THE USE OF ENSILAGED SOYBEAN FORAGE (*GLYCINE MAX* L.) REPLACING VARISME 06 IN THE DIETS FOR RAISING BEEF CATTLE

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ABSTRACT

A Latin square experiment was designed with 4 treatments and 4 periods on 4 growing cattle (252± 54 kg) to study on the effect of ensilaged soybean forage replacing Varisme 06 (*Pennisetum americanum x P. purpureum*) in the diets on nutrient digestibility and nitrogen retention. Each experimental periodwas last 20 days. In the first 10 days, cattle were adapted to the new diets, and the next 5 days the samplings were done. There was a rest period of 5 days between experimental periods and the cattle were fed Para grass. The treatments were ES0, ES10, ES20, and ES30 corresponding to the ensilaged soybean forage replacing Varisme 06 at a level of 0, 10, 20, and 30% (DM basis,) respectively. While Varisme 06 grass was fed *ad libitum*.

Results showed that feed intake and apparent digestibility coefficients for crude protein were increased by supplementation with ensilaged soybean forage (5.19; 5.66; 6.2 and 6.25 kg DM/day) and (60.1; 68.5; 71.0 and 71.9%), respectively. The results were found that the replacement of Varisme 06 grass by ensilaged soybean forage levels were increased intake and nutrient digestibility of cattle among different treatments. Numerically, the replacing ensilaged soybean forage to Varisme 06 grass at a level of 30% gave better results in nutrient digestibility. A replacement of ensilaged soybean forage supported better growth in cattle and was an effective way to make use of what is otherwise an by -products from grown.

Keywords: *digestibility, feed intake, silage, soybean forage, cattle*

INTRODUCTION

The use of crop residues in ruminant nutrition has increased and proved to be a viable alternative for reducing the feeding costs of cattle and minimizing the deposition of these materials into the environment. Ruminants, when compared to other domestic species, have a great ability to convert by-products and residues into noble food (meat and milk) and do not compete directly with food and mono-gastric animals. Thus, the study of feeding strategies that optimizes animal productivity provides environmental benefits (Lima et al., 2013). Moreover, Protein is often limiting in ruminant diets in the tropics where tropical grasses are often the primary component (Rojas et al., 1998).

Soybean forage (*Glycine max* L. Merr.) varieties developed for grain production in tropical environments could potentially be harvested as asupplement protein source in diets of ruminants (Mustafa et al., 2003). Soybean provides forage for dairy and beef production with qualities similar to alfalfa, it may be considered a viable alternative forage when crop damage limits grain yield (Sheaffer et al., 2001). Soybean forage is difficult to preserve as silage due to the relatively low concentration of soluble carbohydrates and relatively high buffering capacity because of the high content of protein. However, this limitation is easily overcome if an additional source of soluble carbohydrates is added to the silage. The addition of sugar cane molasses not only facilitates soybean silage fermentation but also improves silage sensory characteristics (Tobía et al., 2007). The pH of 5.31 after 90 days of ensiling indicates the need for additional soluble carbohydrates and that as little as 2% molasses (DM basis) was sufficient to maintain the pH below 4. The reduction in ammonia from 4.1 to 2.7mg/g DM is further proof of the need for the addition of rapidly fermentable carbohydrates when ensiling soybean foliage (Nguyen Thi Thu Hong et al., 2020).

The soybeans silage can be considered as a protein feed to reduce the use of concentrates, as an alternative to supplement the lamb herd (Lima et al., 2009). The objective of this study provides information on whether combining ensilaged soybean forage (*Glycine max* L.) and Varisme 06 (*Pennisetum americanum x P. purpureum*) improve feed intake and digestibility of cattle.

MATERIALS AND METHODS

Time and location

Experimental period: from July 2019 to March 2020. This experiment was carried out on a farm in ChauPhu district, An Giang province.

Experimental design, Feeding and Management

Four Brahman cattle (252±54 kg live weight) were allocated in a 4x4 Latin square design with 4 treatments. The treatments were ensilaged soybean (ES) ES0, ES10, ES20 and ES30 corresponding to the ensilaged soybean forage replacing Varisme 06 (*Pennisetum americanum x P. purpureum*) at the levels of 0, 10, 20 and 30% (dry matter basis) respectively. The basal diet is Varisme 06. This diet is popular for cattle in area.

