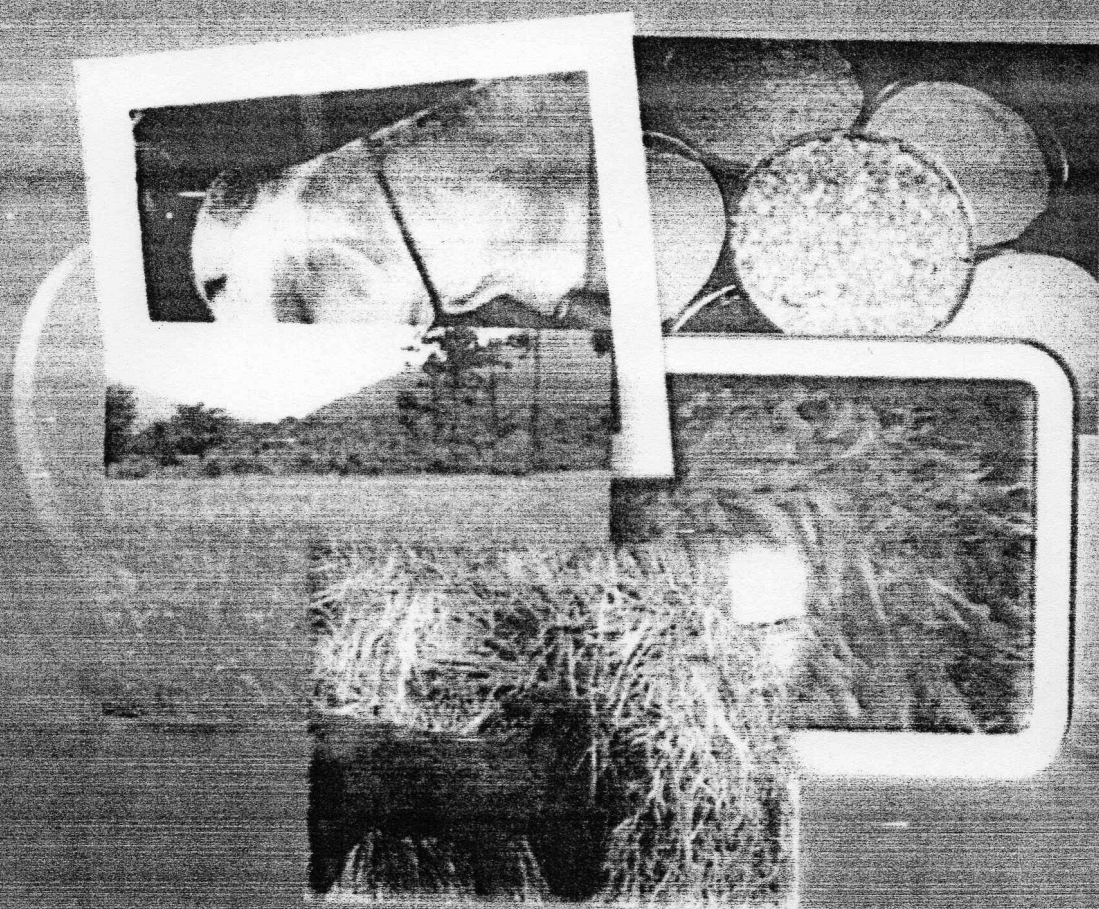


PROCEEDINGS INTERNATIONAL SEMINAR

The 1st International Seminar and the 7th Biennial Meeting
of Indonesian Nutrition and Feed Science Association

EMPOWERMENT OF LOCAL FEEDS
TO SUPPORT FEED SECURITY



Jointly organized by:



FACULTY OF ANIMAL SCIENCE, JENDERAL
SOEDIRMAN UNIVERSITY, PURWOKERTO
INDONESIA



INDONESIAN NUTRITION AND FEED SCIENCE
ASSOCIATION

2010

Proceedings International Seminar

The 1st International Seminar and the 7th Biennial Meeting of Indonesian Nutrition and Feed Science Association (Purwokerto, 18-19 July, 2009)

"EMPOWERMENT OF LOCAL FEEDS TO SUPPORT FEED SECURITY"

First Edition

Purwokerto, 2010

ISBN : 978-979-25-9572-7

Editors:

Ali Agus (Gadjah Mada University)

E. R. Ørskov (Rowett Research Institute-England)

A. R. Alimon (University Putra Malaysia-Malaysia)

Caribu Hadi Prayitno (Jenderal Soedirman University)

Nahrowi Ramli (Bogor Agricultural University)

Juni Sumarmono (Jenderal Soedirman University)

Ning Iriyanti (Jenderal Soedirman University)

Titin Widiyastuti (Jenderal Soedirman University)

Setya Agus Santosa (Jenderal Soedirman University)

Reviewer:

