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DIGESTIBILITY AND RETENTION N RICE STRAW FERMENTATION WITH INOCULUM BACTERIA AND FUNGI CELLULOLYTIC IN SHEEP

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ABSTRACT

This research aim is to know the effect of rice straw fermentation utilizing, using inoculum bacteria and fungi cellulolytic in sheep towards digestibility and retention N. The research was the main research, using 20 local sheep which were divided into 4 treatments with 5 replications. P0: rice straw + 3% urea + 3% molasses + without isolate, P1 isolate bacterium of *Acetobacter liquefaciens*, P2 isolate yeast of *Geotrichum* sp, and P3 isolate *Acetobacter liquefaciens* and *Geotrichum* sp. The data analyzed by the Variant Analysis and for the difference of mean among treatment, tested with the Duncan`s Multiple range Test. The result of the main research was local sheep given feed of rice straw which fermentated by bacterium suspension of *Acetobacter liquefaciens*, yeast of *Geotrichum* sp., and the mixture of *Acetobacter liquefaciens* and *Geotrichum* sp. were able to improve (a) crude fiber, crude protein, organic matter, NDF, and ADF digestibility, but was not have significant effect on (P>0.05) N-balance

INTRODUCTION

Supplying of forage, play an important role and become the elementary problem in development of ruminant livestock. The use of agriculture waste like sugar cane top, rice straw, and corn straw is often made as alternative livestock feed by breeder to overcome the insufficiency of forage. Among the waste of food crop, rice straw play an important thing, beside it is easy to get especially in lowland area, its abundance amount at the time of harvesting. But, as the feed of livestock, rice straw have some insufficiency as its protein rate is too low (3-5% dry matter), the high crude fiber reach 20 - 41,5 % dry matter, and low digestibility, having the character spacions, and also low volumtary feed intake by livestock.

The use of rice straw as livestock feed needs a pretreatment as a mean to improve the nutrition value. One way which can be conducted is by exploiting cellulolytic bacterium and cellulolytic fungi and to conduct the supplementation of substance feed of protein source is well to increase the synthesis protein of rumen microbe, as digestibility of ruminant is very depend on kinds and population of rumen microbe

To demote crude fiber degree in straw, it's very needed the part of livestock woof technologies. Cellulolytic bacterium and cellulolytic fungi utilization as inoculum supposed can demote the crude fiber, because cellulolytic bacterium and cellulolytic fungi producing cellulase enzyme that impersonate in cellulose solution.

This research aim is to know the effect of rice straw fermentation utilizing, using inoculum bacteria and fungi cellulolytic in sheep towards digestibility and retention N. Based on the background that elaborated, it can be formulated troubleshoot as follows: Is gift rice straw which is inoculated by suspension bacteria *Acetobacter liquefaciens*, *Khamir geotrichum* sp. with mixture *Acetobacter liquefaciens* and *Geotrichum* sp. from giraffe's feces can increase the digestibility value of Dry Matter, Crude Fiber, Crude Protein, Organic Matter, NDF, ADF, and Nitrogen retention in sheep?

MATERIALS AND METHODS

The research was the main research, using 20 local sheep which were divided into 4 treatments with 5 replications. P0: rice straw + 3% urea + 3% molasses + without isolate, P1 : rice straw + 3% urea + 3% molasses + with isolate bacterium of *Acetobacter liquefaciens*, P2 : rice straw + 3% urea + 3% molasses + with isolate yeast of *Geotrichum sp*, and P3 : rice straw + 3% urea + 3% molasses + with isolate *Acetobacter liquefaciens* and *Geotrichum* sp. The data analyzed by the Variant Analysis and for the difference of mean among treatment, tested with the Duncan`s Multiple range Test.

RESULTS AND DISCUSSION

The result of the main research was local sheep given feed of rice straw which fermented by bacterium suspension of *Acetobacter liquefaciens*, yeast of *Geotrichum* sp., and the mixture of *Acetobacter liquefaciens* and *Geotrichum* sp. were able to improve (a) crude fiber, crude protein, organic matter, NDF, and ADF digestibility, but was not have significant effect on (P>0.05) N-balance.

