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Effect of Phosphorus and Sulphur Supplementation in Growing Beef Cattle Diet Based on Rice Straw Ammoniated*

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Abstract: This study tried to make use the ample supply of rice straw as the source of roughage. An experiment was conducted to evaluate effect of phosphorus and sulphur supplementation in rations containing ammoniated rice straw in beef cattle diets. The experiment used in randomized block design with cattle of 90±5.63 kg live weight. The experiment diets composed of 50% rice straw and 50% concentrate. The treatment were A = 50%rice straw, previously treated with 4% urea B = A+5% cassava leaves, C = B+0.4% P, D = C + 0.45%S. Differences among treatment means were examined using Duncan multiple range test. The results showed that there were significant differences of the consumption of dry matter and organic matter, digestibility of dry and organic matter and daily gain between treatments. The results indicated that intake, digestibility and daily gain of diets contains ammoniated rice straw with P and S supplementation were significantly higher than the control diet ($p<0.05$). It is concluded that P and S supplementation is important to improve degradability and daily gain of rations contain rice straw ammoniated. The best result showed at treatment D where, dry matter intake was 3407 g day^{-1}, organic matter intake was 3340 g day^{-1}, digestibility of dry matter was 64% and digestibility of organic matter was 66.90% and daily weight gain was 610.25 g day^{-1}.

Key words: Phosphorus, sulphur, cattle, digestibility, rice straw ammoniated

INTRODUCTION

The major limitations of straw as an animal feed are low digestibility and low protein content. Efforts have been made to increase the feed value of cereal straws by chemical and physical treatments, as well as nutrient supplementation. The digestibility of various crop straws can be increased by treating with ammonia (urea) but still requires supplementation. Urea is often used to enhanced digestibility of fibrous by product through ammoniation (Van Soest, 2006). Ammoniation of crop residues and agroindustrial by product with urea can supply nitrogen to rumen microbe. Cereal straw are deficient in critical nutrients and cannot meet nutrients requirement of the animals without supplementation. Additions of branched-chain fatty acids, sulphur and other minerals have met with varying success (Bal and Ozturk, 2006). However, adequate supply of nitrogen, energy and minerals in the diet

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of ruminants is essential for maintaining optimum ruminal activity. The development and utilization of cassava as an on-farm feed has been recommended as a possible solution to lack of good-quality roughages during the dry season in the tropics (Wanapat *et al.*, 1997; Wanapat *et al.*, 2000). Phosphorus is intimately associated with normal functions of all animal tissues by virtue of its role in the process of energy metabolism Kennedy *et al.* (2000) found a significant linear response in the voluntary feed intake in calves supplemented with phosphorous. Although, there is little information explaining how the rumen bacteria and fermentation are influenced by S supplementation, it has been shown that the supplementation of poor quality fiber diets with S improved ruminal fiber degradation as well as apparent organic matter digestibility (Bal and Ozturk, 2006). The present study was therefore, designed to investigate the effects of ammoniation and supplementation of cassava leaves, mineral phosphorus and sulphur on feeding value of ammoniated rice straw when given alone or combination to growing calves.

MATERIALS AND METHODS

An *in vivo* trial was then conducted to determine the effect of cassava leaves, phosphorus and sulphur supplements on dry matter intake, digestibility and daily weight gain in cattle fed the roughage rice straw ammoniated. The trial was initiated on Mei 15, 2008 and ended on September 26, 2008. In this study, 16 Pesisir calves aged 9-12 months were divided into 4 equal groups on the basis of their body weights. All the calves were maintained under similar housing and management conditions and had free access to drinking water.

The calves were fed mixture of rice straw ammoniated (50%) and concentrate (50%). The composition of the feeds, including the concentrate is given in Table 1. Each group of the calves was randomly assigned to one of the following 4 treatments:

A = Control (mixture ammoniated rice straw and concentrate
B = A supplemented with 5% cassava leaves
C = B supplemented with 0.4% phosphorus
D = C supplemented with 0.3% sulphur

Table 1: Ingredient composition and nutrition of experimental diet

	Diet			
Items	A	B	C	D
Ingredient				
Ammoniated rice straw	50.00	50.00	50.00	50.00
Rice bran	24.30	24.30	24.30	24.30
Coconut cake	25.00	25.00	25.00	25.00
NaCl	0.20	0.20	0.20	0.20
Mineral and vitamin	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Supplementation				
Cassava leaves		5.00		
Phosphorus		5.00	0.40	
Sulphur		5.00	0.40	0.30
Nutrient (%)				
Protein	12.59	13.62	13.62	13.62
TDN	60.43	61.45	61.45	61.45
ADF	31.74	33.25	33.25	33.25

Ammonia Treatment of Rice Straw

In this experiment, rice straw was sprayed with 4 kg urea in 100 L of water/100 kg dry matter of rice straw and stored between sheets of plastic for 3 weeks in anaerobic condition. The ammoniated rice straw was aerated prior to feeding.

