

Research Article



The Effect of Feeding Ammoniated Corn Cobs with Different Levels on the Digestibility of Feed in Brahman Crossbred Cattle

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Abstract | The primary objective of this study was to investigate the impact and most effective quantity of urea in the supplementation of ammoniated corn cobs on the digestibility of dry matter (DM), organic matter (OM), Neutral Detergent Fiber (NDF), and Acid Detergent Fiber (ADF) components in Brahman Crossbred cattle. The research utilized a Randomized Complete Block Design (RCBD) comprising of 3 treatments and 3 groups. The experimental treatments consisted of three groups: P0, which consisted of 80% basal feed and 20% untreated corn cobs (0% urea); P1, which consisted of 80% basal feed and 20% ammoniated corn cobs (2.5% urea); and P2, which consisted of 80% basal feed and 20% ammoniated corn cobs (5% urea). The data acquired were assessed utilizing Analysis of Variance at a significance level of 0.05. The variables under observation were the digestibility DM, OM, NDF, and ADF. The findings indicated that the use of ammoniation treatment had a significant impact ($P < 0.05$) on the digestibility of dry matter for treatments P0 (54.33%), P1 (57.97%), and P2 (56.52%), organic matter P0 (57.56%), P1 (58.89%), and P2 (58.38%), as well as acid detergent fiber (ADF) digestibility P0 (49.08%), P1 (55.84%), and P2 (54.80%). However, there was no significant effect ($P > 0.05$) on NDF digestibility for P0 (59.45%), P1 (63.06%), and P2 (63.22%). In summary, the inclusion of ammoniated corn cobs in the diet of Brahman Crossbred cattle has been shown to impact the digestibility of DM, OM, and ADF. The most effective level of ammoniation appears to be at a rate of 2.5% urea.

Keywords | Ammoniation, Corn Cob, Digestibility, Feed, Cattle, Lampung

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INTRODUCTION

One of the livestock that produces meat is beef cattle, one of which is the Brahman Cross. Brahman Cross cattle are cattle produced from a cross between Brahman cattle and European cattle. Brahman Cross cattle are widely kept in Indonesia as producer meat. Brahman Cross cattle have the advantage of high productivity and are resistant to high temperatures (Khotimah et al., 2018).

its genetic quality in the United States and Australia. Brahman Cross cattle are the best type of beef cattle in tropical areas. Even though it grows and develops in the land of four seasons, it is able to adapt well to new environments, being resistant to heat and tick bites. Potential daily increase in body weight is 0.8-1.2 kg/day, fattening time is around 3-4 months with feeder weight around 250-300 kg, carcass percentage is 54.2% (Fikar and Ruhyadi, 2010).

This Brahman cross cattle has been selected and improved One of the factors that really determines the success

of livestock development is the availability of feed in sufficient quantities, both in terms of quality and quantity and continuously throughout the year. However, currently land for growing animal feed is decreasing due to the large amount of land being used for residential and industrial sectors. The use of agricultural waste is an alternative to meet livestock needs and one of the wastes that is quite prospective is corn cobs (Quadros et al., 2023)

The amount of digestibility determines the amount of nutrients that can be utilized to meet basic living needs and growth (Widya et al., 2008). Digestibility is based on the assumption that food substances that are not found in feces are substances that are digested and absorbed. Factors that influence feed digestibility are feed composition, ration composition, feed preparation, animal factors and amount of feed (Tillman et al., 1998).

