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NUTRITIVE EVALUATION OF AMMONIATED BENGGALA GRASS AND FERMENTED SAGO WASTE

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Abstract

Ruminant feed processing technology is really needed in an attempt to increase the quality of Benggala (Panicum maximum) grass and other waste products. One of new local feed resources in North Sulawesi categorized as waste product is Sago waste which is abundantly available and has a big potential in providing animal feedstuffs. The present study was designed to evaluate the utilization of urea and optimal incubation time to produce the best nutritive quality when added to ammoniated Benggala grass. A Pleurotus ostreatus fungus was used to determine the optimal incubation time to produce the best quality of Sago waste. Research results showed that the best quality of ammoniated Benggala grass was seen at the addition of 6% urea with an incubation time of 21 days, as indicated by the increasing of crude protein, cellulose, and hemicelluloses. The best nutrient quality of Sago waste fermented with Pleurotus ostreatus was shown at incubation time of 30 days, as indicated by significantly (P< 0.01) increasing in protein content and the decreasing of lignin of Sago waste. Nutritive value evaluation of ammoniated Benggala grass and fermented Sago waste as fed showed a significant (P< 0.01) increase in dry matter and organic matter digestibility in vitro. It can be concluded that nutritive value of determined ammoniated Benggala grass and fermented Sago was increased as well asdry matter and organic matter digestibility in vitro.

Key words: *feed evaluation, benggala grass, sago waste, ammoniation, fermentation, in vitro digestibility.*

INTRODUCTION

Ruminant animals share the biggest meat supply for human need. A demand rate of cattle meat is projected to increase as the human population increases. On the other hand, land area for animal feedstuffs cultivation is getting smaller in North Sulawesi, Indonesia region due to uncontrolled human settlement and other infrastructures that occupy agricultural area and its function. One of way outs that can be taken is the utilization of locally available feedstuffs such as Benggala grass and other agricultural waste products such as Sago waste which is abundantly available, sustainable, and has a comparative value added.

The limitation of using both local feedstuffs resources for ruminant animals is their high lignin and low protein content. Weiss and Underwood (2002) stated that ammoniation of grass or straw can increase crude protein content about 6−8%, and increase in vitro organic matter digestibility. Ammoniation treatment increased reducing sugar content of rice straw (Kardaja, et al., 2006). Tuomela (2002) pointed out that *Pleurotus ostreatus* fungi is the most efficient type of microbe exists in nature that specifically breakdown lignin. The present study was design to evaluate nutritional value of ammoniated Benggala grass using urea and fermented Sago waste using *Pleurotus ostreatus* fungi.

MATERIALS AND METHODS

The present study was conducted to determine nutritive value of Benggala grass (*Panicum maximum*) by way of ammoniating using urea and fermentation of Sago waste using *Pleurotus ostreatus*. The first experiment was aimed to determine nutritive value of ammoniated Benggala grass (ABG) with different urea supplementation level of 0%, 2.0%, 4.0%, and 6.0%; and then incubated for 0, 7, 14, and 21 days. The second experiment was conducted to elaborate the nutritive value

of fermented Sago waste (FSW) using *Pleurotus ostreatus* fungi for 20, 25, and 30 day′s incubation time. Parameters measured in the second experiment were: dry matter (DM), organic matter (OM), and crude protein (CP) content. Nutrient compositions were all analyzed using AOAC (1990) standard methods. Fiber analysis for NDF, ADF, cellulose, hemicelluloses, and lignin was conducted according to Van Soest (1987) procedure. In vitro digestibility was conducted using Tilley and Terry (1963) procedure as modified by Van der Meer (1980). Both experiments using two-ways Anova and Tukey test was employed to analyze treatment differences.

