PRODUCTIVE PARAMETERS OF GROWING SHEEP GIVEN THE PROCESSED PITH RATION

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ABSTRACT

Sixteen local breed growing sheep (12 months old; 15 ± 1.11 kg BW) were used to examine the effect of feeding processed pith on productive parameters of sheep. Piths were ammoniated (10% urea) and then were fermented for three weeks by mixed microbes (T_0 : 0% mixed microbes; T_1 : 0.5% mixed microbes T_2 : 1% mixed microbes and T_3 : 1.5% mixed microbes). Sheep were fed the rations those contained 70% elephant grass and 30% processed pith. The examined productive parameters of sheep were dry matter and organic matter digestibility, dry matter consumption, nitrogen consumption, total digestible nutrient, nitrogen retention and average daily gain.Dry matter and nitrogen consumption of sheep were increased ($P<.05$) by feeding T_1, T_2 and T_3 rations compared to those of feeding T_0 ration. Total digestible nutrient and in vivo digestibility of the pith ration were increased ($P<.05$) as the level of mixed microbes increased. Amount of nitrogen retention in sheep were increased ($P<.05$) by feeding processed pith. Daily body weight gain were higher ($P<.05$) in sheep given the processed pith rations than that of given pith ration. Though the daily body weight gain of sheep were not significantly influenced by the level of mixed microbes addition, there was a significant different ($P<.05$) between the effect of feeding T_1 ration and T_3 ration on daily body weight gain of sheep. The processed pith could substitute partly the amount of *Pennisetum purpureum* given in the ruminant ration.

Key words: Processed pith, Productive parameters, Sheep

INTRODUCTION

Availability of feedstuff is one of the factor that important in effort of animal husbandry development. Productions of green forage as main feedstuff for ruminants were limited. This is due to limiting land for green forage caused by development in land for food plant. Agriculture by-product was potential to fulfill the requirement of fibrous feed for ruminants. Pith is one of abundance sugarcane industries by-product, and these potential to be used as the source of alternative fibrous feedstuff. However, pith having limiting factor to be used as feedstuff for ruminants. The residues are low in readily available energy, nitrogen, minerals and vitamins and no provide in adequate amounts of nutrients even to maintain the animal body because of their low intake and digestibility (Singh and Oosting, 1993). Pith has low digestibility because of its lignocellulose and lignohemicellulose linkage, and low protein. To improve pith quality as feedstuff for ruminants, it is needed treatments such as physical, chemical, biological and/or its combination treatment. Combination treatments such as ammoniation (physical) and fermentation can be used to increase the nutritive value of pith.

Pith produced from the moist and wet depithing system. Pith produced from moist depithing system still can be used as a fuel, but if produced from wet depithing process, it is usually cannot be used as fuel. Pith consists of soft parenchyma tissue and cannot be used in the paper making process. According to Wardhani *et al.* (1984), pith has to be separated from the fiber and is considered useless. Pith production can be 30% of the whole bagasse (Kwie, 1967). The nutritive value of pith were 45.15% dry matter, 5.23% ash, 2.79% crude protein and 37.54% crude fiber (Gohl, 1981). Pith can be used up to 12-

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15% in beef cattle diets (Paturau, 1982). Like most crop residues, pith has a low dry matter digestibility and crude protein content. Inexpensive and practical pre-treatment method can be used to increase the nutritive value of pith.

