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6th International Conference Sustainable Agriculture, Food, and Energy (SAFE2018). October 19-21, 2018 I'M Hotel, Makati. MANILA, PHILIPPINES

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Preface

We are proud to inform you that the International Conference on Sustainable Agriculture, Food, and Energy (SAFE2018): Inclusive Agri-food Energy Production for Community Empowerment in a Changing Climate" was successfully conducted by SAFE-Network from October 19-21, 2018 in MANILA, Philippine. The host institution was Pampanga State Agricultural University (PSAU), Philippines Centre for Postharvest and Mechanization (PhilMech), and Central Bicol State University of Agriculture (CBSUA), Philippines This conference was the 6th conference after the 1st International Conference on Sustainable Agriculture, Food, and Energy (SAFE2013) in Padang, Indonesia (12-14 May 2014), the 2nd conference SAFE2014 in Bali, Indonesia (17-19 September 2014). The 3rd conference SAFE2015 in Ho Chi Minh City, VIETNAM (17-19 November 2015), The 4th conference SAFE2016, Colombo, Sri Lanka (October 20-22, 2016), and the 5th conference SAFE2017, Malaysia, August 22-24, 2017.

The objectives of the conference were:

1. To provide a forum for international researchers community to exchange and share the experiences, new ideas, sustainability concepts and research results on sustainable agriculture, food, and energy.
2. To promote collaboration in research on sustainable agriculture, foods, and energy production. To establish a regional networking among participants on sustainable agriculture, food, and energy.
3. To increase awareness of the importance of living and working in the manner that enhances the economic, environmental and social well-being of our community through research, education, regional partnerships, and community engagement.

The committee accepted 150 papers of over 300 papers which were presented in SAFE2019 conference.

On behalf of SAFE-Network, we would like to convey our appreciation and thanks very much to the Pampanga State Agricultural University (PSAU), Central Bicol State University of Agriculture (CBSUA), and Philippines Centre for Postharvest and Mechanization (PhilMech) for co-hosting this conference.

We would like especially to thank Prof. Dr.Tafdil Husni, Rector of Andalas University for his strong support to this event, Dr. Norman de Jesus, local conference coordinator and the members of the local organizing committee who helped with all the preparations required to make the conference a success, as well as the session organizers who worked to ensure a high level of science presented at the meeting. Moreover, of course, we thank all honourable speakers and participants who have agreed to attend and discuss your work! Finally, please understand that while every effort was made to publish this proceeding, we know that unavoidable withdrawals and other changes will occur.

Looking forward to welcoming you to the SAFE2019 conference in Phuket, THAILAND!

Prof. Dr. Novizar Nazir
SAFE-Network Executive Chairman


2018
Sustainable Agriculture, Food, and Energy
"Inclusive Agri-food Energy Production for
Community Empowerment in a Changing Climate."

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Analysis of Fibre Fraction of Palm Oil Frond Fermented with Different Microbes and Soluble Carbohydrates Addition as Ruminant Feeding

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Analysis of Fibre Fraction of Palm Oil Frond Fermented with Different Microbes and Soluble Carbohydrates Addition as Ruminant Feeding

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Abstract. This research aimed to analyse the fibre content of palm oil fronds fermentation as a feeding of ruminant for substitution of native grass Fermentation of palm oil frond was done using local microorganisms resources rumen content and Lactobacillus sp. The experimental design used was factorial on complete randomized design 2x3 with 3 replication each treatment. Factor A was the source of inoculums fermentation, where A1=. Lactobacillus sp, A2= local microorganism resources of rumen content, whereas Factor B was the source of soluble carbohydrates where B1 = without a carbohydrates, B2 = rice bran, B3 = tapioca starch. The variables measured were the content of ADF, NDF, cellulose, hemicellulose, lignin, and Silica. The results of this research showed that interaction affect between the source of microorganisms with carbohydrates just on cellulose, no for the other parameters. Factor A were significantly ($P < 0.01$) on the content of lignin, and fermentation by local microorganism resources of rumen content more lower than Lactobacillus sp. (15.41 Vs 20.71%). The effect ($P < 0.05$) factor B on ADF, NDF with addition by tapioca starch. This treatment could reduce the content of fibre fraction.

