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METHANE EMISSION FROM BUFFALO FED RICE STRAW IN INDONESIA

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Abstract

Eight buffalo heifers of about nine months old with body weight 164 kg were used for determining methane emission. They were kept in individual barns and allowed rice straw ad libitum as a basal diet. Methane measurement was done by face-mask method equipped with Methane analyser (Horiba Ltd, Japan) and airflow meter that automatically recorded in IBM PC. Methane emitted was analysed for 10 minutes at 3 hours intervals in 24 hours. The total methane emission per ten minutes was then converted to daily total emission. Dry matter intake was averaged from four days prior CH_4 measurement. The results show that daily methane emission was 34.08 g/kg DMI. By using this result, the buffaloes in Indonesia that mostly fed rice straw contribute methane for 166 Gg/year and it is about 3.54% of total methane emission from all sectors that reported as 4687 Gg/year.

Key words: Methane, Rice straw, Buffalo

Introduction

The greenhouse effect resulted from the change of proportion of gases accumulated in the atmosphere lift the world temperature in the recent decades, and must be reduced, otherwise the world temperature will rise by 0.5 to 1 C in the next 25-50 years. Methane is an important component of greenhouse gases in the atmosphere, and is the most associated with animal agriculture. This gas, although contributes only 19% of the overall warming, is a major component in greenhouse gases because the global warming potential of methane is about 21 times that of carbon dioxide (IPCC, 1994).

Indonesia is one of hundreds countries that signed the Kyoto Protocol, and has to commit to reduce the greenhouse gases (GHG) production. The composition of greenhouse gases in Indonesia in 1994 was reported being 82.8, 14.9, and 2.1% for CO_2, methane, and N_2O, respectively (State Ministry for Environment, 1998). The main sources of CO_2 emission are forestry and energy sector; produce about 97% of total emissions. Total methane emission is contributed mainly (51%) by agricultural sector, which 70 and 30% of its come from rice field and from livestock, respectively.

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Ruminants produce methane in a large portion (15-20%) of the 19% methane in total greenhouse gases. At least 50% of the world cattle population and 90% of the world buffalo population is located in developing countries, many of which are in tropical regions characterized with poor quality forages. The loss of energy from feed as methane is accounted for 5.5 - 6.5% of gross energy intake (Johnson and Ward, 1996), while the values of 2 - 12% has been reported on some diets (Czerkawski, 1969). Rice straw is low in quality forage and is the main roughage fed to buffalo in small holder farmer in Indonesia, has been considered to produce more methane than higher quality feed (Kurihara *et al.*, 1997). Therefore, the methane emission from buffalo fed rice straw should be measured for the base information of reducing the emission.

Material and Methods

Eight buffalo heifers of 164 kg body weight were used in this study. They were fed rice straw ad libitum as sole diet. The daily intake was measured by weighing the total feed given and the orts. The dry matter intake was measured in 4 days. In the last day the methane emission was measured by face-mask method, which use the mask, connected to methane analyser (Horiba Ltd, Japan) for determining methane concentration and airflow meter for total air volume. This measurement was done for ten minutes with interval 3 hours for 24 hours. The methane emission was then converted to the emission per dry matter intake of rice straw.

Results and Discussion

The hourly variation of methane emission and the eating and ruminating time is presented in Figure 1. With assumption that the amount of ingested feed and the rate of ingestion are similar, that figure showed that hourly variation of methane emission was correlated with feed consumption as shown by eating and rumination activity. During the day (from 0700 to 1900) the methane emission was mainly correlated with eating activity while in the night (from 1900 to 0400) it was correlated with both eating and rumination. This result agreed with that reported by Shibata *et al.* (1993) that dry matter intake is highly correlating with the methane emission.

Table 1 showed dry matter intake and methane emission for buffalo heifers fed rice straw. Protein intake (134.4 g/d; 4.5%) showed that the feeding regime applied in this study was low in quality, it was below 10.5% of CP in feed that believed give the normal rumen fermentation. The low quality was also shown by quite low digestibility (24.2%).

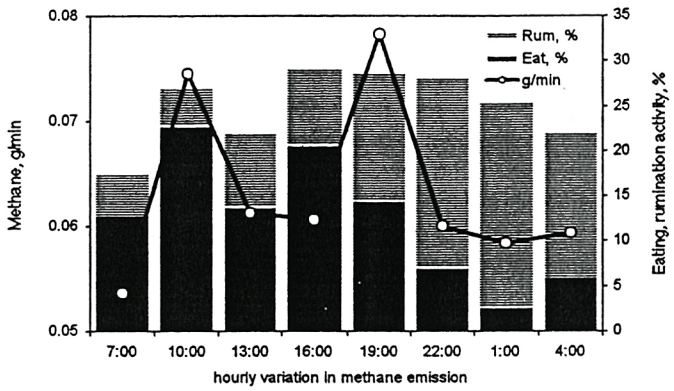

Figure 1. Hourly variation on methane emission (g/min) and eating and rumination activity (% of total eating or rumination per day) in buffalo heifer.

Table 1. The dry matter intake and methane emission in buffalo heifers fed rice straw

Items	Average
Body weight, kg	164.00
Dry matter intake, kg/d	2.99
CP intake, g/d	134.40
Digestibility, %	24.15
Methane, g/kg DMI	34.08

The methane emission per kg dry matter intake was found 34.1 g, and it was very high compared to the emission from heifer, sheep and goats fed grass and concentrate that found 20.3, 18.5 and 19.4 g, respectively (Shibata *et al.*, 1992). This result agreed with the statement of Leng (1993) that methane production from low quality roughage higher than that of good quality. Based on this data of methane emission from rice straw, the calculation for total methane emission from buffalo in Indonesia was done based on some assumptions as follow:

a. Buffalo population in Indonesia is 2.859 million (BPS, 1999) and 70% of them were fed rice straw, while the rest 30% were allowed the field grass.
b. The population was grouped into three (mature; 500 kg BW, growing; 300 kg BW and young; 100 kg BW) in the same rates.
c. Mature and growing was fed rice straw at a level 2.5% body weight, while the young was fed field grass.

With the assumption above, the utilization of rice straw for buffalo was around 4.9 million ton rice straw and it will produce methane around 166 Gg (Gigagram, 10^9 g) per year. By using this result, the buffaloes in Indonesia that mostly fed rice straw contribute 3.54% of total methane emission from all sectors that was reported as 4687 Gg/year. That value is equal with 23.14% of methane emission from livestock, and it is relatively high if consider that the population of buffalo in Indonesia is only 16% of total livestock population (in animal unit). This data showed that rice straw as sole feed Therefore, the improvement of rice straw quality by supplementation of should be made to balance the population and its contribution.

That result is much better if calculation was done based on the rice straw production. Annual production of rice straw in Indonesia has been reported around 40.3 million ton (Deptan, 1990), and only 30 percent (12 million ton) that is utilized as animal feed. This study showed that 1 kg DMI of rice straw produce 34.08 g methane, therefore rice straw potential to produce as much 408.96 Gg methane gas, or equal to 8.72% from total methane reported in Indonesia. This potential contribution of rice straw will be higher if calculation is taken into methane contributed from livestock, being 57.03%.

The conclusion that can be drawn in this study is the improvement of rice straw quality by urea-molasses supplementation or ensilaging rice straw is needed to reduce methane emission from buffalo. Also, further study on methane inventory in animals and methane conversion rate from dietary factors should be carried out.

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