Feed was offered twice daily at 08:00 h and 13:00 h and intake of roughage was measured each day throughout the trial. Fed was offered at 3% LW. The data on daily feed intake and weight gain were collected during a study period of 60 days and 7. Feed samples were analyzed weekly. Feed intake was recorded on the basis of dry matter intake. Samples of feed and feces, composite by animal across the 7 day collection period were analyzed for DM, OM and N by standard procedures (AOAC, 1984). Fecal sub samples (10%) were dried partially at 50°C for 48 h.

Statistical Analysis

The collected data were statistically analyzed using randomized complete block design (Steel and Torrie, 1984). Least Significant Difference (LSD) was used for comparison of means of treatments.

RESULTS AND DISCUSSION

Dry Matter Intake and Organic Matter Intake

Dry Matter Intake (DMI) in calves increased due to the highest intake DM and OM occurred in Diet D, followed by C, B and A. However, a minimum in DMI and OMI was found in control group. Statistical analysis indicated that DMI was significantly increased due to cassava leaves, phosphorus and sulphur supplementation. This result showed that cassava leaves, phosphorus and sulphur could improve population of rumen microbe than will be increase the rate of passage in rumen. It also has been demonstrated before that cassava leaves could improve the digestibility (Wiktorsson and Khang, 2004).

The improvements in digestibility and intake of poor quality roughages supplemented with protein (Berger *et al.*, 1980; Orskov *et al.*, 1980). Valk and Sebek (1999) who pointed out that phosphorus supplementation, increased DMI in dairy animals. Weiss and Wyatt (2004) reported that when the dietary phosphorus was increased from 0.34 to 0.45% of dry matter in diet of cows, DMI increased from 12.4 to 30.5 kg day^{-1}. However, non-significant difference was found between B, C and D diets (Table 2). The possible reason for low DMI in the A diet was indicated that rumen microbe cannot grow with ammonia as sole nitrogen source. Supplementation cassava as source protein, phosphorus and sulphur improved number of rumen bacteria and increased the digestibility and intake of ammoniated rice straw.

Table 2: Feed intake, digestibility and live weight gain of cattle with experimental diet

	Diet			
Items	A	B	C	D
Dry matter intake (g day^{-1})	2144.00^{b}	2892.00^{a}	3076.00^{a}	3407.00^{a}
Organic matter intake (g day^{-1})	2050.00	2690.00	2950.00	3340.00
Dry matter digestibility (%)	51.76^{d}	54.26^{c}	58.84^{b}	64.00^{a}
Organic matter digestibility (%)	53.12^{d}	56.70^{c}	60.92^{b}	66.90^{a}
Protein digestibility (%)	55.34^{c}	58.90^{c}	64.47^{b}	68.20^{a}
ADF digestibility (%)	32.73^{c}	36.45^{b}	38.78^{b}	45.76^{a}
NDF digestibility (%)	35.36^{c}	40.12^{b}	43.58^{b}	49.23^{a}
Live weight gain (g day^{-1})	289.75^{d}	423.00^{c}	530.50^{b}	610.25^{a}

Value with columns without common letters differ ($p<0.01$). A: Control (mixture ammoniated rice straw and concentrate), B: A supplemented with 5% cassava leaves, C: B supplemented with 0.4% phosphorus, D: C supplemented with 0.3% sulphur

Digestibility and Weight Gain

The addition of cassava leaves, phosphorus and sulphur affected all digestibility variables ($p<0.01$). Control diet (A) had the lowest DM, OM, protein, NDF and ADF digestibility ($p<0.01$) (Table 2).

Supplementation cassava leaves, phosphorus and sulphur was effective in stimulating dry matter, organic matter, protein and fibrous fraction digestibility. The increase in digestibility of DM, OM, protein and fibrous fraction of anmoniater rice straw that have been supplemented with cassava leaves, phosphorus and sulphur vs. control demonstrate that supplementation could develops the rumen bacterial growth, resulting in a greater rate of digestibility. This study has also shown that anmoniated RS were deficient in protein, phosphorus and sulphur and it supplementation is important to improve fibre digestibility of fibrous feedstuffs. The present results were in agreement with the results of Little (1986) Komizarczuk and Durand (1991) and Wanapat *et al.* (2000). The researchers had indicated that improvement in fibre degradation by cassaca leaves, phosphorus and sulphur supplementation occurred through its specific stimulation on growth of rumen cellulolytic bacteria and anaerobic rumen fungi.

The weight of calves increased due to cassava leaves as protein source, phosphorus and sulphur supplementation. Maximum increase in daily weight was in diet E (610.25 g day^{-1}), followed by C (530.50 g day^{-1}), B (423 g day^{-1}) and A (289.75 g day^{-1}). Statistical analysis indicated that daily weight gain was significantly affected by nutrient supplementation (Table 2). These results are agreement with the result of Wanapat *et al.* (2000), Valk and Sebek (1999), Karn (2001) and Zinn *et al.* (1997) indicated a significant effect of cassava leaves, phosphorus and sulphur supplementation on weight gain.

CONCLUSION

Based on the findings of the present study, it was concluded that cassava leaves, phosphorus and sulphur supplementation had beneficial effects in terms of daily weight gain in cattle when given alone or combination in anmoniated rice straw diet to growing cattle. The best result achieved when they were given on combination.

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