Research Article

Providing Ration of Corn Straw Silage and Elephant Grass Silage on the Performance of Etawa Crossbreed Goats

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Abstract | The ensilage process is an effort to improve the quality of corn straw and use elephant grass as the main source of fiber for ruminants. The research aimed to obtain a ration formulation through the use of elephant grass silage, corn straw silage, and concentrate for etawa crossbreed goats. The experiment used a randomized block design (RBD) with four treatments and each treatment was repeated four times, so there were 16 experimental units. The four treatments were: A = silage with 0% corn straw silage + 60% elephant grass silage + 40% concentrate; B = 20% corn straw silage + 40% elephant grass silage + 40% concentrate; C = 40% corn straw silage + 20% elephant grass silage + 40% concentrate; D = 60% corn straw silage + 0% elephant grass silage + 40% concentrate. The variables observed were body weight, feed consumption, nutrient consumption, and nutrient digestibility. The results showed that body weight and feed consumption showed no significant differences between all treatments and tended to be the highest in treatment C. Dry matter and crude protein digestibility of treatment A was the lowest but the highest on nitrogen-free extract (NFE) compared to treatments B, C, and D. The crude fiber digestibility was highest in treatment C and significantly different compared to treatment A, B, and D. The nutrient consumption, digestibility of organic matter, crude fat, and total digestible nutrient (TDN) showed no significant differences in all treatments and tended to be the highest on the treatment C. It can be concluded that giving silage with 40% corn straw + 20% elephant grass silage + 40% concentrate produced the highest body weight and the best nutrient digestibility.

Keywords | Elephant grass silage, Concentrate, Corn straw silage, Digestibility, Etawa crossbreed goat, Performance

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INTRODUCTION

Goats are classified as ruminant livestock with the main feed being forage such as grass, legumes, and leaves from tree species, in addition to concentrate as additional feed. Forage is used as a source of energy and the main source of protein for ruminants. During the harvest season, elephant grass and corn straw availability are high enough to be used as ruminant feed and processed into silage. Elephant grass is easy to obtain and has high availability. Corn straw is one of the agricultural wastes that has the potential to be used as a source of forage. The limitation of corn straw is low in quality because it contains high crude fiber with low protein content. The high availability of elephant grass can be made into silage which increases the availability of feed. Efforts to improve the quality of corn straw and the use of elephant grass are through the ensiling process so that its quality can be increased as the main source of fiber for ruminant livestock.

The nutritional content of *Pennisetum purpureum* consists of dry matter 20,49%; ash 12,76%; crude protein 11,23%;

crude fat 2,42 %; crude fiber 31,56%; Ca 0,40%; P 0,32%; NDF 70,33%; 42,73% and nitrogen free extract 41,82% (Dumadi *et al*., 2021). The nutritional content of corn straw silage with 20% pollard is 91.74% dry matter, 93.31% organic matter, 6.69% ash, 16.19% crude protein, 15.13% crude fiber, 7.12% crude fat, BETN 46.59%, and TDN 35.53% (Trisnadewi *et al*., 2017). Trisnadewi and Cakra (2020) found that corn straw silage contain of dry matter 89.65%, organic matter 90.51%, ash 9.49%, crude protein 12.89%, crude fiber 16.32%, crude fat 15.65%, and nitrogen free extract 35.30%, while elephant grass silage contain of dry matter 91.60%, organic matter 88.50%, ash 11.50%, crude protein 13.18%, crude fiber 21.84%, crude fat 14.03%, and nitrogen free extract 31.06%

Krisnaningsih and Susanto (2017) found that fermented corn straw and supplementation with *Gliricidia sepium* leaves and tofu dregs could increase the productivity of etawa crossbreed goats in terms of feed consumption, body weight gain, and feed conversion. Providing a silage mixture of *Indigofera* sp. and elephant grass influenced the digestibility of crude fiber. Still, it did not influence the digestibility of NFE in male garut sheep, as well as the ratio of the silage mixture of *Indigofera* sp. and elephant grass which produces the highest crude fiber digestibility value is mixed of 20% *Indigofera* sp. and 80% elephant grass (Wijaya *et al*., 2018).

MATERIALS AND METHODS

The goats used were male etawa crossbreed goats with a body weight of ± 15 kg. The cages used are 16 individual cages and each plot is equipped with a place for feeding and drinking water.

The ingredients for the ration consist of corn straw silage, elephant grass silage, and concentrate. Rations are given twice a day in the morning and the afternoon. Drinking water is provided ad libitum by the local water company.

