial because it allows for increased proteolysis, which results in a buffering effect that hinders the reduction of the pH to levels that are optimum for fermentation (Napasirth et al., 2015).

Ensiling of Dolichos lablab with Elephant grass and Maize influenced the intake of dry matter, crude protein, organic matter, acid detergent fiber, acid detergent lignin, neutral detergent fiber, and acid detergent fiber without influencing the intake of metabolizable Energy Table 2. The silage DM intake was significantly higher ($P<0.001$) for lambs fed T4 diet than those in T1, T2 and T3 with no statistical difference ($P>0.05$) between lambs fed in T1 and T2 diet. The total DM intake of the present study showed that lambs fed diets in T4 and T3 were statistically non-significant ($P>0.05$) and higher than the rest of treatments. The difference could be attributed to the high digestible protein content of the T4 and T3 diet compared to other dietary treatments, which might have enhanced the efficiency of rumen microorganism that increase fiber degradability and digestibility thereby, improving feed intake (McDonald et al., 2002). Because all the experimental lambs consumed wheat bran based on their body weight, total DM intake showed the same pattern as silage DM intake. Inclusion of legumes in Elephant grass silage based diets has previously been shown to increase dry matter intake

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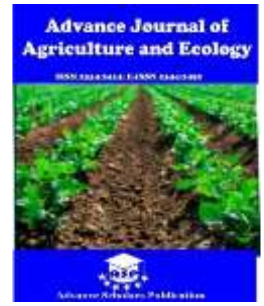

Abdulrazak et al. (1996), which has been attributed to improved palatability and digestibility. This observation has also been shown for wheat-pea silage fed to sheep and cattle Adesogan et al. (2002) and for maize stover-Leucaenadiversifoliafed to sheep (Hindrichsen et al., 2002).

The mean feed intake as a proportion of percent body weight ($p<0.05$) and per unit metabolic body weight ($p<0.01$) revealed significance difference among dietary treatments, where lambs fed diet in T3 and T4 performed similarly ($P<0.05$) in %BW basis and significantly higher than, lambs in T1 andT2 diet. Whereas, significant ($P<0.01$) difference in per unit metabolic body weight basis was observed for lambs fed diet in T3 and T4 as compared to T1 and T2 group. The total DM intake on %BW basis of the present study was within the range of 2 to 6% recommended by the ARC (1980) and suggested by Susan (2003) 2 to 4% of body weight.

Similarly, the DM intake per unit metabolic BW0.75 ranged between 60.0 and 82.0 g/kg obtained in the current study was slightly lower than the finding of Birhanu et al. (2013) and Jalel (2013) who reported in range from 75.02 to 86.66 g/kg for Black Ogaden sheep and 76.2 to 85.9 g/kg for Horro sheep, respectively. The DM intake on percent BW and per unit metabolic body weight basis recorded in the present study was comparable with the findings of Mekonnen et al. (2016) and Abuye et al. (2018a) who reported 3.2-3.5% and 70.3–79.2 g/ Kg and 3.45-3.81% and 75.23-81.69 g/Kg for the same sheep breed, respectively. The observed variations among the studies emanated from the differences in the quality of the feeds used, animal factors (age and physiological status of the animals), rumen fill, rate of passage of articulate matter and rate of digestibility of experimental feeds used.The higher intake of legume forages relative to grass forages is linked to their chemical degradation and physical breakdown within the rumen. These operate through effects on rumen fill. Differences have been attributed to both faster rates of fermentation (Beever and Thorp, 1996) and more rapid particle breakdown and clearance from the rumen (Moseley & Jones, 1984; Waghorn et al., 1989; Jamot & Grenet, 1991). Dewhurst et al. (2003b) suggested that fermentation rate may be more important for WC, whilst rapid particle breakdown may be more important for LUC. Clearly there will be an interrelationship between chemical degradation and particle breakdown. Differences in particle breakdown and rumen passage rate are partly related to plant anatomy.