Sri Suhermiyati

Akhmad Sodiq

Suwarno

Nunung Noor Hidayat

Pambudi Yuwono

Jointly Published by:

Faculty of Animal Science, Jenderal Soedirman University (UNSOED)

and

Indonesian Nutrition and Feed Science Association (AINI)

Printed by:

UNSOED-Press

Jl. Prof. Dr. Bunyamin, Grendeng, Purwokerto,

Central Java, INDONESIA 53122

TABEL OF CONTENTS

KEYNOTE PAPERS

Strategy for the development of feed. The Director of Non Ruminant Management, Department of Agriculture of Republic of Indonesia.....	1
Improving feedstuff supply and quantity with an emphasis on plant and animal breeding multiculture and agroforestry. E.R. Ørskov, P.J. Goddard, Kustantinah.....	5
Strategies to meet feed requirement of smallholder beef cattle toward the acceleration of beef self sufficiency program. Marsetyo, Damry, Dahlanuddin, Dicky Pamungkas, Esnawan Budisantoso, Takdir Saili.....	14
Poultry production and the potency of local raw materials usage in Indonesia. Desianto.....	27

FEEDSTUFF PAPERS

The study of use binders on complete feed block processing on physical and chemical quality. Emmy Susanti, Titin Widiyastuti and Munasik.....	37
Fishmeal quality improvement through antihistamine producer bacteria fermentation. Ning Iriyanti, Budi Rustomo, Efka Aris R.	40
Amino acid indexes of earthworm and earthworm meal (<i>Lumbricus rubellus</i>) for animal feedstuff. Ahmad Sofyan, Lusty Istiqomah, Ema Damayanti and Hardi Julendra	44
The effect of transfer of capsulated omega-3 and l-carnitine supplementation on fatty acid concentration of fresh and grilled goat meat. Sudibya, Titin Widiyastuti and R.S. Santoso	49
Improving the in vitro nutrient digestibility of ration based on local waste fermented by rumen liquor and enzyme complex. I Made Mudita, Anak Agung Putu Putra Wibawa, I Wayan Wirawan and Ni Wayan Siti.....	54
The evaluation of nutrient quality of ramie leaf silage and hay in complete mixed ration for etawah-crossbreed goat using in vitro technique. Hutabarat, I.M.L., Mutia, R., Permana, I.G. and Despal.....	55
Study of feedstuff storage durability using carbondioxyde gas. Tri Rahardjo Sutardi.....	56
The utilization of microorganisms cultures as starter in ensilage process to increase organoleptic value and chemical composition of sedge grass (<i>Imperata cylindrica</i>) silage. Ni Gusti Ketut Roni and I Made Mudita	64
Technical effect and drying time on the quality of ramie (<i>Boehmeria Nivea</i> , L. Gaud) leaf hay. N.D. Asti, I.G.Permana, Suryahadi and Despal.....	68
Acid value and amount of microbe of feedstuff supplemented by antimicrobial agent pseudomonas fluorescens strain fncc-070 during storage. Titin Widiyastuti, Nina Hastiani, Sudibya.	73
Performances of lactating dairy cows fed macerated alfalfa forage as part of complete feed. Suwarno..	77
Performances of king grass (<i>Pennisetum purpoides</i>) at fourth defoliation under the influence of urea and manure fertilizers. Eko Hendarto and Suwarno	84
Fermentation technology on high fiber feedstuffs with <i>Aspergillus niger</i> and lab-cellulolytic mixed (c-lab-m) as ducks rations. Ali Agus, Erna Winarti, Ade Wicaksono and Rosita.....	88
Frequency of application organic fluid fertilizer on yield, and nutrition concentration of elephant grass of Thailand variety. Nur Hidayat and Bahrn.....	92
Fermentation of bagasse with <i>Trichoderma viridae</i> and <i>Saccharomyces cereviceae</i> ; it effect on crude fiber and crude protein degradation as in sacco. Nur Hidayat, dan Caribu Hadi Prayitno.....	97

