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RESEARCH ARTICLE

IN-VIVO DIGESTIBILITY AND NUTRITIVE EFFECIENCY OF VARIETIES OF NAPIERGRASS SILAGE WITH DIFFERENT FERMENTATION SUBSTRATE FED TO UPGRADED GOATS

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ABSTRACT

With the ultimate goal of sustaining eco-friendly goat farming, identifying high quality feeds and preservation techniques to improved utilization efficiency which reduces GHGs, is vital to improve the overall goat productivity and elevate raisers profit. The study aims to determine the feeding efficiency of varieties of napiergrass fermented with various substrates on the growth, *in-vivo* digestibility and economics in raising upgraded goats. Study was laid-out following RCB design, where goats are treated with varieties of napiergrass fermented with different substrates and data were analyzed using Tukey-Kramer Test. Florida cultivar has the highest DM, protein content, and lactic acid content with 30.10%, 5.91g/100g and 32.80%, respectively. Silage fermented with wheat bran have the highest DM of 31.3%-45%, 5.18%-7.03% CP, and 33.0-39.0% lactic acid. Florida significantly improved weight gain (WTG), average daily gain (ADG), feed conversion ratio (FCR), digestibility of forage, grasses, and silage, net income and ROI. Wheat bran in silage significantly improved final weight (FWT), WTG, ADG, FCR, digestibility of forage, grasses, silage, legumes, net income and ROI. Generally, raising goats fed with Florida silage fermented with wheat bran improved the forage, grasses, silage, and legume digestibility, which consequently improved the growth and eventually increases profit in raising upgraded goats.

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INTRODUCTION

Nowadays, ruminant production especially goat industry in the country is characterized as one of the sun-rising industry and are currently being developed continuously (Cervito *et al.,* 2012) due to unceasing improvement and increase awareness of the health benefits and comparative advantages of goats compared to other domesticated animals (PCAARRD, 2011). Therefore, demand for goat feed to improve their productivity through pasture and forage grass establishment which is a pre-requisite since bulk of the ration for goats are roughages is taken into consideration. Likewise, high quality and sustainable forages availability is a main requirement in ruminant production. Seasonal changes affect the availability of forages which are usually abundant in rainy season but very limited in supply especially during dry season which increases the less digestible nutrients like cellulose, hemicellulose, fiber and lignin, hence poses a problem in the feed quality sources that consequently affects the dry matter requirement of the animal and has become the limiting factor for development of ruminant farms resulting in the decreased ruminant productivity and profitability. To overcome the shortage of forage during dry season, the development of forage preservation technology such as fermented forage/silage is needed (Suharti, 2016; Bayble *et al.,* 2007; Islam et al., 2003; Gwayumba *et al.,* 2002). Goat farming is one of the sun-rising industry and developed continuously due to unceasing improvement and awareness of the health benefits and its comparative advantages. Therefore, demand for goat feed to improve their productivity through high quality and sustainable pasture and forage availability which is a limiting factor is indeed plays a vital role to improve goat overall production such as forage preservation technology. Napiergrass (*Pennisetum purpureum*) is the most popular perennial fodder recommended for smallholder crop-livestock farming systems in the Philippines and can be cultivated in most regions of the country. However, the traditional method adopted to use this forage, which is harvested when it is provided to animals, in addition to requiring daily man power, results in low nutritive value during the dry season. In this sense, the conservation of napiergrass harvested during the rainy season guarantees forage of a high nutritional value for the dry season. In spite of its high nutritional value, the use of corn silage also requires labor and financial investments annually for cultivation, cutting and ensilage of this grass, which normally results in more expensive silage than silage made with napiergrass. Therefore, implementing a technology that enables better use of the grasses to produce silage would allow for a reduction of the production costs. Napier grass has low levels of soluble carbohydrates and a high moisture level at the time of cutting, and a high buffering capacity, which hampers the fermentation, and this often results in poor-quality silage. However, the simple use of additives, which can increase the levels of silage dry matter, can improve lactic fermentation, and, consequently, reduce the losses during the fermentation. Among the concentrate foods, wheat bran, rice bran, and corn bran as well as LABS possesses highly favorable characteristics to be used as an additive to napiergrass silage, because of its low cost, high dry matter, and good nutritional value. Therefore, an alternative in goat nutrition that also reduces production costs, especially during the dry season in several regions of the country, has been the use of napiergrass enriched with different fermentation substrate such as wheat bran, rice bran, corn bran and LABS. Florida and Pakchong are newly introduced improved grass in the Philippines (Sarian, 2013) which are varieties of napiergrass known for ruminant production because of its high yield and high nutritional value (Suharti *et al.,* 2016; Bayble *et al.,* 2007; Islam *et al.,* 2003; Gwayumba *et al.,* 2002). However, napiergrass is abundant during the rainy season, which grows well and there is more than enough for goats but become scarce during the dry season. Hence, this study was conducted. It aims to determine the feeding efficiency of feeding different varieties of napiergrass (i.e., native, Florida and Pakchong) silage using different fermentation substrates in the growth performance and in-vivo digestibility of upgraded goats in terms of growth rate, ADG, FCR, digestibility of feeds, grasses, legumes and silage, and the profitability of raising goats fed with napiergrass silage as supplements.

