Conference Paper

The Nutrients Contents, Dry Matter Digestibility, Organic Matter Digestibility, Total Digestible Nutrient, and NH3 Rumen Production of Three Kinds of Cattle Feeding Models

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Abstract

In Indonesia, forage is difficult to obtain in the dry season, while the agricultural waste very abundant and potentially pollute the environment. Use of agricultural waste as feed animal is very advantage to obtain cattle nutrients need and alleviate pollution. An experiment was conducted to evaluate the nutrient quality of fermented complete feed based on soybean straw (CFS), compared with forage (F) or forage and concentrate with 4:1 ratio (FC). Proximate analysis was conducted to three kind of feed, then nutrients digestibility were conducted by in-vitro analyzed. Each kind of feed consisted of 4 replicates. The results showed that CFS had higher ash and crude protein content and less crude fiber than FS and F. CFS had dry matter digestibility (DMD), organic matter digestibility (OMD) and total digestible nutrients (TDN) significantly ($p< 0.05$) higher than F but not significantly different with FC. There are not significantly different of NH_3 production among the three kinds of feed. The conclusion was CFS had highest nutrient content. CFS and FC had digestible nutrient that higher than F. The quality of CFS can still be improved by adding N digestible for rumen microbe growth.

Keywords: complete feed, soybean straw, nutrient digestibility.

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1. Introduction

Eastern Indonesia has large open area, so the cattle could be grazed to meet the needs of forage. But in October 2014, even hundreds of cattle in South Timor Tengah (Timor Tengah Selatan), East Nusa Tenggara (NTT) were died due to lack of forage [1]. The main obstacle of cattle farm in Indonesia is a shortage of forage, especially in the dry

season. When not enough pasture for livestock feed, or grazing of pastures may be detrimental to pasture survival, the nutritional requirement for animal must be met by full hand feeding [2]. Ruminant animal in many tropical countries subsist mainly on crop residue based diets. As an agricultural country, Indonesia produces many of agricultural waste, but agricultural waste generally had a low nutritional quality, thus it can't meet the nutritional needs of cattle.

Soybean processing produce byproducts and waste, there are: harvesting soybean crops produce soybean straw (*rendeng kedelai*). Soybean by-products or waste still has a highly protein content so it can potentially be used as a protein source for cattle feed [3]. The average CP content of soybean straw and soybean pod husk was low (4.91 and 5.04% respectively), while ADF content was high (42.76 and 42.08% respectively). In vitro digestibility of DM, ADF and NDF showed that soybean straw and soybean pod husk can be used as cattle feed [10].

Feedstuff with low nutritional quality need to be improved by fermentation to decrease crude fiber, and equip it with a source of energy that is easily digested. Protein content of feed also need to be improved by adding protein feed materials. The feed can be formed into a complete feed for providing to the livestock nutrients requirement. Complete feed is a mixture of feed ingredients that designed to meet the nutrient requirement of animals. For ruminants, complete feed (total mix rations) contain of forages, by-products, cereals, protein sources, fats, minerals and vitamins. Voluntary feed intake is usually greater when forages and concentrates are mix as a complete feed than when fed separately. This is because the rumen microbial population reaches a stable equilibrium that enhances the digestibility of the forage components. Complete feeds also allow utilization of less-palatable feedstuff that would otherwise be rejected when fed separately [5].

In this experiment, complete feed was formulated in accordance with nutritional requirement of beef cattle, and then fermented for 10 days to increase digestibility. Complete feed then compared with forage or forage plus concentrate as ruminants feed.

2. Materials And Methods

There are three kinds of treatments feed, ie: T1: Forage (F), T2: Forage and concentrate, with 4:1 ratio (FC), T3: Complete feed based on soybean straw (CFS). CFS composed of soybean straw (35%), soybean meal, coconut meal, cassava waste, corn flour, coffee hush, molasses, mineral, NPN and salt that which has crude protein content 15% (DM).

Table 1: Nutrient Content of Forage, Forage and Concentrate, and Complete Feed (100% DM).

	Ash	CP	EE	CF	NFE	DE	TDN
T1	7.542	11.780	7.978	38.853	33.847	3299.91	74.998
T2	7.526	12.228	7.692	36.321	36.233	3327.17	75.617
T3	9.708	15.146	6.820	27.772	40.554	3339.77	75.904

CP: Crude Protein; EE: Extract Ether; CF: Crude Fiber; NFE: Nitrogen Free Extract; DE: Digestible Energy; TDN: Total Digestible Nutrient.