1. Introduction

Feeding is the main requirement of livestock to be able to they can fulfil for their maintenance, growing, producing and reproducing. The main feedstuff of ruminants naturally is grass and forage which is a source of fibre. Fibre fraction is a potential source of energy as long as its availability is not inhibited by other factors such as lignification and crystallization [1]. To determine the nutritional value of fibrous feeds can be conducted by Acid Detergent Fibre (ADF) and Neutral Detergent Fibre (NDF) analysis [2]. It can be got residue consisting cellulose and lignin [3]. Thus, hemicellulose can be estimated from differences in cell wall structure [4].

The high development of the physical sector and land use change causes constraints in fulfilling the need for feed ingredients for forage sources, so that a lot of research have done to get the source of forage not only from leaves and grasses, but also looking for alternative sources of forage from agricultural or plantation by-products. One of the plantation by-products with potential as a substitute for grass, it is relatively abundant and does not depend on the season. There is the by-product of oil palm plantations in the form of palm oil fronds and leaves. Indonesia has the largest oil palm plantation in the world after Malaysia. The area of oil palm plantations in Indonesia in 2016 was 11 914,500 ha [5]. However, because of low nutrient values the uses of palm oil frond as ruminant animal feed sources is not optimal. The oil palm fronds contained 56.93% ADF, 78.05% NDF, 21.91% cellulose, 15.34% hemicellulose, 16.94% lignin, 16.94% and 0.6% silica [16]. The high level of lignin causes the microbes to be unable to master hemicellulose and cellulose perfectly. The higher of ADF content will cause lower the quality or digestibility of forage [7]. Therefore, to improve the nutritional value and benefits as a feeding, it is necessary to process oil palm frond through feed processing technology. Bio-fermentation is one of the technologies that has been widely used to improve the nutritional value of feedstuff agricultural and plantation by-products.

Several researchers have used local microorganisms (isolated from local materials) as a source of microbial inoculum to ferment the feedstuff. [6] Fermentation of palm fronds with local microorganisms source of the rumen contents and could increase 9.86% of fermented palm fronds cellulose content compared to the unfermented cellulose content of palm fronds (45.44% vs. 49.84%). [8] Researched about isolated and morphology test on local microorganism of rumen contents and get 8 gram-positive thermophilic bacteria.

This research aimed to evaluate the content of the fibre fraction of palm oil fronds that were fermented with the source of local rumen microorganisms or *Lactobacillus* sp. with the addition of different carbohydrate sources.

2. Materials and Methods

2.1. Fermentation process:

The rumen contents were collected from cattle in slaughterhouse and placed in tubes. Sugar and coconut water were added to the tubes. The tubes were then incubated for 10 days under anaerobic conditions.[8].

Lactobacillus sp was obtained from dairy Laboratory University of agriculture, Bogor. The palm oil fronds were chopped into small pieces using a manual chopper and then incubated with the rumen contents and *Lactobacillus sp* for 7 days with addition carbohydrate source

2.2. Experimental design:

The experimental design used was factorial complete randomized design 2x3 with 3 replication each treatment. Factor A was the source of inoculums fermentation, namely A1=. *Lactobacillus sp*, A2= local microorganism resources of rumen content. Factor B was the source of soluble carbohydrates where B1 = without a carbohydrates, B2 = rice bran rice, B3 = tapioca starch. [9]

The variable measured were content of ADF, NDF, cellulose, hemicellulose, lignin, and silica of palm oil fronds.