The research was carried out in Pempatan Village, Rendang District, Karangasem Regency, Bali. Corn straw and elephant grass are cut into 3-5 cm pieces, and sprinkled with pollard and molasses on top. Corn straw and elephant grass silage are made with a mixture of 100% corn straw and elephant grass supplemented with 10% pollard and 10% molasses (Trisnadewi *et al*., 2017). Mix all the ingredients, then put them in a plastic barrel, press, and compress until there is no air in the plastic barrel. Next, close and tie it tightly at the lid and store it in a cool place and not exposed to the sun. Silage can be given to livestock after fermentation for 21 days.

The design used in this research was a randomized block design (RBD) with four treatments and four groups as replications, so there were 16 experimental units. Each experimental unit consists of one goat. The four treatments are: A = 0% corn straw silage + 60% elephant grass silage + 40% concentrate; B = 20% corn straw silage + 40% elephant grass silage + 40% concentrate; C = 40% corn straw silage + 20% elephant grass silage + 40% concentrate; D = 60% corn straw silage + 0% elephant grass silage + 40% concentrate. The composition and nutritional content of the ration can be seen in Tables 1 and 2.

Table 1: Composition of feed ingredients in the ration.

Ingredients	Treatments			
	A	B	C	D
Corn straw silage	0	20	40	60
Elephant grass silage	60	40	20	0
Concentrate	40	40	40	40
Total	100	100	100	100

Note: A = 0% corn straw silage + 60% elephant grass silage + 40% concentrate; B = 20% corn straw silage + 40% elephant grass silage + 40% concentrate; C = 40% corn straw silage + 20% elephant grass silage + 40% concentrate; D = 60% corn straw silage + 0% elephant grass silage + 40% concentrate

Table 2: Nutritional content of rations.

Nutrient content	Treatments			
	A	B	C	D
Dry matter (%)	89.4	89.1	88.9	88.61
Organic matter (%)	88.3	88.9	89.6	90.3
Crude protein(%)	14.8	15.0	15.1	15.3
Crude fiber (%)	18.8	18.9	19.1	19.2
Crude fat (%)	4.4	4.1	3.8	3.6
NFE (%)	39.6	40.0	40.4	40.9
TDN (%)	40.5	39.8	39.2	38.5

Variables observed

- Body weight gain is obtained from the final body weight minus the initial body weight and divided by the length of the research
- Ration consumption was obtained from the total consumption of rations during the research
- Nutrient consumption is obtained by multiplying the dry matter consumption of the ration by the nutrient content of the ration
- Dry matter digestibility is obtained by dry matter consumption minus fecal production and divided by dry matter consumption multiplied by 100%. Fecal production is obtained by the amount of feces minus the dry matter of feces.
- Nutrient digestibility is obtained by nutrient consumption minus the fecal nutrient content divided by nutrient consumption and multiplied by 100%. The nutrient content of feces is obtained by multiplying the content of fecal nutrients with fecal production.

Data analysis

The obtained data were analyzed using variance, if the mean value of the treatment had a significant effect on the variable, it was followed by Duncan's multiple range test at the 5% level using software SPSS version 20.

RESULTS AND DISCUSSION

The final body weight of etawa crossbreed goats on treatments A, B, C, and D showed no significant differences (P>0.05) between all treatments. Still, there was a tendency for treatment C to produce the highest final body weight (Table 3). Final body weight is related to feed consumption which also tends to be high in treatment C. The increase of body weight of etawa crossbreed goats given treatment C resulted in the highest increase in body weight gain and was not significantly different from treatments B and D but was significantly different (P<0.05) from treatment A. This indicates that the rations provided are good quality so ration consumption increases and impacts the body weight. The dry matter digestibility of the ration is the highest in treatment C (Table 4) which high digestibility causes the rumen could empty quickly so that the livestock consume more ration and this has an effect on increasing body weight. Ali (2013) stated factors that influence average daily gain are body weight and length of maintenance. Animal body weight is always directly proportional to the level of consumption. The higher the body weight, the higher the food consumption. Kusrianty and Nuraidil (2020) showed that the better the quality of the feed, the higher the amount of consumption, and has implications for livestock body weight.