RUMINANT PAPERS

Growth performance of bali cattle bull (<i>bos sondaicus</i>) feed fermented cocoa (<i>Theobroma cacao</i> L.) waste. M. Mastika 1. I.W. Supartha 2. , I.W. Wiranatha and A.W. Puger.....	104
Effect of saponin as defaunating agent on in vitro ruminal fermentation of forage and concentrate Chusnul Hanim, Lies Mira Yusiati and Syamsul Alim.....	105
The use of cellulolytic microbes from cattle rumen fluid to improve in vitro digestibility of fermented robusta coffee pulp (<i>Coffea Canephora</i> Sp.). Lies Mira Yusiati, Chusnul Hanim and Fatimah Az Zahra.....	111
Improving the nutrition quality of complete feeds based on local waste fermented by rumen liquor and enzyme complex. I Made Mudita, Anak Agung Putu Putra Wibawa, I Wayan Wirawan and Ni Wayan Siti.....	112
Dietary supplementation of vitamin e, <i>Andrographis paniculata</i> and turmeric on colour stability of goats meat. M. Karami, A.R. Alimon, A.Q. Sazili and Y.M. Goh	118
Feeding the level of protein in the diet on rumen volatile fatty acids, methane and carbon-dioxide of the male weaned bali calf. Dicky Pamungkas, Hartutik, Kusmartono and N.H. Krishna.....	119
Blood chemical profile of Priangan ram that ca-pufa, i-pufa, zn-proteinat and cu-proteinat administered in feed. Lovita Adriani, U.Hidayat Tanuwiria, and Andi Mushawwi.....	124
Utilization of coconut oil and <i>Hibiscus rosasinensis</i> on in vitro products of fermentation and numbers of protozoa. Suparwi.....	128
Supplementing energy and protein source at different rate of degradability basal diet of corn waste and coffee pod on rumen fermentation kinetic of beef cattle. Dicky Pamungkas, R. Utomo, N. Ngadiyono and M. Winugroho	132
The potency of <i>Jatropha curcas</i> L. seeds waste as protein source in animal feed. Efka Aris Rimbawanto and Iwan Irawan	141
The supplementation of morea plus for increasing performance of Ettawah crossbred goats fed diet containing gliricidia green forage. Siti, Ni W. I G. M. A. Sucipta, I.M. Mudita, I.B.G. Partama and I G.L.O.Cakra.....	147
The rate of body fat and protein deposition in weaned sheep during resumption of full feeding. Satrijo Widi Purbojo and Pambudi Yuwono.....	152
Free fatty acids and rate of glucose utilisation in weaned thin-tailed sheep. Pambudi Yuwono.....	156
Goat production system related to local feed resources in Banyumas Indonesia. Akhmad Sodik	161
The influence of sulfur and ratio of Starbio fermented rice straw and concentrate on rumen fermentation products. F.M. Suhartati and Wardhana Suryapratama	165
Ratio of rice straw treated with urea-cassava waste and concentrate on nutrient utilization of fattening local male cattle. Muhamad Bata	172
Nutrien digestibility in Ongole cross breed cattle fed amoniated rice straw and concentrate from several different sources. Novita Hindratiningrum.....	177
Protein degradation and solubility of <i>Sauropus androgynus</i> (L.) Merr. and <i>Arachis hypogaeae</i> as alternative protein sources for lactating goat. Sri Utami, Muhamad Bata, and Imbang Haryoko.....	183
Effect of seasons on dairy cattle milk quantity and quality of Cepogo KUD members in Boyolali Regency. Triana Yuni Astuti	190
Probiotic for ruminant (study on digestibility and fermentation pattern). Caribu Hadi Prayitno	194
The effect of chitosan level addition on protein feed source on in vitro rumen microbial degradation activity. Ristianto Utomo, Lies Mira Yusiati, and Hendra Herdian.....	198

THE INFLUENCE OF SULFUR AND RATIO OF STARBIO FERMENTED RICE STRAW AND CONCENTRATE ON RUMEN FERMENTATION PRODUCTS

by

F.M. Suhartati and Wardhana Suryapratama
Animal Science Faculty of Jenderal Soedirman University

ABSTRACT

An experiment was conducted to evaluate the influence of sulfur and ratio of Starbio fermented rice straw and concentrate on rumen fermentation products. The method of the experiment was in vitro using Completely Randomized Design 3x3, factorial pattern. The first factor was ratio of Starbio fermented rice straw and concentrate (30:70; 40:60; 50:50), and the second factor was levels of sulfur supplementation (0.0%, 0.4% and 0.8%). Hence, there were nine treatments, and each treatment was replicated three times. Variables measured were the concentration of VFA, N-NH₃ and rumen protein microbial synthesis. Data obtained were analyzed by analysis of variance continued with Orthogonal Polynomial Contrast. The results showed that treatments had no significant influence ($P > 0.05$) on VFA concentration, but ratio of Starbio fermented rice straw to concentrate had highly significant influenced ($P < 0.01$) on N-NH₃ concentration and rumen protein microbial synthesis. Relationship between the ratio of Starbio fermented rice straw to concentrate and N-NH₃ concentration was linear ($Y = 1.977 + 0.095 X$; $r^2 = 0.671$). Relationship between the ratio of Starbio fermented rice straw to concentrate and rumen microbial protein synthesis was also linear ($Y = 1637.36 - 8.33 X$; $r^2 = 0.32$). Because the treatment have no effects on VFA and the highest microbial protein synthesis in the rumen was obtained from rice straw and concentrate ratio of 30:70 added with 0.4% sulfur, so it can be concluded that the best ration can be produced by mixing Starbio-fermented rice straw and concentrate ratio added with 0.4% sulfur at 30:70.