In Indonesia, corn is the second staple food after rice. Meanwhile, based on the order of staple foods in the world, corn ranks 3rd after wheat and rice, corn (*Zea mays* L) is an annual plant (annual) (Sutardi et al., 2023). The first half of the cycle is the vegetative growth stage and the second half is the generative growth stage. High corn plants vary greatly. Although corn plants generally have a height of between 1-3 meters, there are varieties that can reach a height of 6 meters (Wang et al., 2024; Khalafi et al., 2021)

According to BPS Lampung Province (2021), corn production in Lampung is 1,502,800 tons. Based on the amount of corn production, it can be seen that the production of corn cobs is also large. According to Retnani et al. (2009) that the proportion of corn plant waste based on dry weight consists of 20% leaves, 50% stems, 20% cobs and 10% husks. Thus, in 2021, it is estimated that the potential for corn cob waste in Lampung Province will be around 300,560 tons. Corn cobs have great potential as an alternative feed ingredient because its availability is plentiful, easy to obtain, and cheap, and do not compete with humans. However, corn cobs are of poor quality to be used as animal feed because they have low protein content and high crude fiber, so it is necessary to carry out an ammonization process with the aim of increasing the nutritional value and digestibility of corn cobs (Adhianto et al., 2023).

Ammonia is a chemical treatment that can dissolve hemicellulose and break lignin bonds with cellulose and hemicellulose. Through ammonia, the crude fiber content in corn cobs will decrease while the protein will increase. The increase in crude protein is related to the administration of urea doses for the formation of ammonia. Ammonia formed during the ammonia process will be absorbed into the corn cob tissue, thereby increasing the crude protein content of the corn cob (Yoo et al., 2011; Yuan et al., 2023). According to Fariani and Akhadiarto (2009), administering

urea at a dose of 4% had the best effect on the dry matter, crude fiber and crude protein content of ammoniated corn cobs. Currently there has been no report regarding the effect of giving corn cobs on digestibility of dry matter, organic matter, NDF (neutral detergent fiber) and ADF (acid detergent fiber) fiber fractions in Brahman Cross cattle. So current research was carried out to determine the optimal urea level and proportions in corn cob ammonia which can optimize the level of digestibility of dry matter, organic matter, NDF and ADF fiber fractions in Brahman Cross cattle.

MATERIALS AND METHODS

This research was carried out at KPT Maju Sejahtera, Wawasan Village, Tanjung Sari District, South Lampung Regency.

MATERIAL

The materials used in this research were 9 Brahman Cross cattle aged 8-12 months. The rations used were corn cobs, cassava skin, jenjet, elephant grass, soybean meal, palm oil meal, cassava, molasses, urea and water.

METHOD

The research procedure began with preparing the pen and experimental cows by preparing equipment, cleaning the pen, marking the pen, weighing the initial body weight of the experimental cows, and placing the cows according to the experimental layout. After that, corn cobs ammonia was made (dose of 2.5% urea and 5% urea) with storage in anaerobic conditions for a minimum of 21 days.

The activities in this research consisted of three stages, namely the preliminary stage which was carried out within two weeks, then the maintenance stage by providing rations which was carried out twice every day and providing drinking water regularly. Third phase was data retrieval. Maintenance was carried out for 2 months (8 weeks). Data collection begins when the cow has passed the time prelim, namely 14 days. Feces collection was carried out every day for 7 days after the cow's consumption has become consistent. Stool collection was carried out by collecting and separating the feces according to the treatment and repetition given and weighing the amount of feces produced. The collection method used was by collecting the feces produced 24 hours a day for 7 days.

The design used was a Randomized Complete Block Design (RCBD) which consisted of 3 treatments and 3 groups. The treatments given were P0: 80% basal feed + 20% non ammoniated corn cobs (0% urea), P1: 80% basal feed + 20% ammoniated corn cobs (2.5% urea), and P2: 80% basal feed + 20% ammoniated corn cobs (5% urea). Nutrient content of ammoniated corn cobs with different urea levels was presented in Table 1.

Table 1: Nutrient content of ammoniated corn cobs with different urea levels.

Dosage urea (%)	Nutrient content (%)								
	Dry matter	Crude protein	Crude fat	Crude fiber	Ash	EE	TDN	NDF	ADF
0	90	3.0	0.5	36.0	12.0	48.5	48.0	70.0	48.4
2.5	89	6.9	0.4	21.2	12.1	48.4	69.4	51.5	45.6
5	88	8.4	0.4	21.6	16.4	53.2	72.1	65.16	46.2

EE, Extract Ether; TDN, Total nutrients digested; NDF, Neutral Detergent Fiber; ADF, Acid Detergent Fiber.