Chemical treatment of agriculture by-product with alkali reagents, to increase the utilization of energy by ruminants, is aiming at loosening the interrelative structures of the fiber constituing components (Bruchem dan Soetanto, 1987). The reagents mainly act by saponification of ester bonds between acetic and phenolic acids in lignin thus degrading its three-dimensional structure. Also the uronic acid bounds between lignin and hemicellulose undergo hydrolysis. As a results of this, both hemicellulose and cellulose become more accessible for microbes, partly also as a result of swelling of these substances due to the alkali treatment and subsequent loss of the crystalline structure. Ammoniation is one of alkali treatment that can dissolve hemicellulose, urinoic acid and ester acetic acid saponification, neutralize free nitric acid and reduce lignin cell wall content (Theander and Aman, 1984). Komar (1984) stated that advantages of ammoniation treating straw compare to other chemical treatment were easily in handling, cheaper, higher in increasing crude protein, energy content and intake, more palatable, and gave no pollution in soil. There are three sources of ammonia can be used in treating straw, i.e.: 1) NH_3 in gas and solution, 2) NH_4OH in solution and 3) urea. Urea is an inexpensive material and being fast hydrolyzed to form NH_3 (Schiere and Ibrahim, 1989). Urea is a more readily available source of ammonia to farmers in the developing countries (Saadullah *et al.*, 1981 cited by Doyle *et al.*, 1986). Urea as a source of ammonia more easily handle and have a little risk to the human health during its handling (Sundstol and Coxworth, 1984). Urea has been found to be the most suitable source of ammonia for treating agriculture by-product to increase feeding value because of its ready availability, familiarity of farmers with its transport, storage and application in addition to its good effect on intake, digestibility, growth and milk production (Sharma *et al.*, 1993). Ammonia fixated in material tissue and increase crude protein content. However, non-fixated ammonia will swallow the linkage between lignin and hemicellulose and cellulose. Effectivity of ammoniation treating straw depends on ammoniation dosage, treatment temperature, duration of treatment, moisture content of fibrous feedstuff and source of urease (Jayasuriya and Perera, 1983). Under adequate moisture content and suitable temperature conditions, microbe which produce urease are capable of degrading urea with the formation of ammonium compounds, such as ammonium carbonate, bicarbonate or hydroxide, which then permeate through the straw. Urea-ammonia pre-treatment has been found to rice straw from submaintenance to a maintenance diet for cattle and buffaloes. Ibrahim *et al.* (1984) as cited by Doyle *et al.* (1986) reported that the mechanisms involved have been an increase in straw intake, an increase in digestibility and in some experiments increase both straw intake and digestibility. Jayasuriya and Perera (1983) have shown that urea treatment increases the feeding value of straw by increasing digestibility and intake.

There has been an increasing interest in biological conversion of lignocellulose materials using microorganism and most of the biological treatments are aimed at production of microbial protein (Han and Anderson, 1975). Various attempts have been made to improve agricultural residue quality for animal feeding, or to use by-products of microbial processes on agricultural residue as animal feed. It is essential to remember that these processes have divergent goals, ranging from production of single cell protein for monogastric nutrition, via use of spent agricultural residue after mushroom production to increase of digestible energy value of agricultural residue (Gupta *et al.*, 1993). Zadrazil (1984) reported that white rot fungi have receive most attention for improving the digestibility of lignocellulosic materials because of their ability to degrade lignin in solid substrate medium or in solid state fermentation (SSF) system. Rai *et al.* (1987), using fermented straw with *Coprinus fimetarius* as sole diet in goats, reported that in vivo digestibility of different nutrients

Table 1. Results Mean of Experiment

No.	Parameters	Treatments			
		T_0	T_1	T_2	T_3
1	DM digestibility (%)	49.49^a	51.70^b	52.83^c	53.84^d
2	OM digestibility (%)	50.18^a	53.49^b	56.21^c	57.67^d
3	DM consumption (g/head/day)	38.14^a	443.68^b	447.95^b	453.55^b
4	N consumption (g/head/day)	5.16^a	6.94^b	7.03^b	7.22^b
5	TDN (%)	48.77^a	51.69^b	53.88^c	55.13^d
6	N retention (g/head/day)	1.09^a	1.19^b	1.20^b	1.22^b
7	ADG (g/head/day)	32.32^a	33.04^{ab}	34.29^{bc}	35.00^c

Different superscripts indicate significant difference between means within a row (P<.05)

either declined or remained equal with the control.