In table 1, based on the variant analysis towards rice straw gift treatment which fermented by suspension isolate bacteria *Acetobacter liquefaciens, Khamir geotrichum* sp with mixture isolate bacteria *Acetobacter liquefaciens* and *Khamir geotrichum* sp. showed different result ($p<0.05$) for the digestibility variable of Dry Matter, Crude Fiber, Crude Protein, Organic Matter, NDF, and ADF. While for retention N, it showed a result which is not differ real ($p>0.05$)

Stipulating the digestibility of feed that include the digestibility of dry matter, crude fiber, crude protein, organic matter, neutral detergent fiber (NDF) and acid detergent fiber, done using the collection total method (Harris, 1970). Isolate bacteria *Acetobacter liquefaciens, Khamir geotrichum* sp, with mixture isolate bacteria *Acetobacter liquefaciens* and *Khamir geotrichum* sp. suspension gift treatment can increase the digestibility of Dry Matter, Crude Fiber, Crude Protein, Organic Matter, NDF, and ADF.

According to McDonald *et al.* (1989), digestion is a complex compound severance which is difficult to dissolves to be simple compound which is easy dissolve and producing energy. According to Ensminger and Olentine (1978) marginally manner decides energy is divided in two way, that is total nutrient digestible or total digestible nutrients (TDN) and system calorie. TDN is the quantifying from digestible Crude Protein, digestible Crude Fiber, digestible ETN, and digestible EE, multiplying 2.25; while calorie is energy unit. According to Utomo and Soejono (1988), feed that contain low EE like rice straw, the TDN can be equaled with digestible organic ingredient (BOT). According to Cullison (1979), feed digestible nutrient countable from nutrient digestibility, multiplying with feed nutrient.

This research showed that organic ingredient (BO) digestibility, occur real enhanced, sheep with straw feed treatment which fermented with mixture suspension isolat bacteria *Acetobacter liquefaciens* and *Khamir geotrichum* sp. produce the highest BO digestibility that is 76.937%, followed successive gift treatment *Khamir geotrichum* sp. as big as 72.884%, bacteria *Acetobacter liquefaciens* as big as 72.011% and without isolate as big as 60.806% and so do to the digestibility of Dry Matter, Crude Fiber, Crude Protein, NDF and ADF. But, the digestibility of Dry Matter, Crude Fiber, Crude Protein, NDF and ADF from this research are stills lower than the Lamid, *et al.* (2005) research result, which is use the mixture of cellulolytic bacteria's rumen liquid in rice straw can increase the Dry Matter digestibility become 58.41%, BO 77.90 %, Crude Protein 75.96%, NDF 72.72% and ADF 74.60%.

The increasing of dry matter digestibility, crude fiber, NDF and ADF in this treatment is guessed because of the *Acetobacter liquefaciens* bacteria suspension gift, *Khamir geotrichum* sp. and the mixture of *Acetobacter liquefaciens* and *Khamir geotrichum* sp. bacteria in rice straw can produce enzyme cellulase. Microorganism is very efficient in degradation essence, chitin and polysaccharide in plants cell wall. This thing can be happen because the microorganism produce enzyme that can digest polysaccharide (Warren, 1996). Enzyme cellulase that comes from bacteria consisted of exocellulase and endocellulase that can hydrolyze cellulose (Irwin *et al.*, 2000). Soejono *et al.* (1987), declare feed digestibility value can be increased by biological that is by hydrolyzing cell wall component using bacteria inoculum, fungi, enzyme, rumen's contents and cow's feces.