MATERIALS AND METHODS

Materials: The experiment was conducted in the Mindoro State University, at the Forage Production Area for planting napiergrass for both dry and wet season while feeding trial was conducted at the Animal Production Area on September 1, 2019 to June 30, 2022. The materials that were used in the conduct of the study includes cuttings of the three napier grass cultivar – Native napiergrass, Florida cultivar, and Pakchong cultivar, vermicompost, planting materials and equipment, 90 heads of 4-months old upgraded goats, silage containers (silo) with cover, molasses, wheat bran, rice bran and corn bran, LABS, housing/experimental cages, feeder and waterer, weighing scale, and used sacks, formulated concentrate, kakawate and ipil-ipil.

Experimental design and layout: A total of 90, 4-months old upgraded goats were used following the 3x5 factorial experiment of the Randomized Complete Block Design (RCBD) was implemented with three replications and two goats per replication for each treatment combination. Factor A was the cultivar of napiergrass, while Factor B are the substrates for fermentation. The table below represent the treatment combination implemented.

Table 1. Treatment combination implemented in the study

FACTOR A – Napier grass cultivar	FACTOR B – Fermentation substrate				
	B1 - Molasses	B2 – wheat bran	B3 – Rice bran	B4 – Corn bran	B5 - LABS
A1 – Native	A1B1	A1B2	A1B3	A1B4	A1B5
A2 – Florida	A2B1	A2B2	A2B3	A2B4	A2B5
A3 - Pakchong	A3B1	A3B2	A3B3	A3B4	A3B5

Legend: A1B1 – Native napiergrass silage using molasses as substrate for fermentation; A1B2– Native napiergrass silage using wheat bran as substrate for fermentation; A1B3 – Native napiergrass silage using rice bran as substrate for fermentation; A1B4 – Native napiergrass silage using corn bran as substrate for fermentation; A1B5 – Native napiergrass silage with LABS as substrate for fermentation; A2B1 - Florida napiergrass silage with molasses as substrate for fermentation; A2B2 - Florida napiergrass silage with wheat bran as substrate for fermentation; A2B3 - Florida napiergrass silage with rice bran as substrate for fermentation; A2B4 - Florida napiergrass silage with corn bran as substrate for fermentation;A2B5 - Florida napiergrass silage with LABS as substrate for fermentation; A3B1 - Pakchong napiergrass silage with molasses as substrate for fermentation; A3B2 - Pakchong napiergrass silage with wheat bran as substrate for fermentation; A3B3 - Pakchong napiergrass silage with rice bran as substrate for fermentation; A3B4 - Pakchong napiergrass silage with corn bran as substrate for fermentation; A3B5 - Pakchong napiergrass silage with LABS as substrate for fermentation.