Table 3: Apparent nutrient digestibility coefficient (%) in Horro Lambs fed Maize and Napier grass ensiled alone and with 40% of Dolichos lablab

Table 4: Body weight change and feed conversion efficiency of Horro Lambs fed Maize and Napier grass ensiled alone and with 40% of Dolichos lablab

Parameters	Treatments

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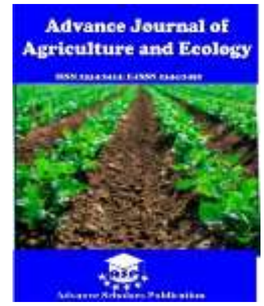

	T1	T2	T3	T4	CV	SL
Initial Body Weight (Kg)	21.9	21.1	20.6	21.8	14.22	NS
Final Body Weight (Kg)	24.00	25.00	25.2	27.56	12.47	NS
Body Weight Change (Kg)	2.3^{c}	3.9b	4.6^{ab}	5.76^{a}	0.422	*
Average Daily Weight Gain (g/day)	25.55^{c}	43.33^{b}	51.11^{ab}	64.00^{a}	26.49	**
FCE	0.047^{b}	0.065^{ab}	0.067^{ab}	0.075^{a}	-	*
FCR	21.41^{a}	16.26^{ab}	14.69^{b}	13.67^{b}	-	*

a,b,c,d =Means within rows for different groups with different superscripts differ (P<0.05); *=(P<0.05); **=(P<0.01); ***=(P<0.001); SEM=standard error of means; SL= significance level;. FCE= feed conversion efficiency; FCR= feed conversion ratio; T1 to T4= treatments.

weight of lambs assigned to dietary treatments were not significantly different (P>0.05) in all groups. Significant difference between dietary treatments were recorded on body weight change (P<0.05) and average daily body weight gains (P<0.01). Comparative to present study results ADG values ranged from 33.3 to 58.7g/day, 27.8 to 87.4, 29.33 to 75.56 g/day for the same breed and32.33 to 85.11 g/day for Nellore ram lambs were reported by Assefu (2012), Mokennen et al. (2016), Abuye et al. (2018), Malisetty et al. (2013) for lambs fed rations containing different roughage to concentrate ratios.The values of ADG ranged from 25.55 to 64.00 g/day observed in the current study were considerably lower than the values ranged from 43.55 to 98.22 g/day for the same breed, 69.1 to 104.1 g/day and 49.33 to 116.22 g/day for Arsi breed reported by Gemechu et al. (2020), Belete et al. (2013) and Firaol (2017) respectively. In the present studyFCE was significantly different (P<0.05) among dietary treatments with the lowest values recorded lambs fed diet in T1. The reduction in FCE for lambs fed in T1 diet was probably the result of low protein intake and high fiber content of the diet that might have caused the net efficiency of use of metabolizable energy to be depressed slightly. Lambs fed legumes have more efficient dietary protein utilization and grow faster than lambs fed grass, in part due to a more rapid rate of digestion (Howes, 2015).

Carcass Characteristics

Main Carcass Characteristics

There were significant effects of ensiling Dolichos lablab with Maize and Elephant grass at 40% on slaughter weight (P<0.05)and rib eye muscle area (P<0.05) without showing effects on

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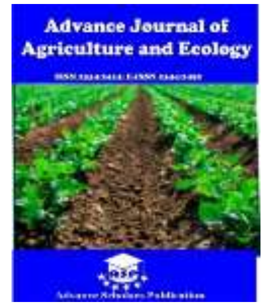

empty body weight, hot carcass weight, Hind quarter, fore quarter, dressing percentage both on slaughter and empty body weight basis. The present study result for slaughter body weight was within the range of the values noted by Gemechu, et al (2020) which was ranged from 23.52 to 28.04 kg for the same breed. Lambs that was assigned to fed T4 diet was significantly ($P<0.05$) higher than T1 but statistically comparable with other groups. In the present study, ribeye muscle area was significantly ($P<0.05$) influenced by dietary treatments. According to the report of Wolf et al. (1980), greater rib-eye muscle area is associated with a higher production of lean in the carcass and higher lean to bone ratio. Lambs assigned to T4 diet showed relatively higher REMA, which is a reflection of increase in lean meat. In the current study rib-eye muscle area ranging from 5.4 to $8.93 cm^2$ was obtained which was comparable to 7.4 to 8.9 cm^2 reported by (Assefu, 2012) and 6.0 to $9.5cm^2$ reported by Mekonnen et al. (2017) for the same breed. But,Abuye et al. (2018b) noted rib eye area ranging from 7.04-9.54 cm^2 for the same breed which is higher than current study result.