The evaluation of nutrients content of forage, forage and concentrate and complete feed by proximate analyze [6]. Evaluation of DM digestibility, organic matter digestibility and total digestible nutrient was performed by *in-vitro*. McDougall's buffer solution placed in the stirrer flask and placed in a heater with temperature 38-39°C. Rumen fluid was filtered and placed in the stirrer flask which contain of buffer solution. The ratio of buffer solution and rumen fluid was 4:1, and maintained at pH 6.9-7.0 with temperature of 38-39°C. Feed sample ± 0.5 gram inserted into the fermenter tube. Taken 50 ml of mixture rumen fluid and buffer solution, and put into the fermenter tube and blank tube using dispencer, flushed with CO_2 gas and closed immediately. After 48 hours of fermentation, the mixture was added with acid-pepsin digested at 39°C for 24 hours, under anaerobic condition. Residual plant materials were then collected and oven dried at 105°C for 12 hours. Ash content was measured by combustion at 550°C for 2 hours [11]. The samples then filtered with filter paper to separate the supernatant for measurement of NH_3 production [2].

3. Result and Discussion

Proximate analysis of forage, the forage and concentrate, and complete feed obtained the nutrient contents as listed in Table 1.

From the Table 1 there are shown that complete feed (T3) has highest content of ash and crude protein (CP) and lowest crude fiber (CF) among the three kinds of feed, while forage (T1) has the highest crude fiber content among the three kinds of feed. [2] mentioned that protein is essential nutrient of the ration for growing and breeding of beef cattle. Complete feed also has a Nitrogen Free extract (NFE), digestible energy (DE) and total digestible nutrient (TDN) highest among the three kinds of feed.

The nutrient quality from T2 was better than T1. The CP, NFE, DE and TDN contents were higher, otherwise the EE and CF contents were lower. [4] mentioned that nutrient

Table 2: Dry Matter Digestibility (DMD), Organic Matter Digestibility (OMD) and Total Digestible Nutrient (TDN) of Feeding Research (%).

Feed	DMD	OMD	TDN
T1	$23.76^{b} \pm 4.80$	$24.98^{b} \pm 5.61$	$22.65^{b} \pm 5.56$
T2	$44.83^{a} \pm 2.57$	$45.88^{a} \pm 2.89$	$42.53^{a} \pm 2.63$
T3	$49.69^{a} \pm 3.33$	$49.70^{a} \pm 2.94$	$46.32^{a} \pm 2.79$
a,b) a different notation on the same column showed a significantly difference ($p<0.05$)			

Table 3: Rumen NH_3 Production.

Feed	NH_3 (ml/lt)
T1	$3.95^{a} \pm 1.16$
T2	$3.68^{a} \pm 0.83$
T3	$2.88^{a} \pm 0.28$
a,b) a different notation on the same column showed a significantly difference ($p<0.05$)	

requirement of beef cattle to meet production need will not be met if only consume forage alone, therefore it is necessary to added with concentrate in the diets.

Digestibility is an important factor in the measure of nutrition value of animal feed. Digestibility for ruminants determines the relation between nutrients contents and energy. Chemical composition of feed provides information about feed quality, can used to derive digestibility and expected the performance of the ruminant [4]. Dry matter is defined as weigh loss of samples when dried in oven at above 100°C for 12-24 hours. Organic matter define as weigh loss of dry matter when combustion (dry matter minus ash content) [5]. Dry matter consisted of all nutrients, whereas organic matter consisted of all nutrients except ash. Dry matter digestibility are very important determinants for evaluate the nutrients absorbed by ruminants. Organic matter digestibility defined as the proportion of organic matter in the feed that apparently digested in the total of ruminant digestive tract. Organic matter digestibility can use to measure the energy available and to estimate the protein microbial synthesis in the rumen. From Table 2 there are can be estimated that complete feed or forage and concentrate can produce protein microbial better than forage alone.

[7] mentioned that season significantly different affect to organic matter digestibility of herbage. In the dry season OM digestibility about 28.5-37.2%, in intermediate about 38.9-45.5% and in the wet season about 23.3-36.3%. From the Table 2 there are shown that complete feed had high of dry matter digestibility, organic matter digestibility and total digestible nutrients same as mixture of forage and concentrate.

Rumen NH_3 production reflect the amount of degradable protein in the rumen. Ruminal ammonia nitrogen is important nutrient for rumen microbial growth and fermentation. Higher level of NH_3 would be required to achieve maximum rate of fermentation. Higher level of ruminal NH_3 can increase digestibility [12]. In this experiment, there are not significantly different of rumen NH_3 production among the three kinds of feed.

Rumen degradable protein is protein in the diet that digested and used by rumen microbe. Protein source for ruminants are from true protein and non-protein nitrogen. The rumen microbe able to convert the non-protein nitrogen into true protein if sufficient energy source in the diet are available. The rumen microbe convert of non-protein nitrogen from forage only 80% efficiency. Urea are non-protein nitrogen source, but to avoid toxicity there are no more than 1% of dry matter diet should consist of urea [8].

4. Conclusion

In this experiment, complete feed had highest CP, NFE, DE and TDN, otherwise had lowest CF and EE. There was no significant difference in DMD, OMD and TDN between complete feed and mixture of forage and concentrate, but significantly difference with forage alone. There was no significantly difference in NH_3 production among three kinds of feed. There are indicated that the quality of complete feed in T3 same as forage and concentrate in T2, but still can be improved by adding digestible nitrogen source to increase rumen NH_3 production.

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