2.3. Statistical analysis:

All data were subjected to an analysis of variance and significant differences were further tested by Duncan's multiple range test [10]

3. Result and Discussions

Below is the average of fibre fraction content. Table 1. The content of unfermented fibre fractions [6] and Table 2 is the content of the palm frond fibre fraction after fermentation with microorganisms and the addition of different carbohydrate sources.

The fibre fraction contents of the fermented palm oil fronds are presented in Table 1. The experimental results showed that there was interaction ($p<0.05$) between factor A and B on cellulose content. The content of ADF and NDF were affected ($p<0.05$) by factor B (the additional of soluble carbohydrate). Lignin and silica contents were affected by factor B, and No interaction was found on hemicellulose, silica and lignin.

Table 1. The content of Fibre Fraction Palm oil Fronds (% BK)

Fibre fraction	%
ADF	64.03
NDF	76.44
Cellulose	45.44
Hemicellulose	12.41
Lignin	15.34

Table 2. The Content of Fibre Fraction Palm oil Fronds Fermented with Different Microbes and Soluble Carbohydrates Addition (% BK)

Factor A (Microorganisms)	Factor B (the source of carbohydrate soluble) B1	B2	B3	Average	SE
		NDF			
A1	72.32	70.57	61.64	68.18	
A2	69.11	67.00	61.67	65.93	1.84
Average	70.72^{A}	68.78^{A}	61.65^{B}	67.05	
		ADF			
A1	60.18	55.95	49.29	55.14	
A2	58.43	55.08	49.14	54.22	
Average	59.30^{A}	55.51^{A}	49.22$^{\mathbf{B}}$	54.68	
		Cellulose			
A1	48.08^{aA}	44.61^{aA}	29.79^{bA}	40.83	1.78
A2	36.22^{aB}	35.02^{abB}	29.29^{bA}	33.51	
Average	42.15	39.82	29.54	37.17	
		Hemicellulose			
A1	12.15	14.62	12.35	13.04	1.1
A2	10.68	11.92	12.52	11.71	
Average	11.41	13.27	12.44	12.37	
		Lignin			
A1	13.88	12.86	19.50	15.41$^{\mathbf{B}}$	1.3
A2	22.21	20.06	19.86	20.71^{A}	
Average	18.04	16.46	19.68	18.06	
		Silica			
A1	1.36	1.71	1.93	1.67^{B}	
A2	2.67	2.96	3.49	3.04^{A}	
Average	2.02	2.34	2.71	2.35	

Note : A1 = Lactobacillus sp, A2= local microorganism resources of rumen content. B1 = without a carbohydrates, B2 = rice bran, B3 = tapioca, a-c= Significant differences between the rows ($p<0.05$), A-B significant differences between cell

The Duncan's multiple range test showed that the addition of tapioca starch powder caused the lowest value of NDF and ADF (Table 1). There was a decrease in the average of ADF content at level of 15.6% and NDF at level of 11.78% when compared with the previous results.[6]. It was stated that microbial enzymes can reduce the levels of NDF [11]. It was states that the decrease in NDF was caused by the breaking of the lingo-hemicellulose bond during fermentation on the substrate [12]. The results of this study showed a positive correlation between ADF and NDF content, where the more higher the ADF content will be caused more higher NDF content too. It be shown on the figure 1. Feedstuffs with low ADF levels have high energy content [13].