The cattle were vaccinated against foot and mouth disease and de-wormed before the start of the experiments. They were tethered in the individual stalls in a barn with open walls.

Each experimental period was the last 20 days. In the first 10 days, cattle were being adapted to the new diets. Pooled samples of feed offered, refused and feces from the metabolic trial were subjected to preliminary processing and preserved for subsequent chemical analysis in the morning during the next five days of each period. There was arest period of 5 days between experimental periods when the cattle were fed mixed-grass included para grass and elephant grass.

The cattle were vaccinated against foot and mouth disease and de-wormed before the start of the experiment. They were individually fed in metabolism cages with free access to water and mineral blocks. New feed was offered daily at 08:00 and 16:00. Dry matter intake was 3.0% body live weight.

Soybean forage was collected and eliminated roots and then wilted under sunshine. Soybean forage with around 25% dry matter (DM) was used for making silage with molasses (4 kg molasses for 100 kg of fresh soybean forage) in a plastic bag of 25 kg. The silage was used for feeding cattle from day 14 to day 21.

Measurements and analysis

Apparent nutrient digestibility of DM, organic matter (OM), and crude protein (CP) was determined following methods described by Mc.Donald et al. (2002). The feed offered, refused and feces were analyzed for DM by drying at 105°C for 24hrs, OM by ashing at 550°C for 4hrs and CP by Kjeldahl technique (AOAC-1990). Neutral detergent fiber (NDF) was be analyzed using the method of Van Soest and Robertson (1985).

Data analysis

The data were analyzed preliminary by Microsoft Excel (2010) and analyzed of variance (ANOVA) using the General Linear Model (GLM) procedure of Minitab 16.10 software (Minitab 2010). Modify the method for comparison two treatments.

RESULTS AND DISCUSSION

The chemical composition of the feeds used in the experiment was shown in Table 1. The DM, OM, CP and NDF of ensilaged soybean were 24.6, 89.6, 16.9 and 50.7 %, respectively. The CP content of ES was higher than that of VA06 grass.

Table 1**.** The chemical composition of feed ingredients (% in DM, except DM which is on fresh basis)

Items	DM	CP	OM	ADF	NDF
Ensilaged soybean forage	24.6	16.9	89.6	39.7	50.7
Varisme 06	18.7	9.87	90.0	40.1	67.5

The CP content of ensilaged soybeanis 16.9%, the result is higherto that reported by Nkosi et al. (2016) with values of 14.9% and 14.21% (in DM), but lower than that reported by Tobía et al. (2008) with values from 19 -21.7%. The study of Vargas-Bello-Pérez et al. (2008) showed that soybean silage had CP content of 18.4%.

The ADF, NDF content of silages soybean in the experiment were 39.7%, 50.7%, respectively, this result is similar to the report by Vargas-Bello-Pérez et al. (2008) with 46.9%NDF and 37.7%ADF . This result is higher than that reported by Nkosi et al. (2016) with values of 31.4% and 39.8% for ADF and NDF respectively. Garcia (2006) reported that soybean silage have CP (16.0 - 20.6%); NDF (38.3 - 48.3%); ADF (27.3 - 37.3%). The results were found that the replacement of Varisme 06 by ES stimulated the appetite ofcattle in the diet. It led to DM intakes of the ES diet were higher than the control (Table 2). The DM and CP intake were significantly different (P<0.05) among the treatments. In a study by Nguyen Van Thu (2010) using ensilaged water hyacinth (*Eicchornia Crassipes*) replacing Para grass at 0, 15, 30, 45% levels (DM basis) for growing cattle, it was indicated that cattle could consume at maximum ensilaged water hyacinth level of 30%.