Keywords: Rice straw and concentrate ratio, sulfur, VFA, N-NH₃ and rumen microbial protein.

INTRODUCTION

The performance of ruminant depends on the rate of growing and productivity of rumen microorganism fermenting diet in the rumen and as protein sources for host. The low rate of growing rumen microorganism can limited rate of diet fermentation in the rumen (Bohnert *et al.*, 2002) and decrease rumen fermentation product and finally can decrease digestibility of crude fibre and availability of amino acid. Therefore, it influences growth of ruminant especially they fed forage containing low protein and fed non protein nitrogen only.

The availability of forage (grass) is very limited during the dry season. It is therefore necessary to find an alternative grass substitute that is obtainable the whole year, among others in the form of rice straw. Rice straw production varies, ranging from 12-15 tons per hectare in one single harvest. Overall, rice straw production in Indonesia reaches up

to 128 million tons for an area of 10.7 million hectares (Badan Pusat Statistik Indonesia, 2005). The production displays that rice straw is extremely prospective as animal feed. As an agricultural waste, rice straw has one constraint, i.e. a low digestibility due to its high lignin. The constraint can be prevailed through fermentation using probiotics. Probiotic is a natural additive in the form of living microbes that are able to enhance the digestibility of plant cell walls. Cellulolytic microbes found on probiotics will create enzymes which will help in breaking the lignocellulosic linkage, in order to enhance the digestibility of rice straw (Syamsu, 2003), which in the process will raise VFA, N-NH₃ concentrates and microbic protein synthesis in the rumen fluid.

Probiotic fermentations, besides being able to amplify the digestibility are also capable of increasing the availability of protein

for rumen microbes. To increase protein biosynthesis, which is essential for microbial growth, sulfur can be added. Sulfur is an essential mineral in animal nutrition, lack of nutrient in the diet will cause physiological and metabolic disorders, inhibit rumen microbial protein synthesis, loss of production and can cause death of cattle (NRC, 2001). On the basis of the need for a study of the influence of sulfur and the ratio of starbio fermented rice straw and concentrate on rumen Fermentation products.

Sulfur is an essential mineral in animal nutrition, lack of nutrients in the diet will cause physiological and metabolic disorders inhibit rumen microbial protein synthesis, loss of production and can cause death of cattle (NRC, 2001). Therefore, need for a study of the influence of sulfur and the ratio of starbio fermented rice straw and concentrate on rumen fermentation products.

MATERIALS DAN METHOD

Research Material

Rice straw, Starbio probiotic produced by the Lembah Hijau Multi Farm Surakarta, sulfur (sulfur purified manufactured by Merck), concentrates, rumen fluid from cows which was taken from the slaughter house immediately after slaughtering.

Research Method and Design

The method used was in vitro (methode of Tilley dan Terry, 1963) experiments with Completely Randomized Design, 3x3 factorial patterns. As the first factors were three ratio of rice straw fermentation with concentrate (30:70, 40:60 and 50:50), the nutrient contained in the treatment feed listed in Table 1. Three sulfur levels (0%, 0.4% and 0.8%) was second factor. Each treatment was repeated three times, so there were 27 units of experiment. The nine treatments were:

1. R1 = 30% rice straw fermentation, 70% concentrate + 0,0% sulfur
2. R2 = 30% rice straw fermentation, 70% concentrate + 0,4% sulfur
3. R3 = 30% rice straw fermentation, 70% concentrate + 0,8% sulfur
4. R4 = 40% rice straw fermentation, 60% concentrate + 0,0% sulfur
5. R5 = 40% rice straw fermentation, 60% concentrate + 0,4% sulfur
6. R6 = 40% rice straw fermentation, 60% concentrate + 0,8% sulfur
7. R7 = 50% rice straw fermentation, 50% concentrate + 0,0% sulfur
8. R8 = 50% rice straw fermentation, 50% concentrate + 0,4% sulfur
9. R9 = 50% rice straw fermentation, 50% concentrate + 0,8% sulfur

Table 1. Nutrient content in treatment diet

Treatment Diet	BK (%)	PK (%)	LK (%)	SK (%)	Abu (%)
Straw Fermentation 30%, Concentrate 70%	89.90	10.11	7.49	17.07	12.42
Straw Fermentation 40%, Concentrate 60%	90.03	9.46	5.96	19.26	13.45
Straw Fermentation 50%, Concentrate 50%	90.17	8.82	6.40	21.46	14.49

Table 2. Average VFA concentration (mM) in results of the in vitro experiment

The ratio of rice straw : concentrate	Sulfur Level		
	0.0 %	0.4 %	0.8 %
30:70	153.00 ± 3.61	142.70 ± 3.06	170.33 ± 19.14
40:60	159.30 ± 27.15	158.70 ± 8.08	150.70 ± 32.02
50:50	158.00 ± 12.49	167.00 ± 6.00	156.70 ± 1.15

Measured Variables

- 1) VFA concentration using steam distillation technique (Department of Dairy Science. 1966).
- 2) N-NH₃ concentration using the Conway cup method (Department of Dairy Science. 1966).
- 3) Microbial protein synthesis of rumen fluid using the Zinn and Owens method (1995).