OBSERVED VARIABLES

The variables observed in this research are digestibility of DM (dry matter), OM (organic matter) (AOAC, 2019), NDF and ADF (Van Soest, 1994). Before calculating digestibility, feces are collected followed by checking the water content and ash content.

DATA ANALYSIS

The data obtained were analyzed using Analysis of Variance (ANOVA), with a significance level of 5%. When differences were found between treatments, the Least Significant Difference test (LSD) at the 5% level was applied.

RESULTS AND DISCUSSION

DRY MATTER DIGESTIBILITY IN BRAHMAN CROSS CATTLE

The average effects of treatments on dry matter digestibility can be seen in Table 2. The results of the analysis show that providing treatment rations had a significant effect ($P<0.05$) in increasing dry matter digestibility. Digestibility of feed ingredients are substances that can be processed and consumed by the body of living creatures so that they are not thrown away (Tillman et al., 1998). Digestibility was determined from the difference between the nutritional content consumed and the nutrients excreted.

Table 2: Effect of treatments on dry matter digestibility of brahman cross cattle.

Replicates	Treatments		
	P0 (%)	P1 (%)	P2 (%)
1	53.49	57.36	54.47
2	54.42	57.60	56.53
3	55.07	58.95	58.57
Mean	54.33	57.97	56.52

P0: 80% basal feed + 20% non ammoniated corn cobs (0% urea).
P1: 80% basal feed + 20% ammoniated corn cobs (2.5% urea).
P2: 80% basal feed + 20% ammoniated corn cobs (5% urea).

The results of the analysis of variance (Table 2) show that the dry matter digestibility values in treatment P1 (2.5% corn cob ammonization) and P2 treatment (5% corn cob ammonization) had a significant effect ($P<0.05$) on treatment P0 (control). The dry matter digestibility values

of treatments P0, P1, and P2 were 54.33%, 57.97%, and 56.52%, respectively. The increase in digestibility values is thought to be due to changes in the composition and structure of cell walls in the P1 and P2 rations that have been ammoniated. Komar (1984) stated that ammonia causes changes in the composition and structure of cell walls which play a role in liberating the bonds between lignin and cellulose and hemicellulose so that the fibers can be easily broken down by microbial enzymes.

Ammonia treatment on corn cobs can increase the dry matter digestibility of the ration. This is supported by research by Nugroho (2020) which states that giving 15% cassava peel with 3% urea ammonia can increase the dry matter digestibility value from 63.32% to 70.73%. Increased dry matter digestibility also occurs in fermentation ammonia. Prastyawan et al. (2012) stated in their research that the addition of 5% ammonia and 2% commercial starter cedar could increase the dry matter digestibility of corn cobs from 41.30% to 49.78%.

Ammonia treatment on corn cobs plays a role in increasing crude protein levels in the ration and reducing crude fiber levels. Kastradisastra (2007) said that the addition of urea in ammonia serves to destroy the bonds of lignin, cellulose and silica found in feed ingredients. In addition, ammoniation causes N to be fixed in the tissue, thereby increasing the protein content of ammoniated feed ingredients (Fariani and Akhadiarto, 2009). This is very useful in increasing the digestibility of feed ingredients by livestock. Arora (1996) said that the level of feed absorption is influenced by the nutritional value of the feed. If the feed has high nutritional value, the digestibility value of the food will be high, and vice versa, if the feed has low nutritional value, the digestibility will also be low.