MATERIALS AND METHODS

Research was conducted in Animal Science Faculty, Diponegoro University. Materials used in this research were 16 heads of local goats (12 months, average body weight 15 ± 1.11 kg), pith, urea as a source of ammonia, mixed microbe from Budi Mix Farming (BMF), *Pennisetum purpureum*, and molasses. Pith ammoniated using urea (10% urea) and aged during 3 weeks. Ammoniated pith, then, fermented using BMF mixed microbe and aged during 3 weeks. Treatments examined in this research were:

T0 = Pith + 10% urea
T1 = Pith + 10% urea + 0.5% BMF microbe
T2 = Pith + 10% urea + 1.0% BMF microbe
T4 = Pith + 10% urea + 1.5% BMF microbe

Ration given to the experimental animal contained 70% *Pennisetum purpureum* and 30% pith. Molasses was added in the ration to increase its palatability.

The examined productive parameters of sheep were dry mater (DM) and organic matter (OM) digestibility, DM consumption, nitrogen (N) consumption, total digestible nutrient (TDN), N retention and average daily gain (ADG). Completely randomized design (CRD) and Duncan multiple range test (DMRT) were used to analyze the data.

RESULTS AND DISCUSSION

Result means of the experiment are described in Table 1.

Dry matter (DM) and organic matter (OM) digestibility of T_1, T_2 and T_3 ration were higher (P<.05) than T_0 ration. The increased level of mixed microbe addition in the fermentation of pith more enhanced DM and OM digestibility of sheep ration. The addition of mixed microbes on fermentation process of pith outside the rumen may alter fibre structure of pith. Lignocellulosic and lignohemicellulosic compounds are degraded to more simple components by mixed microbes which in turn increasing digestibility of fermented pith in the rumen. There were significant different among DM and OM digestibility and TDN of T_1, T_2 and T_3 ration. The combined process of ammoniation and fermentation on pith (T_1, T_2 and T_3 ration) may result bioconversion of some components in pith. Availability of nitrogen and weakness in crystal bound of lignocellulose resulted from pre-treatment of ammoniation may enhance activity of mixed microbes more effectively to degrade fibre component or to convert OM. Therefore, TDN of ration increased according to level of mixed microbes addition on T_1, T_2 and T_3 treatment.

The increased of feed digestibility may increase feed consumption of sheep because the time retention of feed in the rumen become shorter which in turn affected the particle of feed removed from the rumen more rapidly. The feed consumption of sheep given T_1, T_2 and T_3 ration were higher ($P<.05$) than that of given T_0 ration (see Table 1). In addition, the increased of DM consumption was accompanied by the increased of N consumption in feed. The increased of N consumption in feed was related to higher content of crude protein in ration. The higher N content in the ration was accompanied by the higher addition of mixed microbes in fermentation process.

Fermented pith increased ($P<.05$) amount of N retention in sheep. Sheep given T_1, T_2 and T_3 ration had higher N retention than those of T0 ration (see Table 1). The increased of N consumption may enhance the amount of N absorption from gastro-intestinal which in turn increased N retention. The increased of N retention indicated a protein gained in body tissue. This was shown by an increase in the production variable of ADG. The ADG of sheep were 32.32; 33.04; 34.29 and 35.00 g/head/day, respectively for T_0, T_1, T_2 and T_3 ration. The ADG of sheep were higher ($P<.05$) when given on T_3 ration than that of T_0 ration, though there were no significant different in ADG of sheep between T_0 and T_1, T_1 and T_2, and T_2 and T_3 treatments.

The growth of body tissue needs energy from TDN despite of N from protein. The higher N availability in T_1, T_2 and T_3 ration than that of T_0 ration needed more energy for activity of body tissue biosynthesis. This phenomenon was indicated by unconformity results of feed digestibility, TDN and N retention pattern.

CONCLUSIONS

In conclusion, feeding of mixed microbes-fermented pith could increase DM and OM consumption, DM and OM digestibility, N retention and ADG in sheep.

REFFERENCES

Bruchem, J.V., and H. Soetanto. 1987. Utilization of fibrous crop residues - associative effect of supplementation. In : M. Soejono, A. Musofie, R. Utomo, N.K. Wardhani and J.B. Schiere (Eds.). Crop Residues for Feed and Other Purposes. *Proceedings Bioconversion Project Second Workshop on Crop Residues for Feed and Other Purposes*, Grati.