Except for empty gut and omasum-abomasum edible offal components of lambs fed Maize and Napier grass ensiled alone and with 40% of Dolichos lablab were not significantly influenced ($P>0.05$). The highest value of empty gut contents weight were recorded for lambs assigned to fed T4 and T2 diet. The heaviest empty gut content of lambs fed T4 and T2 diet may be due to the higher roughage or relatively poor quality feed used

Table 5: Carcass components of Horro Lambs fed Maize and Napier grass ensiled alone and with 40% of Dolichos lablab

Parameters	**Treatments**					
	T1	**T2**	**T3**	**T4**	**SEM**	**SL**
Slaughter Body Weight (Kg)	23.30^{b}	26.50^{ab}	26.17^{ab}	27.45^{a}		*
Empty Body Weight (Kg)	20.37	21.40	18.12	22.01		NS
Hot Carcass Weight (Kg)	10.80	11.30	9.15	10.90		NS
Fore Quarter (Kg)	5.93	6.15	5.025	5.95		NS
Hind Quarter (Kg)	4.87	5.15	4.12	4.95		NS
Rib-eye area (cm2)	5.4^{b}	6.53^{b}	6.90^{ab}	8.93^{a}		*
Dressing Percentage on						

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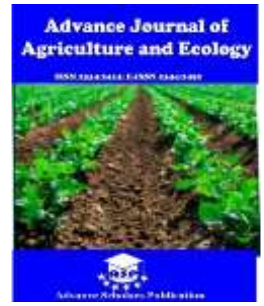

Slaughter Weight basis	41.04	42.54	39.29	39.52		NS
Empty Body Weight basis	52.84	52.74	50.42	49.27		NS

a,b,c,d =Means within a row not bearing a common superscript differ significantly; *=(P<0.05); **=(P<0.01); ***=(P<0.001); SEM=standard error of means; SL= significance level; T1 to T4= treatments.

Table 6: Edible offal of Horro Lambs fed Maize and Napier grass ensiled alone and with 40% of Dolichos lablab

Edible Offal Components (g)	**Treatments**				
	T1	**T2**	**T3**	**T4**	**SL**
Blood	306.67	500.00	300.00	450.00	NS
Heart	120.00	120.00	112.00	111.25	NS
Heart fat	41.5	27.00	32.5	21.67	NS
Liver	373.33	388.75	337.5	392.5	NS
Full gut	7366.67	6850.00	6750.00	7375.00	NS
Empty gut	1566.67^{b}	1750.00^{ab}	1575.00^{b}	1937.5^{a}	*
Reticulo-rumen	633.33	625.00	550.00	637.5	NS
Omasum-abomasum	243.33^{b}	250.00^{b}	270.00^{ab}	337.5^{a}	*
Omental fat	75.00	57.5	81.25	83.75	NS
Right testicle	143.33	167.5	118.75	175.00	NS
Left testicle	116.67	163.75	131.25	167.5	NS
Tongue	100.00	113.00	110.00	100.00	NS

a,b,c,d =Means within a row not bearing a common superscript differ significantly; *=(P<0.05); **=(P<0.01); ***=(P< 0.001); SL= significance level; T1 to T4= treatments.

Table 7: Non Edible offal of Horro Lambs fed Maize and Napier grass ensiled alone and with 40% of Dolichos lablab

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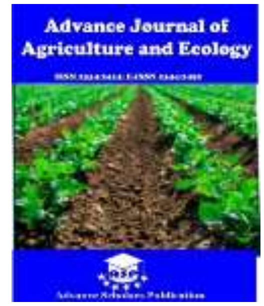

Non-Edible Offal Components (g)	Treatments					
	T1	**T2**	**T3**	**T4**	**SEM**	**SL**
Skin	2333.33	2512.5	2150.00	2600.00		NS
Gut contents	5800	5100	5175	5437.5		NS
Lung with trachea	475.00	445.00	433.33	425.00		NS
Spleen	40.00	62.5	58.75	56.25		NS
Pancreas	30.00	41.25	28.75	32.5		NS
Penis	55.00	67.5	55.00	47.5		NS

a,b,c,d =Means within a row not bearing a common superscript differ significantly; *=(P<0.05); **=(P<0.01); ***=(P< 0.001); SEM=standard error of means; SL= significance level; T1 to T4= treatments.