Data Analysis

The data obtained were analyzed using a analysis of variance. Because the ratio of rice straw to concentrate affected the N-NH₃ concentration and microbial protein synthesis of rumen fluid, an orthogonal polynomial test followed subsequently.

RESULTS AND DISCUSSION

Volatile Fatty Acid Concentrations of Rumen Fluid

The average of VFA concentration in rumen fluid ranges from 142.70 ± 3.06 mM to $19.14 \text{ mM} \pm 170.33$ (Table 2). The average was within the range of results of research conducted by Suhartati and Bata (2008), namely from 131 mM to 214.33 mM. Khampa and Wanapat (2006) state that the normal concentration of rumen VFA in cows was 70-130 mM, thus the average VFA concentration in the research result was higher than the normal concentration required to support the ecosystem in the rumen. The high VFA concentration can measure the availability of energy in the form of ATP, although the high concentration of VFA may also be due to lack of absorption of VFA in the in vitro experiments. On ruminants, the VFA formed was absorbed through the rumen walls, then

enter the bloodstream and become the main energy source for body cells.

Based on the results of variance analysis, VFA was not affected ($P > 0.05$) by the balance of rice straw : concentrate, the addition of sulfur and the interaction between the balance of rice straw : concentrate. The essential fatty acids (VFA) were produced by certain bacteria and the amount depends on the number of bacteria in the rumen. Among the VFA components, acetic acid is the most widely produced by almost all types of bacteria, followed by propionate, butyrate and valerat acid. According to Haryanto et al. (2006), VFA composition in general contains 2-carbon (acetate), 3-carbon (propionic) and 4-carbon (butyrate) that has a molar proportion of the near constant 63: 21: 16. However, the content and type of organic material in the diet will cause changes in the molar proportion of short-chain fatty acids.

If in this study measurements of individual VFA were also conducted, there was a possibility of treatment effect. This is because the increased proportion of rice straw fermentation : concentrate caused an increase in crude fiber (Table 1), so although the total VFA were not affected, there was a possibility that the increase in acetic acid concentrations went in line with an increasing proportion of rice straw fermentation : concentrate.

N-NH₃ Concentration in Rumen Fluid

The results show that the average of NH₃-N concentration ranges from 4.7 ± 0.2 mM up to 7.1 ± 0.2 mM (Table 3). The average shows that the rations used for the most part provided ammonia in the rumen fluid in levels that were ideal for microbial rumen growth.

Table 3. Average N-NH₃ concentration (mM) as a result of the in vitro experiment

The ratio of rice straw : concentrate	Sulfur Levels		
	0.0 %	0.4 %	0.8 %
30:70	4.8 ± 0.2	5.3 ± 0.8	4.7 ± 0.2
40:60	6.4 ± 0.7	5.3 ± 0.6	5.3 ± 0.4
50:50	6.9 ± 0.5	6.5 ± 0.4	7.1 ± 0.2

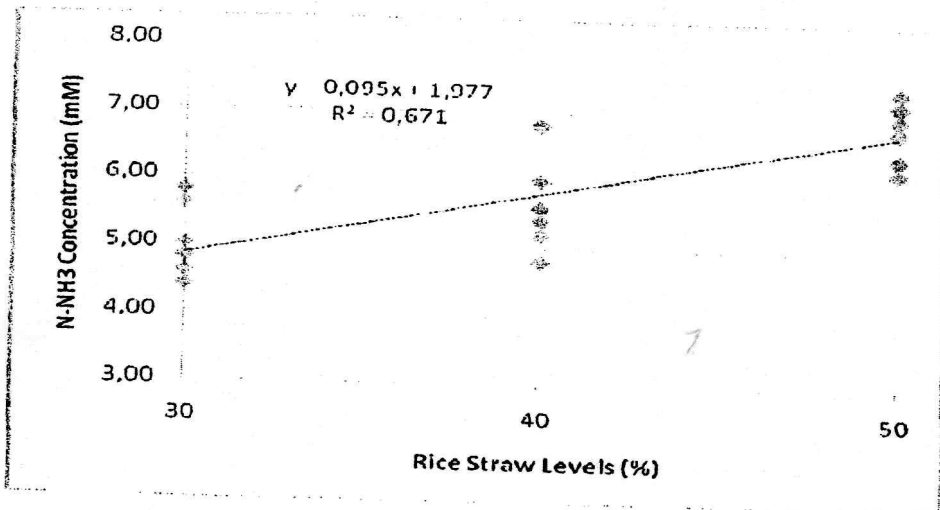


Figure 1. The relationship between rice straw levels in animal diet with N-NH₃ concentration in rumen fluid