RESULTS AND DISCUSSIONS

Experiment 1.*Nutritive value of Ammoniated Benggala Grass (ABG)*

Nutritive value and in vitro digestibility of Ammoniated Benggala Grass (ABG) with different urea level and incubation time is presented in Table 1. Urea level and incubation time significantly ($P< 0.05$) increased organic matter (OM) content of ABG; while ammoniating time had no significant ($P > 0.05$) effect on organic matter (OM) increase on ABG. There was an interaction effect ($P < 0.05$) between urea level and incubation time of *Pleurotus ostreatus* on dry matter (DM) content of ABG. The highest dry matter content was found in urea level of 5% with incubation time of 21 days. Level of urea used in this experiment gave a significant ($P< 0.01$) different on the increase of ABG organic matter (OM); whereas, incubation time did not give a significant ($P> 0.05$) effect on the increase of organic matter content of ABG. There was an interaction effect ($P< 0.01$) on urea level and incubation time increment. Treatment with an increase in urea level gave a significant ($P< 0.05$) increase on ABG crude protein (CP) content. The higher the urea level, the higher the crude protein content of ABG. Incubation time was also increased ($P< 0.01$) crude protein (CP) content. There was an interaction effect ($P< 0.01$) between urea level and incubation time on crude protein (CP) content and neutral detergent fiber (NDF) of ABG. There was no interaction effect ($P> 0.05$) between urea level and incubation time on acid detergent fiber (ADF) of ABG. Level of urea, incubation time, and interaction of both gave a significant ($P< 0.01$) effect on the decrease of lignin, cellulose, and hemicelluloses content of ABG.

Urea level, incubation time, and interaction of both treatments gave a significant ($P< 0.01$) effect on DM and OM digestibility in vitro of ABG. DM, OM, and CP content of ABG increased as urea level and incubation time increased in the present study. The highest DM, OM, and CP content were found in urea level of 6% and incubation time of 21 days. It is understandable because the higher the level of urea and incubation time, the higher the retention time of nitrogen (N) in ABG. At further stage, ureolytic process can take place then N is changed to NH_3 and CO_2 by urease produced by feed bacteria, and reduced sugar level increases. Kardaya, et al., (2006) reported that ammoniating treatment on rice straw using urea can increase crude protein (CP) content, dry matter and organic matter digestibility in vitro. This report was in accordance with the present study, where the highest DM and OM digestibility was found at urea level of 6% and incubation time of 21 days. The decrease in neutral detergent fiber (NDF) of ABG in this experiment might be due to the structural carbohydrate bond damage. Weiss and Underwood (2002) stated that the decrease in NDF content of foliage when treated with ammonia is due to the damage on lignin and hemicelluloses bond. Acid detergent fiber (ADF) content in this experiment was not affected much by treatment given due to the lignocelluloses bond is being hydrolyzed as was indicated by the decrease in lignin content. Indeed, the increase in cellulose content was observed at urea level of 6% with incubation time of 21 days treatment.

Table 1. Nutrient content and in vitro digestibility of ammoniated Benggala grass (ABG) with different urea level and incubation time

Parameters	Urea Level					Sig
Nutrient content (%)						
Dry matter (DM)	U0	36.34	36.34	36.34	36.34	
	U2	37.11	37.92	37.84	38.92	
	U4	38.52	38.48	38.92	38.91	
	U6	38.48	38.72	38.69	38.96	*
Organic Matter (OM)	U0	25.73	25.73	25.73	25.73	
	U2	26.63	26.87	26.81	26.75	
	U4	27.32	27.26	27.55	27.63	
	U6	28.28	28.38	27.50	28.78	**
Crude fiber (CF)	U0	4.92	4.92	4.92	4.92	
	U2	5.05	5.64	5.75	6.09	
	U4	5.27	6.85	6.91	7.03	
	U6	5.29	8.84	8.95	9.12	**
NDF	U0	77.91	77.90	77.89	77.98	
	U2	77.88	77.89	77.68	77.64	
	U4	77.89	76.45	75.44	75.49	
	U6	77.87	76.70	75.86	75.69	**
ADF	U0	55.79	55.80	55.78	55.77	
	U2	55.38	55.40	55.49	55.52	
	U4	55.44	55.43	55.09	55.47	
	U6	55.41	55.38	54.60	54.06	
LIGNIN	U0	13.52	13.53	13.51	13.52	
	U2	13.46	12.92	12.23	11.98	
	U4	13.48	12.90	11.62	11.46	
	U6	13.42	12.41	10.72	10.59	**
Celluloses	U0	51.70	51.57	51.61	51.59	
	U2	51.80	51.89	52.21	51.87	
	U4	51.68	51.04	52.87	52.97	
	U6	51.73	51.91	53.19	53.92	**
Hemicelluloses (%)	U0	25.41	25.39	25.44	25.43	
	U2	25.70	26.12	26.77	26.64	
	U4	24.98	25.08	25.88	26.94	
	U6	25.75	26.4	26.90	26.88	
In vitro digestibility (%):						
Dry matter (DM)	U0	41.40	41.39	41.43	41.42	
	U2	41.43	43.32	43.53	45.32	
	U4	41.42	47.27	48.10	48.17	
	U6	42.01	47.96	48.18	50.49	**
Organic matter (OM)	U0	39.79	39.83	40.01	39.97	
	U2	39.96	41.92	44.47	45.54	
	U4	40.02	45.34	46.81	47.18	
	U6	40.98	45.85	47.22	49.92	**