Table 2. Mean values for DM intake

Items	Treatments				SEM	P
	ES0	***ES10***	***ES 20***	***ES 30***		
DM intake, kg/day						
Varisme 06,	5.19[a]	4.98[ab]	4.77[b]	4.35[c]		
Ensilaged soybean forage,	0[c]	0.68[b]	1.43[a]	1.90[a]		
Total *DM intake, kg/day*	5.19[b]	5.66[ab]	6.20[a]	6.25[a]	0.15	0.004
DM intake, kg/100kg LW (Covariates LW)	1.96	2.14	2.37	2.41	0.03	0.001
OM intake, kg/day	4.69[b]	5.10[ab]	5.58[a]	5.63[a]	0.12	0.005
CP intake, kg/day	0.53[b]	0.61[b]	0.73[a]	0.76[a]	0.02	0.002
CP/100kg KL, g	197[c]	234[b]	275[a]	291[a]	6.00	0.001
ADF intake, kg/day	2.08[b]	2.28[ab]	2.48[a]	2.50[a]	0.06	0.009
NDF intake, kg/day	3.52[b]	3.72[ab]	3.97[a]	3.93[a]	0.06	0.005

Note: ES00, ES10, ES20, ES30: Ensilaged soybean forage replacing Varisme 06 grass at levels of 0, 10, 20 and 30 % (DM basis) respectivel, [abc] Means with different letters within the same row differ at p<0.05

The apparent nutrient digestibility was showed in Table 3.

Table 3. Nutrient digestibility (%) of cattle

Items	**Treatments**				**SEM**	**P**
	ES0	***ES10***	***ES 20***	***ES 30***		
Dry matter	48.9^{b}	57.4^{a}	61.3^{a}	59.4^{a}	1.66	0.008
Crude protein	60.1^{b}	68.5^{ab}	71.0^{a}	71.9^{a}	1.74	0.011
Organic matter	52.1^{b}	60.7^{ab}	64.9^{a}	63.4^{a}	1.80	0.009
ADF	39.8	50.0	54.9	53.7	3.40	0.069
NDF	55.4^{b}	60.3^{ab}	62.6^{ab}	63.2^{a}	1.58	0.044

Note: ES00, ES10, ES20, ES30: Ensilaged soybean forage replacing Varisme 06 grass at levels of 0, 10, 20 and 30 % (DM basis) respectivel, ^{abc} Means with different letters within the same row differ at p<0.05.

The nutrient digestibility (DM, OM, CP, and NDF) was significantly different (P<0.05) among treatments. The results indicated that ES could be used to replace Varisme 06 grass at a level of 30% in the growing cattle diet. Moreover, the low CP content of the diets makes supplementing the diet with protein-rich forages is necessary, especially if such forage is fed in large amounts (Bruinenberg et al., 2006). Spanghero et al. (2015) indicated that harvesting soybean forage at an advanced maturity stage (e.g., from R4 to R6) greatly increases the protein, the fat, and the degradable NDF contents. R4 stage is pod 2cm long at one of the four uppermost nodes and R6 stage is full seed with pod at one of the four uppermost main stem nodes has one seed that has extended to the length and width of the pod. At the full seed stage is 70 day of development (Hintz and Albretcht, 1994). In general, legumes have higher intakes than grasses, which is attributed to a lower cell wall content, a faster particle size reduction, a faster rate of OM removal from the rumen, and a higher protein content (Bruinenberg et al., 2006). The results of OM and CP digestibility coefficients in this study are within ranges of those on dairy cows using ensilaged soybean reported by Vargas-Bello-Pérez et al. (2008) with OM (71,8%) and CP (70,6%). The result of CP digestibility in a current study was within a range (63.7 – 66.3%) of digestibility experiments on Brahman presented by Dinh Van Dung et al. (2014), and Chumpawadee and Pimpa (2009) 65.8 -74.5%.

Soybean forages are legumes and can make good feeds. The nutritive value of a soybean plant can be comparable to early bloom alfalfa. Soybean silage appeared to be a good alternative to take advantage of the excellent nutritional value of this legume to reduce the cost of producing which was actually very dependent on imported raw materials (Tobía et al., 2008).

CONCLUSIONS

Feed intake and nutrient digestibility of growing cattle were improved when ensilaged soybean forage replacing Varisme 06 diets and this was an effective way to make use of the residues of crops.

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