Feed consumption of etawa crossbreed goat rations treated with treatments A, B, C, and D showed no significant differences (P>0.05) between all treatments (Table 3). It shows that the goats can consume the provided rations that consist of corn straw silage, elephant grass silage, and a combination of both silages with the addition of concentrate. The rations for each treatment had the same palatability so the consumption showed no significant differences. Church and Pond (1988) stated that feed consumption is also influenced by palatability which depends on several things, including the appearance and shape of the feed, smell, taste, and texture of the feed. Rostini *et al*. (2013) stated that the quantity and quality of feed influence the nutrient consumption. The characteristics of feed ingredients as reflected by organoleptics such as appearance, smell, taste, texture, and temperature can stimulate and attract livestock to consume them (Yusmadi *et al*., 2008). There was a tendency for the C treatment to be higher compared to other treatments and showed that giving a combination of elephant grass silage and corn straw silage was preferable to one type of silage. Tangendjaja and Wina (2006) stated that during the fermentation period, corn straw is rich in nutrients, especially sugar which helps the fermentation process, and the silage formed is preferred by livestock with total digestible nutrients of 60-70% and protein of 11-15%.

Table 3: Body weight, feed, and nutrient consumption of etawa crossbreed goats given corn straw silage and elephant grass silage in ration.

Variable	Treatment[1)]				SEM[3)]
	A	B	C	D	
Initial body weight (kg/head)	15.5	15.1	14.6	14.7	1,6
Final body weight (kg/head)	17.6	17.7	18.6	17.5	1,42
Body weight gain (g/head/day)	91.3 b	114.1a	171.2a	119.6a	19,54
Feed consumption (g/head/day)	463.4	540.5	571.8	517.2	36,89
Nutrient consumption (g/head/day)					
Dry matter	410.8	478.1	504.6	393.3	36.8
Organic matter	367.5	430.3	456.9	356.3	38.9
Crude protein	67.8	79.7	84.9	67.3	6.0
Crude fiber	86.1	101.1	107.6	85.0	7.7
Crude fat	20.7	23.0	23.0	16,32	2.0
Nitrogen free extract (NFE)	187.9	220.9	235.6	183.1	17.9
Total digestible nutrient (TDN)	189.6	218.4	228.1	173.0	17.8

[1)]A = 0% corn straw silage + 60% elephant grass silage + 40% concentrate; B = 20% corn straw silage + 40% elephant grass silage + 40% concentrate; C = 40% corn straw silage + 20% elephant grass silage + 40% concentrate; D = 60% corn straw silage + 0% elephant grass silage + 40% concentrate. [2)]Different alphabets on the same line were significantly different (P<0.05). [3)] Standard error of the treatment means.

The nutrient consumption of etawa crossbreed goats was consumption of dry matter, organic matter, crude protein, crude fat, NFE, and TDN, showed no significant differences (P > 0.05) between treatments A, B, C, and D. This caused by the feed consumption of all treatments also showed no significant differences. Feed nutrient consumption follows the feed consumption of each treatment. The dry matter consumption was not significantly different, indicating that etawa crossbreed goats given treatment rations A, B, C, and D were able to consume the same amount of dry matter in all treatments. Tarigan (2009) states that dry matter consumption depends on whether forage is given alone or together with concentrate. Dry matter consumption in goats is generally 3-3.8% of body weight. Consumption of organic matter also shows a nonsignificant difference because consumption of organic matter is influenced by dry matter. After all, organic matter is part of dry matter. This is also supported by Murni et al. (2012) who stated that the high or low consumption of organic materials will be influenced by the high or low consumption of dry materials because most of the 15 components of dry materials consist of organic material components, the difference between the two lies is in the ash content. Consumption of crude protein, crude fiber, crude fat, NFE, and TDN showed no significant differences between all treatments (A, B, C, and D). This is also related to the consumption of organic materials which are not significantly different in all treatments.

The dry matter digestibility of etawa crossbreed goats on treatments B, C, and D showed a significantly higher (P<0.05) compared to treatment A (Tabel 4). Dry matter consumption was not significantly different (P>0.05) in all treatments but dry matter digestibility showed significant differences. It shows that ration on treatments B, C, and D, which are a combination of elephant grass and corn straw silage, as well as corn straw silage, are better digested by fiber-degrading microbes in the rumen. A high digestibility ration indicated that ration could available high nutrients for livestock. Mayulu *et al.* (2018) stated that feed with high digestibility indicated that high digested nutrient intake. Digestibility is an initial indication of various nutrient availability contained in a feedstuff to be consumed by the livestock. Feed that has low digestibility shows that thus feed has less supply of nutrients to livestock. The fermentation process through silage technology can improve the quality of elephant grass and corn straw so that digestibility increases. Yuniarsih and Nappu (2013) stated that the quality of corn straw as animal feed can be improved with silage technology as a fermentation process assisted by microorganisms in anaerobic conditions (without oxygen). Silage technology can change corn straw from a low-quality feed to a high-quality feed and source of energy for livestock. Sondakh *et al.* (2018) stated that the higher the percentage of dry matter digestibility of a feed ingredient, the higher the quality of the feed ingredient. The different results found by Tresia *et al.* (2023), that the increasing proportion of maize straw silage in the rations as a partial replacement of napier grass resulted in reduced dry matter and organic matter digestibility. Maize straw was harvested at 115 days of maturity when the process of cell wall synthesis was ongoing which increased the lignin cellulose fraction.