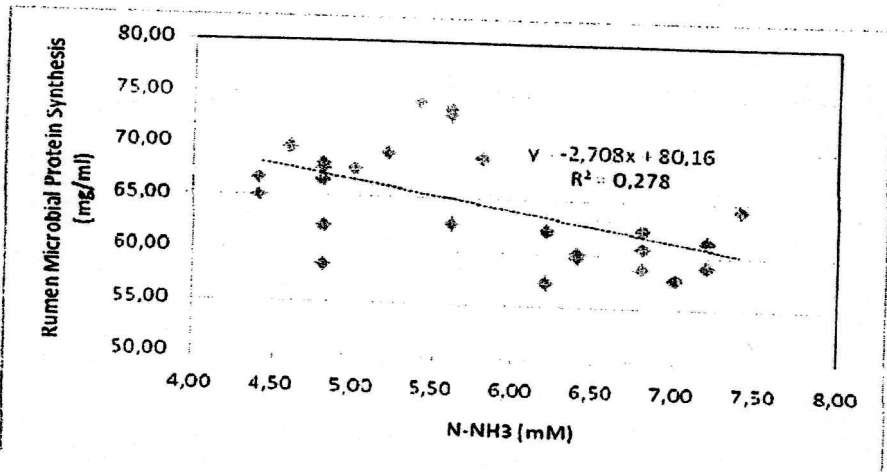


Figure 2. The relationship between N-NH₃ concentration with microbial protein synthesis in rumen fluid

According to Khampa and Wanapat (2006), the optimal rumen N-NH₃ to improve rumen ecology, microbial protein synthesis and the digestive capability of feed, is in the range of 15-30 mg/dl. Ammonia, both originating from the protein/peptide/amino acids or from non-protein nitrogen (NPN) such as urea, is the main precursor of nitrogen for microbial protein synthesis and an essential element for the growth of various rumen bacteria species (Dewhurst et al., 2000).

An analysis of variance shows that the balance of rice straw fermentation and

concentrates highly significant effect ($P < 0.01$), while the addition of sulfur and the interaction between the proportion of fermented rice straw and concentrate and the addition of sulfur had no effect ($P > 0.05$) on the average N-NH₃ concentration in rumen fluid. Based on an orthogonal polynomial test, the balance of rice straw: concentrate demonstrates a linear effect and according to a linear regression test equation $Y = 1.977 + 0.095 X$, coefficient of determination ($r^2 = 0.671$) (Figure 1) was obtained. Increasing concentrations of N-NH₃ in line with the

Increased level of fermented rice straw did not mean that a diet was more fermentable or more capable of providing N-NH₃, but precisely because the N-NH₃ was not utilized by rumen microbes for its protein synthesis.

Figure 2 shows that the decrease in rumen microbial protein synthesis was in line with the increasing N-NH₃ concentration of rumen fluid, with the equation $Y = 80.16 - 2.708 X$, coefficient of determination (r^2) = 0.278. The increased level of rice straw led to the less utilization of N-NH₃ by rumen microbes for its protein synthesis, as due to the increased amount of hay causes decreased of concentrates. In other words, reducing the supply of fermentable carbohydrates, and ultimately decreasing the amount of microbial protein synthesis.

Rumen Microbial Protein Synthesis

The average rumen microbial protein synthesis ranges from 58.25 ± 1.29 mg/ml to 69.74 ± 3.47 mg/ml (Table 3). The results show that rumen fluid that was fed with a balance of rice straw : concentrate 30:70 plus 0.4% sulfur produced the highest microbial protein synthesis. The high level of microbial protein synthesis was very profitable to the animal host. According to Vlaeminck et al. (2005), the protein available to ruminantias comes from the duodenal absorption supplied by bypass feed protein, the secretion of endogenous proteins and microbial proteins. Supply of microbial protein reaches 59% of the protein that are available to be absorbed. Microorganisms in the rumen degrade nutrients to produce VFA and microbial protein synthesis, as a source of energy and protein for ruminants (Calsamiglia et al., 2007).

An analysis variance influences of treatment on rumen microbial protein synthesis indicated that the balance of rice straw: concentrate obviously affected the microbial protein synthesis. Based on the orthogonal polynomial test the response took a linear form and a regression test produced the equation $Y = 81.10 - 0.416 X$, coefficient of determination (r^2) = 0.48 (Figure 2).