Doyle, P.T. C. Devendra and G.R. Pearce. 1986. *Rice Straw as Feed for Ruminants*. International Development Program of Australian Universities, Canberra.

Gohl, Bo. 1981. Tropical Feeds. *Feed Information Summaries and Nutritive Value*. Food and Agricultural Organization of The United Nations, Rome.

Gupta, B.N., G.P. Singh and K. Singh. 1993. Biological treatment of lignocellulosics as feed for animals - an overview. In : K. Singh, T.W. Flegel and J.B. Schiere (Eds.). Biological, Chemical and Physical of Fibrous Crop Residues as Animal Feed. *Proceedings of An International Workshop Held on 20 - 21 January 1987 in New Delhi*, India.

Han, Y.W., and A. W. Anderson. 1975. Semi solid fermentation of rye grass straw. *Appl. Microbiol.*, 30:930-934.

Jayasuriya, M.C.N., and H.G.D. Perera. 1983. Urea, ammonia treatment of rice straw to improve its nutritive value for ruminants. *Agric. Wastes.*, 4:143.

Komar, A. 1984. *Teknologi Pengolahan Jerami sebagai Makanan Ternak*. Yayasan Dian Grahita, Bandung.

Kwie, O.A. 1967. Pembuatan kertas dari bahan ampas tebu. *Majalah Perusahaan Gula*. No. 1 (2).

Paturau, J.M. 1983. By-product of The Cane Sugar Industry. *Elsevier Sci. Publ.*, Amsterdam.

Rai, S.N., T.K. Walli and B.N. Gupta. 1987. Investigations on fungal treatment of rice straw and its evaluation as sole feed for cross-bred goats. In : K. Singh, T.W. Flegel and J.B. Schiere (Eds.). Biological, Chemical and Physical of Fibrous Crop Residues as Animal Feed. *Proceedings of An International Workshop Held on 20 - 21 January 1987 in New Delhi*, India.

Rai, S.N., J. de Witt, V.C. Badve and T.K. Walli. 1993. A model to optimize energy intake of ruminants from biologically treated crop residues. In : K. Singh and J.B. Schiere (Eds.). Feeding of Ruminant on Fibrous Crop Residues. *Proceedings of An International Workshop Held at The National Dairy Research Institute.* Karnal, India.

Singh, G.P., and S.J. Oosting. 1993. Nutritive value of straw. In : K. Singh, T.W. Flegel and J.B. Schiere (Eds.). Biological, Chemical and Physical of Fibrous Crop Residues as Animal Feed. *Proceedings of An International Workshop Held on 20 - 21 January 1987 in New Delhi*, India.

Sharma, O.O., D.V. Rangnekar and M. Singh. 1993. Physical and chemical treatment of fibrous crop residues to improve nutritive value - a review. In: Biological, Chemical and Physical of Fibrous Crop Residues as Animal Feed. K. Singh, T.W. Flegel and J.B. Schiere (Eds.). *Proceedings of An International Workshop Held on 20 - 21 January 1987 in New Delhi*, India.

Schiere, J.B., and M.N.M. Ibrahim. 1989. Feeding of urea-ammonia treated rice straw. *A Compilation of Miscellaneous Report Produced by The Straw Utilization Project*, Srilanka.

Sundstol, F., and E.M. Coxworth. 1984. *Ammonia Treatment. Department of Animal Nutrition.* Agricultural University of Norway, Norway.

Theander, P., and O. Aman. 1984. Anatomical and chemical characteristics. In : F. Sundstol and E. Owen (Eds.). Straw and Other Fibrous By-product as Feed. *Elsevier Sci. Publ., Amsterdam.* Pp.:45-75.

Wardhani, N.K., S. Tedjowahjono dan A. Musofie. 1984. Empulur ampas tebu sebagai pengganti onggok dalam ransum sapi potong. *Buletin BP3G* No. 98.

Zadrazil, F. 1984. Microbial conversion of lignocellulosic into feed. In : F. Sundstol and E. Owen (Eds.). Straw and Other Fibrous By-product as Feed. *Elsevier Sci. Publ., Amsterdam.* Pp.:45-75.