because the empty gut content is the difference of full digestible roughage, which would retain in the gut for gut and gut content that was discarded. This was agreed longer time to be degraded by rumen microbes.

with the views of VanSoest (1994) and pond et al. (1995) All the parameters considered as non-edible offal of in that non supplement animals fill their gut with less Horro lambs fed Maize and Napier grass ensiled alone

Table 8: Partial budget analyses of Horro lambs fed Maize and Napier grass ensiled alone and with 40% of Dolichos lablab

Items (ETB/lamb)	Treatments			
	T1	**T2**	**T3**	**SL**
Purchase price of lambs	3285	3165	3090	3270
Cost of Silage	360	552.825	820.8	1332
Cost of WB	1139.85	1102.5	774	774
Total Variable Cost (TVC)	1499.85	1655.325	1594.8	2106
Selling price of lambs	4800	5000	5040	5520
Total return	1515	1835	1950	2250

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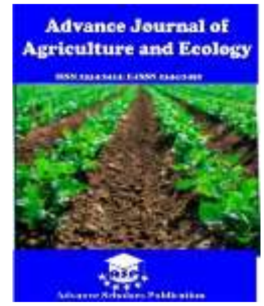

Net return	15.15	179.675	355.2	144
Change in total return (ΔTR)	-	320	115	300
Change in total variable cost (ΔTVC)	-	155.475	-60.525	511.2
Change in net return (ΔNR)	-	164.525	175.525	-211.2
Marginal rate of return (MRR)	-	1.058209	-2.90004	-0.41315
MRR (%)	-	105.8209	-290.004	-41.3146

ETB/lamb = Ethiopian birr per lamb; MRR=marginal rate of return; WB=wheat bran; T1 to T4= treatments.

and with 40% of Dolichos lablab were not significantly (P>0.05) influenced among treatment groups.

CONCLUSION

Generally, the study revealed that ensiling of 40% Dolichos lablab with both Napier grass and Maize implies the improvement of silage nutritional concentration, increased intake of DM, CP and OM. Consequently, the growth performance, average daily gain and carcass characteristics of Horro sheep was improved. The partial budget analysis result suggests that lambs fed diets in T2 (Maize ensiled alone) shows positive marginal rate of return. While, the experimental animals fed diet in T4 shows negative values of partial budget which can be tolerable since it is higher in biological values. Therefore, ensiling of 40% Dolichos lablab with Maize had beneficial effects on silage properties, intake and digestibility of the nutrients which was also feasible for lambs.

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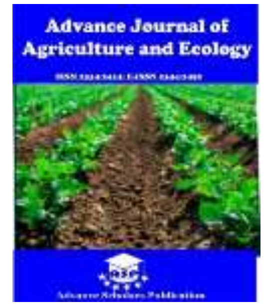

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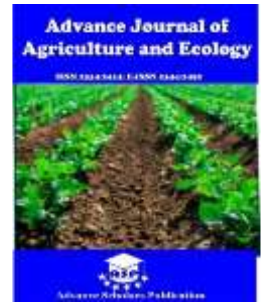

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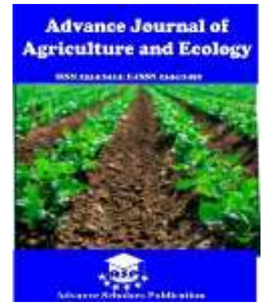

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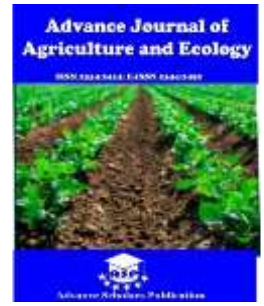

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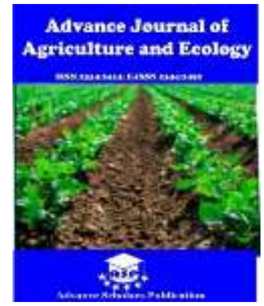

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