As described previously, the increased level of rice straw led to less rumen microbes utilizing N-NH₃ for their protein synthesis, as increased level of rice straw led to the decreased of concentrate amount; in other words, reducing the supply of carbohydrates and ultimately the amount of protein synthesis decreased. The fact was in accordance with Ginting's (2005) opinion, which stated that the process of nutrient transformation into microbial protein requires an optimal rumen environment and conditions for microbial growth, including the availability of nutritional substances in the number, composition and time. N compounds, carbohydrates, vitamins, minerals, co-factors and various growth factors is an element of rumen microbial growth, but N compounds and carbohydrate are required in large numbers, and must be available simultaneously to encourage the rapid growth of microbes; in other words, there must be synchronization between the degradation of proteins (N) and energy (carbohydrates). The definition of synchronization can be associated with a positive-associative relationship, i.e. the increasing nutrient utilization when combined with other nutrients at the right time and amount. In connection with the rumen microbial nutrients, the nutrient that plays a central role is carbohydrate and protein (compound N). With few exceptions, rumen microbes generally use only carbohydrates as the energy source for growth. Carbohydrates are also needed as a source of carbon atoms (C) to form the framework of rumen microbial protein structures. Energy and carbon atoms (C) for microbial protein synthesis are derived from the degradation of carbohydrates. As a supplier of amino groups, ammonia is the primary as a result of protein degradation, a degradation of non-protein nitrogen compounds (NPN) in the animal feed material or a degradation of recycled urea. The degradation process of energy-producing substrate as well as the protein synthesis process by microbes is difficult to separate.

Table 4. The average of microbial protein synthesis in rumen fluid (mg/ml) as a result of the in vitro experiment

The ratio of rice straw : concentrate	Sulfur Levels		
	0.0 %	0.4 %	0.8 %
30:70	68.53 ± 1.01	69.74 ± 3.47	66.42 ± 1.34
40:60	62.46 ± 0.14	64.48 ± 4.06	68.61 ± 8.78
50:50	61.73 ± 2.26	58.25 ± 1.29	59.71 ± 1.48

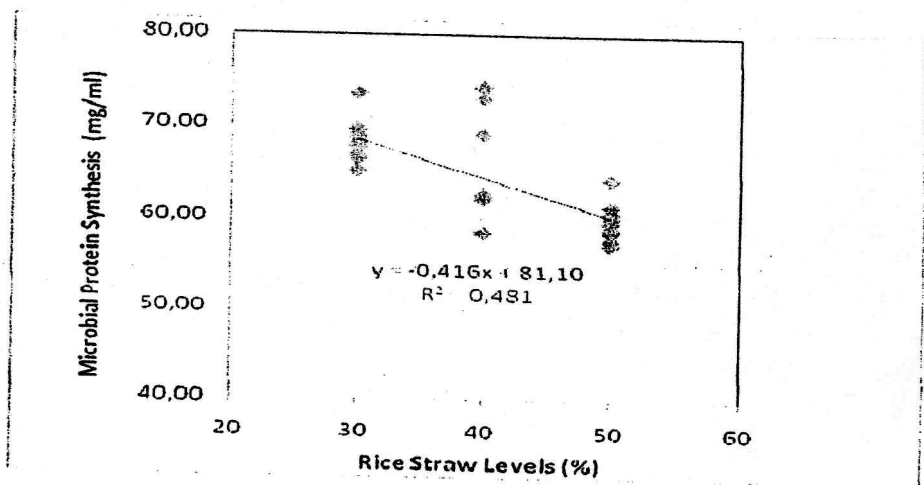


Figure 3. The Relationship between Rice Straw Levels in Animal diets with Microbial Protein Synthesis in Rumen Fluid

Microbial growth is supported by substrate fermentation, whereas substrate fermentation is done through microbial growth. This is no different from the opinion of Griswold (2003), who states that the rumen microbial growth depends on the availability of nitrogen in the form of peptides, amino acids and N-NH₃. Microbial protein synthesis contributes 59% of amino acids that enters into the small intestine besides amino acids that are not degraded, and will complement the amino acid requirements of cattle to produce more quickly (Sniffen et al., 2004).

CONCLUSION

Rumen fluid which obtained diet a balance of rice straw: concentrate 30:70 added 0.4% sulfur produces the highest microbial protein synthesis.

ACKNOWLEDGMENT

The author wishes to thank and appreciate the Directorate General of Higher Education which gave the funds through the National Strategic Research Grant for Fiscal Year 2009. Also to the Rector and Unsoed Research Institute, both facilitated and evaluated the proposal so that it is able to obtain a grant.

REFERENCES

- Badan Pusat Statistik Indonesia. 2005. *Potensi lahan Pertanian Indonesia*. BPS. Jakarta.
- Calsamiglia, M. Busquet, P. W. Cardozo, L. Castillejos, and A. Ferret. 2006. *Invited Review : Essential Oils as Modifiers of Rumen Microbial Fermentation*. *J. Dairy Sci.* 90:2580-2595.