**) ($P<0.01$)
*) ($P<0.05$)

Experiment 2.*Nutritive value of fermented Sago waste (FSW)*

Nutrient content and in vitro digestibility of Sago pulp fermented with *Pleurotus ostreatus* fungi at different incubation time is presented in Table 2.

Table 2. Nutritive value and in vitro digestibility of Sago pulp at different incubation time

Parameters	Incubation (Fermentation) Time (day/s)				
	F0	F20	F25	F30	Sign
Nutrient content (%)					
Dry matter	75.10	74.21	74.10	74.09	**
Organic matter	71.98	69.78	68.52	68.53	**
Crude fiber	2.89	3.79	5.14	5.27	**
NDF	56.06	55.07	54.04	53.56	**
ADF	31.54	32.09	32.24	32.59	**
LIGNIN	9.86	6.85	5.53	5.49	**
celluloses	26.52	27.40	28.00	28.11	**
Hemicelluloses	17.92	16.10	15.06	15.11	**
In vitro Digestibility					
Dry matter	54.01	54.25	55.58	57.83	**
Organic matter	53.50	54.68	57.44	59.02	**

**) (P<0.01)
*) (P<0.05)

The results showed that fermentation using *Pleurotus ostreatus* fungi gave a significant (P< 0.01) effect on dry matter (DM), organic matter (OM), crude protein, neutral detergent fiber (NDF), acid detergent fiber (ADF), cellulose, hemicelluloses, lignin, in vitro digestibility of dry matter DM), and organic matter (OM) of Sago pulp. Fermentation using *Pleurotus ostreatus* significantly decreased dry matter (DM), organic matter (OM) content of Sago pulp. Badve et al., (1987) stated that cell wall content of sugar cane pulp (bio) converted by *pleurotus sajor caju* can breakdown hemicelluloses bond, increase fiber component solubility, and decrease cell wall component content from 88.4% to 77.2%. Besides, in fermentation processes, microbes consume carbon substances from their growth medium, so that organic matter content decreased. The increase in crude protein content is understandable because of increase in single cell protein biomass. The decrease in neutral detergent fiber (NDF) content of Sago pulp indicated that there is a breakdown of cell wall by *Pleurotus ostreatus* fungi, especially the decrease in lignin when fermentation time prolonged. In their growth, these fungi utilize hemicelluloses, so that hemicelluloses content decreases as fermentation process takes place which is then followed by fungi mycelium growth. Hydrolysis of lignocelluloses by this fungus is indeed increased Sago pulp cellulose content. In vitro digestibility of dry matter (DM) and organic matter (OM) of Sago pulp increased as fermentation time increased. Substrates that undergone fermentation becomes more digestible due to catabolic and anabolic nature of these Pleurotus fungi that enable it to breakdown complex component become more digestible.

CONCLUSIONS

It can be concluded that nutritive value of Benggala (*Panicum maximum*) grass is improved by fermentation using 6% urea for 21 days. The best nutritive value of Sago pulp is reached at fermentation time of 30 days using *Pleurotus ostreatus* fungi.

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