The crude protein values in treatments P0, P1, and P2 in this study were, 46%, 10.24%, and 10.53% respectively, while the crude fiber values were 20.88%, 17.81% and 18.00%, respectively. This is supported by research by Fariani and Akhadiarto (2009) who reported that administering a dose of 4% urea was able to increase the crude protein content from 6.54% to 8.64% and reduce the crude fiber content from 21.95% to 17.15%. Furthermore, Hanifah et al. (2010) added that an increase in crude protein content also occurred in cassava skin that was ammoniated with 3%

urea from 5.48% to 17.8%.

The results of the smallest real difference test showed that the highest dry matter digestibility value was found in P1 (57.97%), this value was higher when compared to treatment P2 (56.52%). This is thought to be due to differences in the level of urea applied to corn cob ammonia. [Fariani and Akhadiarto \(2009\)](#) said that applying 6% urea to corn cobs can increase crude fiber. This is because the microbes that produce the urease enzyme which forms ammonia no longer work optimally to break down lignocellulose and lignin hemicellulose bonds, so it is suspected that the water content in the feed ingredients is insufficient to degrade urea at higher doses.

The highest dry matter digestibility values in this study were obtained from treatments P1, P2, followed by P0. The level of digestibility of dry food in a feed ration is influenced by the crude fiber content present. Rations that have a high crude fiber content will be difficult to process even though they have a high protein content. As mentioned by [Price et al. \(1980\)](#), the higher the crude fiber, the lower the digestibility of dry matter, crude protein and energy that can be absorbed by livestock.

The level of urea that is too high on corn cobs with 5% ammonia (P2) is believed to affect the DM digestibility value in livestock. This is because feed protein consumed in large quantities will eventually be converted into N-ammonia. Not all of the N-ammonia produced from protein degradation by rumen microorganisms can be used as part of rumen protein. Excess N-ammonia will be consumed by the rumen walls and then distributed to the liver through the circulatory system and converted into urea. Only some of the urea returns to the intestinal system through the salivary organs and other metabolic pathways, while the other part is excreted in the urine ([Sutardi, 1976](#)).

Dry matter digestibility was also influenced by feed consumption and quality, where feed consumption is influenced by the animal's palatability which is determined by the nutrients contained in the ration provided. [Parakkasi \(1999\)](#) stated that consumption of feed with good nutritional value was higher than low quality feed. In addition, [Herman et al. \(2007\)](#) revealed that the elements that influence the digestibility of dry matter are the amount of feed eaten, the speed at which the food passes through the digestive system and the type of nutritional content contained in the feed.

ORGANIC MATTER DIGESTIBILITY IN BRAHMAN CROSS CATTLE

The average value of the effect of treatments on the digestibility of organic matter can be seen in [Table 3](#). The results of the analysis show that providing treated

rations had a significant effect ($P<0.05$) in increasing the digestibility of organic matter. Digestibility of organic matter is the difference between the amount of organic matter consumed in the diet and the amount of organic matter in the feces ([Anggorodi, 1998](#)). An increase in organic matter digestibility is always in line with an increase in dry matter digestibility, because most of the dry matter components consist of organic matter.

Table 3: Effect of treatment rations on the organic matter digestibility (KCBO) of Brahman cross cattle.

Replicates	Treatments		
	P0 (%)	P1 (%)	P2 (%)
1	56.20	57.62	56.90
2	57.70	58.91	58.05
3	58.78	60.14	60.20
Mean	57.56	58.89	58.36

P0: 80% basal feed + 20% non ammoniated corn cobs (0% urea).
P1: 80% basal feed + 20% ammoniated corn cobs (2.5% urea).
P2: 80% basal feed + 20% ammoniated corn cobs (5% urea).

The results of data analysis ([Table 3](#)) show that the organic matter digestibility value of the P1 and P2 treatment rations had a significant effect ($P<0.05$) on P0. The research results showed that the digestibility of organic matter in treatment rations P0, P1, and P2 was 57.56%, 58.89%, and 58.38%, respectively. The table also shows that the digestibility of organic matter in rations that have been ammoniated can increase the digestibility of organic matter in Brahman Cross cattle. This is in accordance with research by [Nugroho e al. \(2020\)](#) who reported that giving 15% ammoniated cassava peel with 3% urea in the ration can increase the digestibility value of organic matter from 66.39% to 73.00%.