The 90 heads upgraded goats was randomly distributed to 45 experimental cages ($4m^2$) throughout the duration of the experiment and was fed 20% formulated concentrates (comprises of 25kg RBD1, corn grits of 18.5kg, cassava meal of 1.5kg, copra meal of 33kg, SBOM of 10kg, molasses of 10, salt and dicalphos of 1kg with a crude protein of 16%CP, and a price per kg of 19.32/kg$^-$), 20% legumes (kakawate and ipil-ipil), 20% fresh napier grass and 40% napiergrass silage with various fermentation substrate and napier grass cultivars. All management practices from housing establishment, acclimatization, health management practices, sanitation, and production system (cut-and-carry system) was the same except for the treatment combination applied in the study (i.e., napiergrass silage with various fermentation substrate and napier grass cultivars). In addition, napiergrass that was produced from the study component 1 will be the one to be utilized in silage production (20 kilograms chop napier grass and 5 kg substrate fermented for 14 days).

Data gathered: The produced napier grass silage using different fermentation substrate and napier grass cultivar was analyzed for chemical analysis at the Animal and Dairy Science Cluster, UPLB, Los Banos, Laguna. The parameters gathered includes the initial and final body weight, ADG after 3 and 6 months of feeding trial, FCR at 3 and 6 months, total feed consumption, DM feed intake, DM of the feces, digestibility of the feeds, legumes, grasses and silage, and the cost and return analysis in terms of net income, income per kilogram and return on investment. The following parameters were gathered based on the following procedures.

Initial Body Weight. The initial body weight was gathered before the conduct of the study which serves as the references for computing the average daily gain of experimental goat and appropriate experimental design.

Final Body Weight. The final body weight was gathered after 3 and 6 months of the conduct of the study which serves as the references for computing the average daily gain of experimental goat actual price per kilogram during marketing period.

Average Daily Gain. Experimental animals were weighed individually on monthly basis every 6 a.m. to make sure that the animals have not yet eaten and to minimize experimental error or variation. ADG is computed as the gain in weight in kg divide to the number of feeding days.

Feed Conversion Ratio. The feed conversion efficiency of fattening goat refers to their ability to convert feeds into meat. This was computed by dividing the total feed consumption of fattening goat by their total body weight gain.

Feed Consumption. This was determined by adding the previous amount of feed consumed to the current feed consumption.

DM Intake. This is the difference between DM offered and DM refused.

DM Feces. This was determined by getting the percentage of DM Feces by oven drying the feces for 8-12 hours at 107°C dividing to the Fresh weight of the feces multiplied by hundred percent and %DM Feces multiplied by Fresh weight of feces to get the DM Feces in kilogram.

Digestibility. The digestibility of a feed determines the amount that is actually absorbed by animals and therefore the availability of nutrients specifically for growth and reproduction. The formula is as follows:

$$Digestibility = \frac{\text{DM Intake (kg)} - \text{DM Weight of feces (Kg)}}{\text{DM Fee Intake (kg)}} \times 100$$

DM Intake = Feed consumption – DM Feedstuff

$$\%DM\ Feces = \frac{\text{Oven dried weight (g)}}{\text{Fresh weight of feces}} \times 100$$

DM Feces = %DM Feces – Fresh weight of feces

Cost and Return Analysis. Economics was determined using the cost and return analysis parameters such as net income, income per kilogram, and return on investment. Net income is computed as total sales minus total expenses. Income per kilogram is net income divide the total kg of meat produced while ROI is computed as net income divide total expenses multiplied by 100.

Statistical Analysis: All data was consolidated, organized, encoded, tabulated and were analyzed using analysis of variance and significant differences among treatment means will be further analyzed using Tukey-Kramer Test.

RESULTS AND DISCUSSION

Samples of napiergrass silage using different fermentation substrate and napiergrass cultivar was analyzed for the chemical analyses and was done at the Animal and Dairy Science Cluster, UPLB, Los Banos, Laguna and were used as basis for possible correlation of results with the findings of the feeding trials. In general, Florida cultivar (A2) has the highest DM (low moisture content), protein content, and lactic acid content with 30.10%, 5.91% and 32.80 respectively. On the other hand, regardless of napiergrass variety, silage fermented with wheat bran (B2) have the highest DM (31.3% to 45% and an average of 37.63%), CP content (5.18% to 7.03% and an average of 6.19%), and lactic acid content (33.0 to 39.0 and an average of 35.67), hence good fermentation quality (Rusby, 2016). Moreover, pH of all the silages was acidic and ranges from 3.69 to 3.78 which could be correlates to the quality of fermentation and the silage produced.