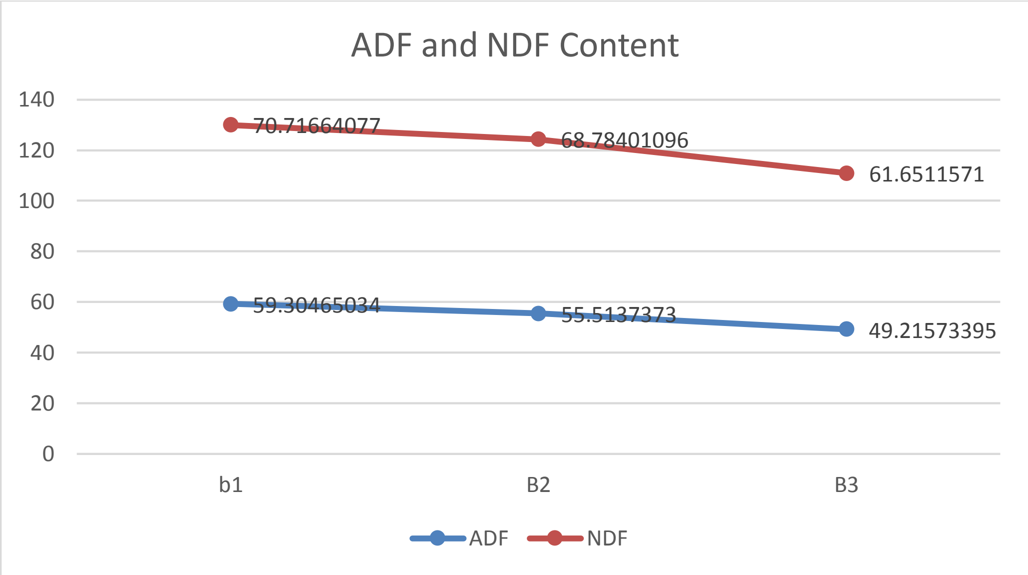

Figure 1. The average ADF and NDF content with effect of addition The Soluble of Carbohydrate (% BK)

DMRT test showed that the highest cellulose content was found in the palm oil frond fermented with *Lactobacillus sp*, without the addition of carbohydrate sources (48.08%) and the lowest in the palm frond fermentation using local microorganism source rumen content with the addition of carbohydrate sources from tapioca starch (29.29%). The results of this studied indicate that the interaction of local microorganism resources of rumen content with carbohydrate sources tapioca starch reduce cellulose content. This indicates that local microorganism resources of rumen content contained cellulolytic microorganisms that could digested fibre. This study agree with the observation of Church et al. [14] who reported that rumen microorganisms of ruminant produced a lot of cellulolytic enzymes so that ruminants could digest and utilize cellulose.

The results of this study Overall showed that the palm frond fermentation with the addition of carbohydrate sources have reduced the content of ADF, NDF, and cellulose, with using local microorganism source rumen contents or lactobacillus, sp. This was because the addition of carbohydrate sources could contribute to the energy needed by microbes. Simanihuruk et al. [15] stated that the fermentation process will succeed when soluble carbohydrates were available for supply energy during the fermentation process. [16] (Harry, 2007). Microbes used the energy for their maintenance, so could improve their performance in degrading the substrate fibre.

The content of NDF, ADF and cellulose in this study was lower compared to Astuti (2015) [6] who fermented palm oil fronds using rumen contents without adding carbohydrate sources. The NDF content of the palm oil fronds was lower than that of the empty bunches palm oil NDF produced by Ref. [17]

The results of further tests on Lignin and Silica content in this study showed different affect ($p < 0.05$) between source of microorganisms in the palm oil fronds fermented. The lower content of lignin and silica palm midrib with fermentation by l *Lactobacillus sp* local microorganisms of rumen contents. maybe produce the enzyme ligninase to reduced lignin content, than *Lactobacillus*,sp. And supply energy from rice brain more soluble than tapioca starch. The average of lignin content palm midrib fermentation by local microorganisms of rumen contents was 15.41%

This was still more higher than Imsya Research 2008 [18] the lignin content palm midrib fermentation by 10.64% of liquid starter.

4. Conclusion
It was concluded that the fermentation of palm oil fronds using local microorganisms resources rumen content and *Lactobacillus* sp. With the addition of the source of soluble carbohydrates could reduce the ADF, NDF, cellulose, and lignin.

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8th International Conference on Sustainable Agriculture, Food and Energy
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