[Table 3](#) shows the differences in organic matter digestibility values in ammoniated and non-ammoniated rations. Ammoniated feed (P1 and P2) showed an increase in organic matter digestibility. This is thought to be because ammoniated feed has a lower crude fiber content than non-ammoniated feed. The decrease in crude fiber content in corn cob ammonia will affect the digestibility value of dry matter and organic matter, high or low crude fiber in feed is a limiting factor in the length of rumen microbial degradation ([Suprpto et al., 2013](#)).

Ammonia treatment on corn cobs can increase nutrition and degrade crude fiber in the ration and this is very useful for increasing the digestibility of the ration by livestock. Increased nutrient content in the ration can increase the digestibility of dry matter and organic matter. This is in accordance with the opinion of [Fathul and Waijizah \(2010\)](#) who state that organic matter is part of the dry matter, if the dry matter increases, the organic matter will also increase

and vice versa. Furthermore, [Riswandi et al. \(2015\)](#) stated the digestibility of organic matter is intricately linked to the digestibility of dry matter, as a portion of dry matter comprises organic matter containing crude protein, crude fat, crude fiber, and extract ether. Therefore, the digestibility of crude protein, crude fat, crude fiber, and extract ether is pertinent to the overall digestibility of organic matter.

The results of the smallest real difference test showed that the highest digestibility value of ration organic matter was found in P1 (2.5% corn cob ammonization). This result was higher when compared with treatments P2 (5% corn cob ammonization) and P0 (no ammoniation). This is because the crude fiber content in treatment P1 is lower than in treatments P2 and P0. The nutritional content of crude fiber in the respective treatments was 17.81% (P1), 18.00% (P2), and 20.88% (P0). [Tillman et al. \(1998\)](#) reported that the digestibility of organic materials is also influenced by the crude fiber content in the feed ingredients. The high crude fiber content in feed will result in low degradation values, because crude fiber in the form of cellulose and hemicellulose often binds to lignin and is difficult to break down by digestive enzymes, thus digestibility will be lower if a feed ingredient contains high fiber.

The crude fiber content in the ration can influence the low digestibility of organic matter. The crude fiber component consists of cellulose, hemicellulose and lignin. Lignin is a cell wall component that is difficult for bacteria to digest. Apart from that, lignin is very resistant to chemical degradation, including enzymatic degradation ([Tillman et al., 1998](#)). The decreased lignin content in corn cob ammonia (P1 and P2) is thought to result in increased digestibility of organic matter because the lignin component is better able to be digested. [Parrakasi \(1999\)](#) stated that the factors that influence the digestibility of organic materials are the crude fiber and mineral content of the feed ingredients. The digestibility of organic materials consists of the digestibility of carbohydrates, proteins, fats and vitamins and is closely related to the content of inorganic materials (ash).

NDF DIGESTIBILITY OF BRAHMAN CROSS CATTLE

The amount of digestibility determines the amount of nutrients that can be utilized to meet basic living needs and growth ([Widya et al., 2008](#)). Digestibility is based on the assumption that food substances that are not found in feces are substances that are digested and absorbed. Factors that influence feed digestibility are feed composition, ration composition, feed preparation, animal factors and amount of feed ([Tillman et al., 1998](#)). The results of research regarding the effect of giving corn cob ammonia with different levels of NDF digestibility for Brahman Cross cattle can be seen in [Table 4](#).

Table 4: Average NDF digestibility of Brahman cross cattle.

Replicates	Treatments		
	P0 (%)	P1 (%)	P2 (%)
1	59.72	59.00	61.10
2	61.11	66.31	64.72
3	57.53	63.86	63.84
Mean	59.45	63.06	63.22

P0: 80% basal feed + 20% non ammoniated corn cobs (0% urea).
P1: 80% basal feed + 20% ammoniated corn cobs (2.5% urea).
P2: 80% basal feed + 20% ammoniated corn cobs (5% urea).