(p0.05) to the weight performance of goats provided with pakchong. The significant effect of providing florida and pakchong to upgraded goats could be attributed to their higher nutritional value particularly DM and protein content (Suharti *et al.,* 2016; Aganga *et al.,* 2005) compared to native napiergrass that consequently enhanced higher growth rate. Growth performance as affected by fermentation substrate. Analysis showed that initial weight of all the goats used were comparable (p>0.05) before the conduct of the study. Findings revealed that the FWT and WTG were significantly (p0.05) to goats provided with silage fermented with rice bran and molasses; but were significantly higher (p<0.05) in the FWT and WTG of goats provided with silage fermented with LABS. Moreover, results show that the ADG of goats provided with silage fermented with wheat bran and rice bran have significantly higher (p<0.0001) ADG. On the other hand, goats provided with silage fermented with wheat bran, corn bran and rice bran are more efficient (p<0.05) in converting feeds into meat compared to goats fed with silage fermented with molasses and LABS. The results could be associated to the higher nutritive value of wheat bran (Table 2) and could be attributed to the findings of Silva et al., (2014) who reported that the performance of goats fed with corn silage and goats fed with napiergrass silage with wheat bran have comparable (p>0.05) dry matter intake, crude protein intake and neutral detergent fiber intake and digestibility. In addition, Rusdy (2016) and Cheng and Peng (2004) reported that corn meal as substrate for napiergrass silage produced well preserves silages as indicated by higher DM, protein, and lactic acid (70%), while lower pH of 3-4 (Soderfund, 2016), and acceptable NH3-N/TN (<10%), acetic acid (<3%) and butyric (<0.1) contents (Ward and Ondara, 2016; Kung and Shaver, 2016).

Table 2. Chemical composition of the napiergrass silage using different varieties and substrates for 45 days fermentation period

Treatment combination	DM	Moisture g/100g	Ash g/100g	Fat g/100g	Crude Fiber (%)	Protein g/100g	Lactic Acid	pH
A1B1	19.90	80.10	2.58	0.19	2.51	4.40	19.00	4.02
A1B2	31.30	68.70	2.02	0.98	3.60	5.18	33.00	3.66
A1B3	38.80	61.20	1.81	0.16	2.47	5.63	34.00	3.73
A1B4	31.30	68.70	3.26	2.90	4.27	4.21	31.00	3.72
A1B5	16.40	83.60	2.06	0.25	2.04	4.85	26.00	3.77
Mean	27.54	72.46	2.35	0.90	2.98	4.86	29.00	3.78
A2B1	20.10	79.90	2.33	0.27	2.52	6.73	25.00	3.83
A2B2	45.00	55.00	1.67	0.60	4.57	6.38	39.00	3.60
A2B3	28.80	71.20	1.94	0.49	2.40	6.39	34.00	3.66
A2B4	37.60	62.40	3.82	4.21	5.30	4.83	37.00	3.66
A2B5	19.00	81.00	2.35	0.07	2.77	5.21	29.00	3.69
Mean	30.10	69.90	2.42	1.13	3.51	5.91	32.80	3.69
A3B1	20.00	80.00	2.54	0.30	2.88	4.46	25.00	3.87
A3B2	36.60	63.40	1.74	1.14	4.29	7.03	35.00	3.65
A3B3	31.00	69.00	1.76	0.37	3.34	4.86	34.00	3.70
A3B4	37.60	62.40	3.52	3.28	5.37	6.26	37.00	3.69
A3B5	17.40	82.60	2.14	0.26	1.58	4.83	27.00	3.70
Mean	28.52	71.48	2.34	1.07	3.49	5.49	31.60	3.72