- Department of Dairy Science. 1966. *General Laboratory Procedures*. University of Wisconsin. USA
- Dewhurst R. J., Davies D.R. and Merry R. J. 2000 Microbial protein supply in the rumen. *Animal Feed Science and Technology* 85: 1-2
- Ginting, S. P. 2005. Sinkronisasi Degradasi Protein Dan Energi Dalam Rumen Untuk Memaksimalkan Produksi Protein Mikroba. *Wartazoa* Vol. 15 :1-10
- Griswold, K. E., G. A. Apgar, J. Bouton and J. L. Firkins. 2003. Growth, Digestibility, and Fermentation in Continuous Culture. Effects of Urea Infusion and Ruminant Degradable Protein Concentration on Microbial. *J Anim Sci*. 81:329-336
- Haryanto, B., A. Thalib, Supriyati dan S. N. Jarmani. 2006. Karakteristik Rumen Domba Yang Diberi Pakan Jerami Padi Fermentasi Dengan Suplementasi Vitamin A Intramuskuler Pada Waktu Yang Berbeda. *Seminar Nasional Teknologi Peternakan dan Veteriner 2006*
- Khampa, S. and M. Wanapat. 2006. Supplementation Levels of Concentrate Containing High Levels of Cassava Chip on Rumen Ecology and Microbial Protein Synthesis in Cattle. *Pakistan Journal of Nutrition* 5(6):501-505.
- NRC. 2001. Nutrient Requirements of Dairy Cattle. 7th rev. ed. National Academy Press, Washington, DC.
- Sniffen, Durand, Ordanza and Donaldson. 2004. Predicting the Impact Of a Live Yeast Strain on Rumen Kinetics and Ration Formulation. Global Dairy Consultancy.Co. (On-line)
- <http://www.animal,cals,arizona.edu/swnmc/papers>. Diakses tanggal 12 Desember 2004.
- Steel, R.G.D and J.H. Torrie. Prinsip dan Prosedur Statistika. Suatu Pendekatan Biometrik. Edisi kedua. Diterjemahkan oleh Sumantri, B. 1993. PT Gramedia Pustaka Utama, Jakarta.
- Suhartati, F. M. dan M. Bata. 2008. Uji Banding Minyak Kedelai, Minyak Biji Bunga Matahari Dan Minyak Wijen Sebagai Sumber Asam Linoleat Dalam Biosintesis *Conjugated Linoleic Acid*. *Laporan Penelitian Fundamental* (tidak dipublikasikan). Fakultas Peternakan, UNSOED. Purwokerto.
- Syamsu, J.A. 2003. Kajian Fermentasi Jerami Padi dengan Probiotik sebagai Pakan Sapi Bali di Sulawesi Selatan. *Jurnal Ilmu Ternak*. 2003. Vol.3(2). Fakultas Peternakan Universitas Padjadjaran, Bandung (On-line). <http://jasmal.blogspot.com/2007/12/kajian-fermentasi-jerami-padi-dengan.html>
- Tilley, J. M. A. and R. A. Terry. 1963. A Two Stage Technique for the in vitro of forage crops. *Jurnal of the British Grassland Society*. 18(2):104
- Vlaeminck, B., C. Dufour, A. M. van Vuuren, A. R. J. Cabrita, R. J. Dewhurst, D. Demeyer, and V. Fievez. 2005. Use of Odd and Branched-Chain Fatty Acids in Rumen Contents and Milk as a Potential Microbial Marker. *J. Dairy Sci*. 88:1031-1042
- Zinn, R. A. and F.V. Owens. 1995. A Rapid Procedure Purine Measurement and its Use for Estimating Net Ruminant Protein Synthesis. *Can.J.Anim.sci*. 66:157-166.



CERTIFICATE OF PARTICIPATION



This certificate is presented to :

Prof. Dr. Ir. FM Suhartati, MP.

For having participated in

"EMPOWERMENT OF LOCAL FEEDS TO SUPPORT FEED SECURITY"

THE 1st INTERNATIONAL SEMINAR AND THE 7th BIENNIAL MEETING OF INDONESIAN NUTRITION AND FEED SCIENCE ASSOCIATION (AINI)

Purwokerto, July 18-19, 2009

Organized by :

Indonesian Nutrition And Feed Science Association (AINI)

In cooperation with

Faculty of Animal Science, The University of Jenderal Soedirman (UNSOED)



Prof. Dr. Ir. Mas Yedi Sumaryadi, MS
Dean of Faculty of Animal Science



Dr. Ir. Sri Suhermiyati, MS
Chair of Organizing Committee



Dr. Ali Agus, DAA, DEA
Chairman of AINI