The results of data analysis ([Table 4](#)) show that giving ammoniated corn cobs had no significant effect ($P>0.06$) on the digestibility of NDF in Brahman Cross cattle. This is thought to be due to the lack of feed variation between treatment rations and also because the percentage of corn cobs used in the rations is the same. The NDF content in each treatment feed, namely P0, P1, and P2, only had a slightly different difference. The content of NDF and ADF is closely related to crude fiber. A smaller fiber content can increase digestibility because rumen microbes will digest it more easily. [Wahyono et al. \(2019\)](#) stated that the lower the fiber fraction component, the less energy the microbes need to digest cellulose, hemicellulose and lignin, so that this can increase digestibility. Lignin levels in feed are one of the factors that influence digestibility.

The results of the research in [Table 4](#) show that the rations treated with ammoniated corn cobs (P1 and P2) gave the highest average NDF digestibility compared to the treated corn cobs without ammoniated (P0). This is thought to be because ammonia treatment can reduce the crude fiber content, including NDF and ADF, thereby increasing the digestibility of corn cobs given to experimental cows. This is in accordance with [Sumarsih et al. \(2007\)](#) which states that ammonia treatment can increase digestibility by loosening lignocellulose bonds, making carbohydrates easier to digest, increasing digestibility by swelling plant tissue, and increasing palatability. [Tuturong et al. \(2014\)](#) stated that the digestibility of feed ingredients is influenced by several factors, including chemical composition, frequency of feed ingredients, physical form of feed, type of feed, plant age, environmental temperature, livestock species, age of livestock, diversity between individual livestock and microbial activity.

Average NDF digestibility in Brahman Cross Cattle treated with corn cobs ammonia with a 5% level (P2) of $63.22 \pm 1.89 \%$, corn cob treatment ammonia with a urea level of 2.5% (P1) and corn cob treatment without ammonia (P0) of $63.06 \pm 3.72\%$, and $59.45 \pm 1.80\%$. NDF and ADF digestibility are used to assess the nutrient absorption of feed ingredients in livestock. [Arora \(1996\)](#)

states that measuring the digestibility of a material is an attempt to determine the amount of nutrients from a material that are degraded and absorbed in the digestive tract, the results of which will be known by looking at the difference between the amounts nutrition consumed by the amount of nutrients excreted in feces. The higher the digestibility value of a feed ingredient, the greater the food substances that are absorbed (Sondakh et al., 2018). From the results of the research data in Table 4, it can be concluded that the digestibility of NDF in rations treated with ammoniated corn cobs with urea levels of 5% and 2.5% was better than treatment rations using corn cobs without ammonization (P0).

Tillman et al. (1998) stated that the digestibility values of NDF and ADF can be influenced, among other things, by livestock species, physical form of food, amount of feed consumed, composition of feed ingredients, rate of food in the digestive tract and environmental temperature. Anggorodi (1998) added that the NDF digestibility value can be caused by the nutritional content of the feed, ration composition (protein level), amount of feed, feed preparation, and livestock factors. The digestibility of feed NDF is influenced by the nutrient content of the feed, especially NDF and PK. The higher the NDF level, the lower the NDF digestibility of the feed. The higher the protein content, the higher the NDF digestibility. Waani (1999) reported that the NDF digestibility of feed is related to the NDF content and PK content of the feed. The amount of crude protein that enters the rumen will influence the development of the microbial population in the rumen which plays a large role in the food digestion process in livestock.