Legend: A1B1 – Native napiergrass silage using molasses as substrate for fermentation; A1B2– Native napiergrass silage using wheat bran as substrate for fermentation; A1B3 – Native napiergrass silage using rice bran as substrate for fermentation; A1B4 – Native napiergrass silage using corn bran as substrate for fermentation; A1B5 – Native napiergrass silage with LABS as substrate for fermentation; A2B1 - Florida napiergrass silage with molasses as substrate for fermentation; A2B2 - Florida napiergrass silage with wheat bran as substrate for fermentation; A2B3 - Florida napiergrass silage with rice bran as substrate for fermentation; A2B4 - Florida napiergrass silage with corn bran as substrate for fermentation;A2B5 - Florida napiergrass silage with LABS as substrate for fermentation; A3B1 - Pakchong napiergrass silage with molasses as substrate for fermentation; A3B2 - Pakchong napiergrass silage with wheat bran as substrate for fermentation; A3B3 - Pakchong napiergrass silage with rice bran as substrate for fermentation; A3B4 - Pakchong napiergrass silage with corn bran as substrate for fermentation; A3B5 - Pakchong napiergrass silage with LABS as substrate for fermentation.

Table 3. Growth performance of fattening upgraded goats fed with different varieties of Napiergrass silage

Variety of Napier grass	IWT *(P value= 0.9167)*	FWT *(P value= 0.0587)*	WTG *(P value=0.0064)*	*ADG (Pvalue=0.0020)*	FCR *(Pvalue=0.0301)*
Native	11.600	15.500	3.900^{b}	36.567^{b}	6.042^{b}
Florida	11.450	16.760	5.310^{a}	44.250^{a}	5.387^{a}
Pakchong	11.550	16.760	4.663^{ab}	39.417^{ab}	5.574^{a}

Legend: Means within column with different superscript is significantly different (p<0.05)

Growth Performance: Growth performance as affected by napiergrass cultivar. Findings showed that initial and final body weight among upgraded goats used in the experiment were comparable (p>0.05). However, analysis on the weight gain (WTG), average daily gain (ADG) and feed conversion ratio (FCR) showed that goats provided with Florida cultivar have significantly highest

Digestibility: *Digestibility of upgraded goats as affected by napiergrass cultivar.* Findings revealed that the digestibility of concentrate (DOC), digestibility of grasses (DOG), and digestibility of silage (DOS) significantly affected (p<0.05) by the variety of napiergrass used in making silage. Moreover, goats fed with Florida cultivar have significantly higher (p0.05) on silage digestibility of upgraded goats but were significantly higher ($p>0.05$) on silage digestibility of upgraded goats but were significantly higher ($p<0.05$) to the silage digestibility of upgraded goats using native napiergrass. Results on the significant effect of providing Florida to the digestibility of upgraded goats could be attributed to their higher feed intake which results in more supply of nutrients to the animal and increase microbial protein synthesis in the rumen, thus improves the efficiency of the animals to digest feedstuffs (Silva *et al.,* 2014). Results was in line to the findings of Gwayumba *et al.,* (2002) and Irungu *et al.,* (2006) who reported that Florida cultivar significantly enhanced the growth, feed intake, digestibility and milk yield of cows and sheep.

Digestibility of upgraded goats as affected by fermentation substrate. In general, analysis showed that concentrate and grass digestibility were significantly higher ($p<0.0001$) in goats fed with silage fermented with wheat bran, corn bran and rice bran. However, silage digestibility was significantly higher ($p<0.01$) in goats fed with silage fermented with molasses, wheat bran, corn bran and rice bran compared to the digestibility of goats fed with silage fermented with LABS. bran produced silage with higher pH and NH3-N/TN contents, hence poor fermentation quality. On the other hand, the lower digestibility of goats fed with silage fermented with LABS could be attributed to the short duration of fermentation days used in the study (14 days). Rahman *et al.,* (2021) and Yammuen *et al.,* (2017) reported that silage fermented with LABS for 30-60 days improved the silage quality which is indicated by the increased lactic acid, reduced acetic acid concentration and improved lactic to acetic acid ratio which consequently inhibits the growth of many detrimental microorganisms and helps reduce proteolysis and other plant enzyme activity.

