

Fermentation and methane production of Indigofera-based ration in Rumen Simulation Technique (RUSITEC)

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Introduction

Effort to increase the productivity of dairy goats in Indonesia is often hampered by the poor quality of feed, so that milk production on average is still less than 1.5 liters/head/day. Farmers usually give concentrate to fulfill nutritional requirement of the animals. However, the price of concentrate is relatively expensive especially for small-holder farmers. Introducing certain legume species that contain high protein content is a potential solution to overcome such a problem. One of the promising legume species is *Indigofera zollingeriana* (further called Indigofera). It has been previously observed that Indigofera had a rapid growth, adaptive to low fertility soil, easy and inexpensive maintenance, high biomass production (up to 51 tons of DM/year/ha), and high protein content (28-31% DM) as well as minerals (Abdullah and Suharlina, 2010). When being fed to dairy goats, Indigofera increased milk production up to 26% and increased feed efficiency 15-23% compared to control (Abdullah *et al.*, 2012). This study is a continuation of the previous studies in which Indigofera-based ration was investigated for its effect on rumen fermentation and methane production *in vitro* by using Rumen Simulation Technique (RUSITEC).

Materials and Methods

Prior to use, Indigofera was sun-dried, followed by oven-dried at 70 °C for 3 h. The dried plant materials were included in rations at different levels of inclusion. Rations were then processed in the form of pellets with a diameter of 4 mm. Accordingly, five treatment rations were examined in this study, i.e. R1: 80% Indigofera, R2: 60% Indigofera, R3: 40% Indigofera, R4: 20% Indigofera, and R5: commercial ration (no Indigofera). Proximate composition and fiber fraction were determined from the respective rations. The rations were subjected to an *in vitro* study by using RUSITEC (Czerkawski and Breckenridge, 1977). Variables observed were dry matter and organic matter digestibility, methane emission, protozoa and bacteria populations, and volatile fatty acid (VFA) concentrations. The data were analyzed using analysis of variance (ANOVA), followed by least significance difference (LSD) test among treatment means when ANOVA results showed significantly different at $P < 0.05$.

Results and Discussion

Higher levels of Indigofera addition increased crude protein (CP) contents of the rations

since *Indigofera* itself contained a high CP content, i.e. 29.2% DM. *In vitro* dry matter digestibility (IVDMD) and organic matter digestibility (IVOMD) of the treatment rations were significantly different ($P<0.05$). Higher values of IVDMD and IVDMO were obtained on R1, R2, R3 and R5 compared to those of R4 ($P<0.05$); R4 showed low digestibility value due to a lower portion of *Indigofera*. Rations containing 40% to 80% *Indigofera* had similar digestibility values with commercial ration containing 28% soybean meal. This suggests that *Indigofera* may substitute soybean meal up to a certain extent.

Higher inclusion of *Indigofera* proportion in rations led to lower methane production (Figure 1); methane productions from incubation of R1, R2 and R3 were significantly lower than that of R4 ($P<0.05$). The respective results were associated with data on protozoa population; higher levels of *Indigofera* resulted in lower protozoa population. This is in agreement with the fact that some methanogens are living symbiotically with protozoa (Morgavi *et al.*, 2010). Apart from that, lower methane production by increasing levels of *Indigofera* addition was apparently due to lower fiber content. Overall, this study showed a potentiality of *Indigofera* to improve nutritional quality of ration and at simultaneously to mitigate methane emission resulted from enteric fermentation.

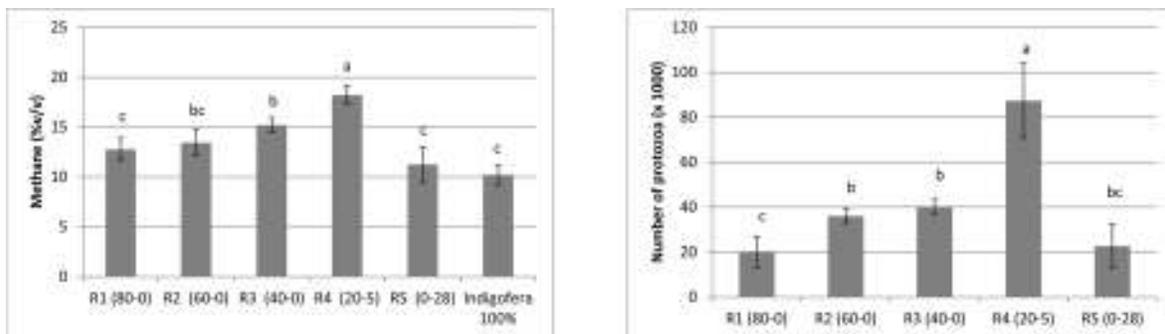


Figure 1. Methane production and protozoa population *in vitro* of *Indigofera*-based rations when incubated in RUSITEC.

References

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