Increasing the protein content in the ration can increase the population and activity of rumen microbes to digest crude fiber (Budiman et al., 2006). There is no difference in NDF digestibility because the NDF content and protein content of the ration are relatively the same so that different protein sources do not significantly change rumen fermentation conditions, resulting in no difference in digestibility. The crude protein content in corn cob feed without ammonization is 9.5% and the crude protein content in ammoniated corn cob feed with a urea level of 2.5% is 10.2% and the crude protein content in ammoniated corn cob feed with a urea level 5% by 10.5%. From these data it can be concluded that the protein content in each treatment is not relatively the same. Ammonia treatment on corn cobs plays a role in increasing crude protein levels in the ration and is also able to reduce crude fiber content. This is supported by research by Fariani and Akhadiarto (2009) who reported that administering a dose of 4% urea was able to increase the crude protein content from 6.54% to 8.64% and reduce the crude fiber content from 21.95% to 17.15%.

ADF DIGESTIBILITY OF BRAHMAN CROSS CATTLE

Feed digestibility is the part of the feed that is not excreted in feces is the part that is absorbed by the livestock and the difference is the part that is digested (McDonald et al., 1995). The results of research regarding the effect of giving corn cob ammonia with different levels of ADF digestibility for Brahman Cross cattle can be seen in Table 5.

Table 5: Average digestibility of ADF for Brahman cross cattle.

Replicates	Treatments		
	P0 (%)	P1 (%)	P2 (%)
1	48.75	49.93	51.23
2	50.69	59.16	57.68
3	47.80	58.43	55.49
Mean	49.08 ^b	55.84 ^a	54.80 ^a

Note: Values with different superscript letters on the same row indicate significant (P<0.05) difference. P0: 80% basal feed + 20% non ammoniated corn cobs (0% urea). P1: 80% basal feed + 20% ammoniated corn cobs (2.5% urea). P2: 80% basal feed + 20% ammoniated corn cobs (5% urea).

The results of data analysis (Table 5) show that giving ammoniated corn cobs had a significant effect (P<0.06) on the digestibility of ADF in Brahman Cross cattle. Based on the BNT (Least Significant Difference) further test, there was a significant difference in the results of giving ammoniated corn cobs on the digestibility of ADF in Brahman Cross cattle. From the research results, treatment P0 (49.08±1.47%) was significantly lower than treatment P1 (55.84±5.13%) and P2 (54.80±3.28%). Meanwhile, treatment P1 was not significantly different from treatment P2. The increase in digestibility values is thought to be due to changes in the composition and structure of cell walls in the P1 and P2 rations that have been ammoniated. Addition ammonia In feed ingredients high in fiber, it can cause changes in the structure and composition of the cell walls which play a role in loosening the lignocellulosic bonds so that the fiber can be more easily broken down by microorganisms in the rumen (Simbolon et al., 2016).

From the results of the research data in Table 5, it can be concluded that the digestibility of ADF in rations treated with ammoniated corn cobs with 2.5% urea level was 55.84 ± 5.13% and 5% urea level was 54.80 ± 3.28% more. better compared to the treatment ration using corn cobs without ammonization (P0) of 49.08 ± 1.47%. The digestibility of feed ingredients is high and the flow rate of feed out of the rumen is faster, making the rumen empty more quickly so consumption increases. Tilman et al. (1991) added that the speed and level of feed degradation can influence feed consumption because it is related to the length of stay of the feed in the rumen. The digestibility of each feed

ingredient or ration is influenced by the animal species, the physical form of the feed, the composition of the feed ingredient or ration, and the level of feeding (Ranjhan, 1980).

The research results in Table 5 show that the rations treated with ammoniated corn cobs (P1 and P2) gave the highest average ADF digestibility compared to the treated corn cobs without ammoniated (P0). This is because cellulose and hemicellulose have undergone breakdown by ammonia from degraded urea so that the bonds between cellulose and hemicellulose become looser. This is in accordance with the opinion of Syukur (2016) who states that the aim of making ammonia is to improve the quality of feed ingredients that are low in nutrient content and digestibility. This is also in line with the opinion of Melati and Sunarno (2016) who stated that higher levels of ADF indicate that the quality of the feed ingredients is decreasing, causing the digestibility of ADF to also decrease. Low protein content can reduce the digestibility of ADF because the growth and activity of rumen microbes in it is inhibited. Low protein content in feed ingredients can cause the ammonia concentration and pH in the rumen to decrease.