Economics: Findings revealed that feeding Florida cultivar significantly increases ($p<0.0001$) the net income and ROI of raising upgraded goats than providing Pakchong and native napiergrass. The significant increase in the net income and ROI in raising upgraded goats fed with Florida cultivar could be attributed to the higher nutritive values of Florida cultivar (Table 2), significant increase in the weight gain, ADG, and FCR (Table 3) and improve digestibility percentage (Table 5) which eventually enhances the overall weight and digestibility performance of the animals, and thus increases the profit.

Table 4. Growth performance of fattening upgraded goats fed with napiergrass silage with different fermentation substrates.

Fermentation Substrate	IWT *(Pvalue=0.7235)*	FWT *(Pvalue=0.0417)*	WTG *(Pvalue=0.0169)*	ADG *(Pvalue=<.0001)*	FCR *(Pvalue=0.0356)*
Molasses	11.167	15.500^{ab}	4.333^{ab}	36.111^{b}	6.083^{b}
Wheat bran	11.583	17.167^{a}	5.538^{a}	53.306^{a}	5.310^{a}
Rice bran	11.833	16.333^{ab}	4.389^{ab}	37.500^{b}	5.399^{a}
Corn Bran	11.583	17.000^{a}	5.417^{a}	45.139^{a}	5.387^{a}
LABS	11.500	14.900^{b}	3.400^{b}	28.334^{c}	6.158^{b}

Legend: Means within column with different superscript is significantly different (p<0.0001)

Table 5. Digestibility of raising fattening upgraded goats fed with different variety of napiergrass silage.

Variety of Napier grass	Digestibility Rate			
	(Pvalue=<0.0038)	*(Pvalue=<0.1286)*	*(Pvalue=<0.0185)*	*(Pvalue=<0.0391)*
	Concentrate	Legumes	Grasses	Silage
Native	87.464^{b}	79.500	86.000^{b}	91.287^{b}
Florida	91.000^{a}	81.300	89.714^{a}	94.075^{a}
Pakchong	88.750^{b}	80.500	87.143^{b}	93.079^{ab}

Legend: Means within column with different superscript is significantly different ($p<0.05$)

Table 6. Digestibility of raising fattening upgraded goats fed with different napiergrass silage fermented with various substrates

Fermentation Substrate	Digestibility Rate			
	(Pvalue=<0.0001)	*(Pvalue=<0.0001)*	*(Pvalue=<0.0008)*	*(Pvalue=<0.0029)*
	Concentrate	Legumes	Grasses	Silage
Molasses	87.083b	80.000a	85.283b	93.138a
Wheat bran	91.250a	82.917a	90.000a	95.008a
Rice bran	90.417a	82.083a	89.048a	93.500a
Corn Bran	91.250a	82.083a	90.000a	93.630a
LABS	85.357b	74.667b	83.810b	88.792b

Legend: Means within column with different superscript is significantly different ($p<0.0001$)

Table 7. Economics of raising fattening upgraded goats fed with different variety of napiergrass silage

Variety of Napier grass	Net income (Pvalue=<0.0001)	ROI (Pvalue=<0.0001)
Native	193.53b	4.886b
Florida	282.34a	7.562a
Pakchong	202.42b	5.522b

Legend: Means within column with different superscript is significantly different (p<0.0001)

Higher digestibility of goats supplemented with silage fermented with wheat bran and corn bran could be associated to their higher nutritive values (Table 2), higher feed intake and more efficient FCR (Table 4). In addition, several publications (Kung and Shaver, 2016; Rusdy, 2016; Soderfund, 2016; Ward and Ondara, 2016; Silva *et al.,* 2014; Bureenok *et al.,* 2012; Mtengeti *et al.,* 2006; Cheng and Peng, 2004) reported agro-industrial by products such as wheat bran, corn bran and molasses enhances the silage quality of napier grass in terms of DM, CP, pH, NH3-N/TN, lactic acid content, acetic acid and butyric acid, that consequently improves the digestibility of the animals. However, Rusdy (2016) reported that napiergrass fermented with rice

Generally, results revealed that feeding napiergrass silage fermented with wheat bran significantly increases ($p<0.0001$) the net income and ROI of raising upgraded goats than providing napiergrass silage fermented with other agro-industrial by-products like molasses, rice bran, and LABS. Considering that the economics is directly correlated and could be associated to the growth, data on net income and ROI implies that the weight of the goats after the end of feeding trial (during marketing) compensate the additional expenses of using wheat bran and corn bran as fermentation substrate, hence higher incurred net income and ROI.