The organic matter digestibility of etawa crossbreed goats showed no significant differences (P>0.05) between all treatments (A, B, C, and D) tended to be higher on treatment C (Table 4). The high protein content of the diet, especially in treatment C, causes the digestibility of organic matter to be higher. This is in line with Andayanis (2010) statement that the high digestibility of organic matter is also due to the high crude protein content, which results in the increased development of microorganisms that digest these feed ingredients. The organic matter digestibility followed the pattern of dry matter digestibility. Usually, the digestibility of organic matter is higher than the digestibility value of dry matter (Riswandi *et al.*, 2015; Sondakh *et al.*, 2018).

Table 4: Nutrient digestibility of etawa crossbreed goats given corn straw silage and elephant grass silage in ration.

Variable	Treatment[1)]				SEM[3)]
	A	B	C	D	
Nutrient digestibility (%)					
Dry matter	60.8 c	65.9 b	71.0 a	66.1 b	1.3
Organic matter	66.9	68.1	70.9	68.3	1.4
Crude protein	58.1 b	65.6 a	65.6 a	66.2 a	2.0
Crude fiber	50.0 b	53.2 b	61.6 a	54.7 b	2.5
Crude fat	56.6	63.5	68.6	58.7	3.4
Nitrogen-free extract (NFE)	83.7 a	74.8 b	76.2 b	75.0 b	1.3
Total digestible nutrient (TDN)	77.3	80.23	77.4	79.5	1.3

[1)]A = 0% corn straw silage + 60% elephant grass silage + 40% concentrate; B= 20% corn straw silage + 40% elephant grass silage + 40% concentrate; C = 40% corn straw silage + 20% elephant grass silage + 40% concentrate; D= 60% corn straw silage + 0% elephant grass silage + 40% concentrate. [2)]Different alphabets on the same line were significantly different (P<0.05). [3)]Standard error of the treatment means.

The crude protein digestibility of etawa crossbreed goats given treatment A was the lowest and significantly different (P<0.05) from treatments B, C, and D (Table 4). This shows that through the ensiling process, the quality of elephant grass and corn straw is increased as indicated by increased crude protein digestibility. Crude fiber digestibility in treatment C was the highest and was statistically significantly different (P<0.05) compared to treatments A, B, and D. The combination of corn straw which was higher than elephant grass in treatment C allowed the microbes to degrade the silage more optimally. Through the fermentation process, fiber-degrading microbes were able to work better in digesting corn straw silage and elephant grass silage which resulted in crude fiber digestibility increases.

The NFE digestibility was highest in treatment A compared to treatments B, C, and D (Table 4) because ration A only consisted of elephant grass silage so it was easier to digest compared to corn straw silage. NFE is a degradable carbohydrate. According to Aling *et al*. (2020), the largest NFE component is non-structural carbohydrates, such as starch, monosaccharides, or sugars. The TDN digestibility for treatments A, B, C, and D showed no significant differences between all treatments. This shows that all treatment rations have the same digestible nutrients. Tahuk *et al*. (2021) stated that the type of feed, nutrient content of feed as well as body weight affected the variation of digestibility value.

CONCLUSIONS AND RECOMMENDATIONS

It could be concluded that providing 40% corn straw silage + 20% elephant grass silage + 40% concentrate produces the highest body weight gain and the best nutrient digestibility. Providing 40% corn straw silage+20% elephant grass silage + 40% concentrate and 20% corn straw silage+40% elephant grass silage + 40% concentrate had a better effect on ration and nutrient consumption.

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NOVELTY STATEMENT

The authors have developed a ration that provides corn straw and elephant grass silage with concentrate could improve the performance of the etawa crossbreed goat.

AUTHOR'S CONTRIBUTION

The author contributed to the implementation research, laboratory analysis, data analysis, and creating the articles.

Conflict of interest

The authors have declared no conflict of interest.

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