Ammonia functions to break the bonds between cellulose and lignin, and makes the fiber bonds loose, while in the fermentation process, cellulase enzymes from various cellulolytic microbes can penetrate more easily into the fibrous feed material, thereby reducing crude fiber which ultimately increases digestibility (Hastuti et al., 2011). The fermentation process will be more effective in increasing the digestibility of fibrous feed ingredients if combined with ammonia treatment first, because of the nitrogen supply (Riswandi et al., 2014).

Low ammonia concentrations can inhibit the growth and activity of microbes in digestion feed in the rumen, this results in decreased ADF digestibility (Siswanto et al., 2016). Rahalus et al. (2014) stated that low protein content can cause rumen pH to decrease, causing rumen microbes to not develop properly and not optimally digest feed and resulting in decreased fiber digestibility. This was also stated by Koddang (2008) that the development of rumen microbes is very dependent on the amount of N ammonia that can be degraded from the protein of the diet consumed. Increased rumen microbial activity causes ADF digestibility to increase.

Ammonia with the addition of urea functions to loosen the bonds between cellulose and lignin. One of the factors that causes low digestibility of a feed ingredient is the lignin, cellulose and silica content contained in the feed ingredient. In accordance with Amin's et al. (2016) that urea in the ammonia process functions to loosen the bonds

of lignin, cellulose and silica which are factors causing the low digestibility of straw for livestock.

The average digestibility of ADF also did not differ due to differences in protein sources. This is understandable because ADF is part of NDF which consists of cellulose and lignin so that ADF is more difficult to digest because of the lignin and silica content in the feed, whereas according to the opinion of (Van Soest, 1994) it is stated that lignin and silica cannot be digested by rumen microorganisms. The fiber fraction is often present in a form bound to lignin, making it difficult for rumen microbes to digest. The digestibility of a feed ingredient is a reflection of the high or low beneficial value of the feed ingredient by measuring the amount of food consumed and the amount of food excreted in feces (Sadeli, 2011).

The results of research conducted by Farian and Akhadiarto (2009), reported that the addition of urea at a dose of 2% did not affect changes in the crude fiber content of corn cobs. This is because the amount of urea dose given is still too small so that the ammonia produced to loosen the bonds of lignocellulose and lignin hemicellulose is also small so that not too much crude fiber is dissolved. When the urea dose was increased to 6% in the treatment there was an increase in crude fiber again whose value exceeded that of the control. This is because the microbes that produce the urease enzyme which forms ammonia and CO₂ no longer work optimally to break down bond lignocellulose and lignin hemicellulose, so it is suspected that the water content in the feed ingredients is insufficient to degrade urea at higher doses.

This is also supported by the results of research conducted by Veronita (2005) who reported that the use of urea at a dose of 6% resulted in an increase in crude fiber, this is because during ammonia, urea will decompose into ammonia which will attack the lignocellulose and lignin hemicellulose bonds, so that the cell wall structure changed. In accordance with Komar's (1984) opinion that ammonia causes changes in the composition and structure of cell walls which play a role in liberating the bonds between lignin and cellulose and hemicellulose.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the conducted research, it can be concluded that ammoniation treatment of corn cobs in the ration has no effect on the digestibility of DM, OM, and NDF. However, treatments P1 (2.5% corn cob ammoniation) and P2 (5% corn cob ammoniation) showed a significant effect on the digestibility of ADF in Brahman Cross cattle.

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NOVELTY STATEMENT

The research on ammoniation of corn cobs for use as feed for beef cattle has not been extensively conducted. It is hoped that this study will serve as an initial step in developing a complete feed formulation based on corn plant waste.

AUTHOR'S CONTRIBUTION

All authors are equally sharing.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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