Table 8. Economics of raising fattening upgraded goats fed with silage using different fermentation substrates.

Fermentation Substrate	Net income (P value=<0.0001)	ROI (P value=<0.0001)
Molasses	145.61^{c}	3.679^{bc}
Wheat bran	395.62^{a}	9.965^{a}
Rice bran	186.85^{c}	5.044^{b}
Corn Bran	337.62^{b}	8.894^{a}
LABS	64.56^{d}	2.366^{c}

Legend: Means within column with different superscript is significantly different (p<0.0001)

Table 9. Interaction effects of the varieties of napiergrass and fermentation substrate on the growth performance, digestibility and economics of raising upgraded goats

Parameters	Highest Interaction ±SD	Treatment combination	*P value*	Significance
Initial weight	11.77±1.89	A1B3	0.8791	Comparable
Final weight	16.85±2.02	A2B2	0.0545	Comparable
Weight Gain	5.41±0.63	A2B2	0.0023	Significant
Average Daily Gain	45.12±3.29	A2B2	0.0020	Significant
Feed Conversion Ratio	5.36±1.01	A2B2	0.0338	Significant
Digestibility of concentrate	91.08±8.23	A2B2	<0.0001	Significant
Digestibility of Legume	81.35±6.09	A2B2	0.0562	Comparable
Digestibility of Grasses	89.00±5.87	A2B2	0.0231	Significant
Digestibility of Silage	95.01±4.61	A2B2	<0.0001	Significant
Net Income	344.05±12.57	A2B2	<0.0001	Significant
ROI	8.22±3.36	A2B2	<0.0001	Significant

Legend: A1B3 – Native napiergrass silage using rice bran as substrate for fermentation; A2B2 - Florida napiergrass silage with wheat bran as substrate for fermentation

As per factor interaction (Table 9), analysis showed that upgraded goats fed with Florida napiergrass fermented with wheat bran (A2B2) have generally improved the growth performance in terms of weight gain, average daily gain and feed conversion ratio. Likewise, digestibility of provided concentrate, grasses and silage have significantly higher digestibility in goats fed with A2B2. Moreover, goats fed with A2B2 significantly increases (p<0.0001) the net income and ROI.

CONCLUSION

The chemical analysis on the different produced silage shows that silage using Florida cultivar fermented with wheat bran have the highest nutritive value particularly dry matter, protein content, and lactic acid content, hence good fermentation quality. Results showed that Florida cultivar significantly affects the growth performance and digestibility of fattening upgraded goats which eventually increases the net income and ROI. In general, except for LABS fermentation substrates such as wheat bran, corn bran, rice bran and molasses significantly improve the digestibility of fattening upgraded goat. Wheat bran and corn bran as fermentation substrate compensates the profit due to higher growth rate, hence improves the economics. Generally, raising goats fed with Florida silage fermented with wheat bran improved the forage, grasses, silage, and legume digestibility, which consequently improved the growth and eventually increases profit in raising upgraded goats.

Recommendation

In raising fattening upgraded goats, supplementation of 40% silage on the dietary ration (20% concentrate, 20% legumes; 20% fresh napiergrass, 40% napiergrass silage) using Florida cultivar fermented with wheat bran is recommended for it has the highest growth rate, more efficient digestibility, and the highest net income and ROI. Alternative recommendation is to conduct similar study but considering the cutting interval (30, 45, 60 days cutting interval) as factor in harvesting napiergrass and producing silage, as age of the plants is correlated to its nutritional content, which may have significant effects on the silage quality and eventually to the overall growth and digestibility performance of the animals upon supplementation.

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