Table 1. Average and Contents Deviation Standard of Digestibility dry matter (%), crude fiber (%), crude protein (%) organic Matter (%), NDF (%), ADF (%), and Retention N rice straw which fermented with cellulolytic fungi isolate suspension

Digestibility (%)	Treatments			
	P0	P1	P2	P3
Dry Matter	48.71 ^{a}±2.80	55.14^{b}± 5.27	59.47^{bc}± 2.57	61.16^{c} ± 3.55
Crude Fiber	54.84^{a}± 4.01	58.95^{ab}± 3.24	62.24^{b}± 2.29	62.91^{b}± 3.99
Crude Protein	54.26^{a}± 4.28	58.78^{ab}±3.55	59.15^{ab}± 2.32	62.54^{b}± 2.60
Organic Matter	60.81^{a}± 1.83	72.01^{b}± 2.99	72.88^{b}± 2.48	76.94^{c}± 3.39
NDF	59.33^{a}± 2.57	64.59^{b}± 4.99	70.68^{c}± 1.95	72.44^{c}± 3.24
ADF	55.44^{a}± 3.56	62.82^{b}± 4.72	67.80^{bc}± 4.17	71.03^{c}± 4.88
Retention N	2.65 ± 0.31	3.03 ± 0.59	3.20 ± 0.86	3.33 ± 0.95

Different superscript in the same column showed real difference ($p<0.05$)

According to Bisaria and Ghose (1981), cellulolytic bacteria produce, minimal, two units of enzyme cellulase that is enzyme endo- β -1,4 -glucanase that play a part in hydrolyzing cellulose fiber become a short chain, then continued by enzyme exo- β -1,4 –gluconase which break the short chain become a dissolved simple compound.

Acetobacter liquefaciens, Khamir geotrichum sp. bacteria suspension with bacteria mixture *Acetobacter liquefaciens* and *Khamir geotrichum* sp. gift treatment in rice straw can increase the digestibility of dry ingredient, but the digestibility of dry matter that is produced is still not achieve feed with high value of digestibility yet, which is according to Fluharty and Dehority (2002), if the digestibility of dry matter feed revolve 65-70% it can be categorized as feed with high value of digestibility.

Acetobacter liquefaciens, Khamir geotrichum sp. bacteria suspension with bacteria mixture *Acetobacter liquefaciens* and *Khamir geotrichum* sp. gift treatment in rice straw can increase the digestibility of protein digestibility. In the process of rice straw feed fermentation, also added with urea as Nitrogen source and molasses as energy source, so that the growth and activity of bacteria and khamir can be optimal, so that, it can cause the increasing of protein digestibility.

The mixture of *Acetobacter liquefaciens* and *Khamir geotrichum* sp. bacteria gift in rice straw gives the best result, followed with *Khamir geotrichum* sp. and *Acetobacter liquefaciens* bacteria. Accoring to Baldwin and Allison (1983), the fermentation of complex carbohydrate, such as cellulose, can be increased by the interaction of the existing microbe. The synergism between fungi with bacteria explainable that fungi in course of digestion physically can remove cell wall surface layer with lignin (for an example is in stick part or twig), which is finally can be penetrated by bacteria henceforth done cell wall degradation (Wang and McAllister, 2003).

The counting of N retention, show positive result, but, it is not differ real between the treatment, even if so, if seen from the average, it can be seen that the increasing of *Acetobacter liquefaciens* isolate bacteria suspension, *Khamir geotrichum* sp. also the mixture of *Acetobacter liquefaciens* and *Khamir geotrichum* sp. bacteria, the average of the N retention are inclination increase. According to Hartadi *et al.* (1991), feed with low protein causes the low consumption of Nitrogen, so that happen negative nitrogen retention, on the contrary, feed with high protein causes high consumption of Nitrogen, so that happen positive nitrogen balance.

CONCLUSION

Local sheep given feed of rice straw which fermented with the mixture of bacterium of cellulolytic *Acetobacter liquefaciens* and cellulolytic yeast of *Geotrichum sp.* gave the best result, followed successively conferral suspension of yeast of cellulolytic *Geotrichum sp.*, and conferral

suspension of bacterium of cellulolytic *Acetobacter liquefaciens*.

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