Urea Treated Cocoa Pod as Barley Grain Substitution in Ruminant Ration on Microbial Metabolism and Feed Degradation (Rusitec Study)

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Abstract

Limited sustainable supply of high quality feedstuff is the major constrain in ruminant production in Indonesia. Aim to convert underutilized cocoa pod to quality feedstuff and its inclusion in ruminant ration have been done. Cocoa pod was treated with 20 g urea per kg fresh material. The effects of replacing barley grain by urea treated cocoa pod on methane release, SCFA production as well as the amount and efficiency of microbial-N fixation in Rusitec have been studied. The experiment included six different rations (T1 = 10 g/d hay; T2 = T1 + 4 g/d barley-soybean mixture (barley); T3 = T1 + 3 g barley + 1 g cocoa pod); T4 = T1 + 2 g barley + 2 g cocoa pod; T5 = T1 + 1 g barley + 3 g cocoa pod; T6 = T1 + 4 g cocoa pod) and three runs of Rusitec in a block random design. Substitution of barley by urea treated cocoa pod up to 100% in hay based rations did not decrease the rate of ration DM disappearance, and fiber degradation even tended to be increased. Microbial N-fixation decreased with the inclusion of cocoa pod in the rations, but the efficiency of microbial N-fixation was increased in line with the cocoa pod level. Methane release per unit NDF disappearance decreased inversely to the cocoa pod level. Although urea treated cocoa pod cannot replace barley/soybean meal-mixture equivalently in feed rations for ruminants, in fact, the inclusion of urea treated cocoa pod at the expense of higher fermentable feed components will reduce the fermentation intensity thereby yielding lower amounts of SCFA and microbial protein for the host animal. Nevertheless, the urea treated cocoa pod can be used as a feedstuff for low performance ruminants as a substitute for barley/grain meal-mixture or as a supplement to hay based rations without reducing the efficiency of microbial synthesis. Moreover, no toxicity effects were observed with the inclusion of urea treated cocoa pod in the ration as to a dramatically disturbed fermentation or a too high concentration of ammonia.

Keywords: Rusitec, *urea treated cocoa pod, microbial protein, Methane, ruminant*

Introduction

Background

Cocoa pod is a potential feed source for ruminants. Their availability increase inline with the escalation of world-wide cocoa demand. ICCO (2003) forecasted of 3 million tons world cocoa seed production which released about 6 million tons of cocoa pod meal (a 1 to 2 cocoa bean to cocoa pod meal ratio (DUKE, 1983)). Cocoa pods is quite palatable, however its utilisation by ruminant is limited according to low protein content and high cell wall constituents. As a late-maturing plant component, the pod contains high lignocellulosic and low non-polysaccharide substances. To be used as ruminant feedstuff, cocoa pod needs quality upgrading.

Based on in vitro study using gas test (Menke et al., 1997), Despal (2005) reported that cocoa pod treated with 14 kg urea per 100 kg DM produced higher gas in compare to 0, 7 and 21 kg urea/100 kg DM treatments. Relative to untreated cocoa pod, the urea treatment increased gas production (Gb) by 38%. Since the amount of urea used in this study were higher than that applied by CHENOST (2001) for rice straw equivalent to 5.3 kg urea per 100 kg DM or WILLIAMS et al. (1984) who applied 4 kg urea per 100 kg barley straw, it seems necessary to test the possible toxicity of urea treated cocoa pod in a more physiological rumen model such as Rusitec. A too high consumption of dietary urea would however be toxic for the animal (HELMER & BARTLEY, 1971; BARTLEY & DEYOE, 1981; VAN SOEST, 1982).

According to SMITH (1974), urea toxicity can be minimized by ensuring an adequate matched supply of available energy instead of replacing urea with more expensive NPN sources. In this study, the urea treated cocoa pods were mixed with different amounts of barley as an energy source and constant amounts of these mixtures were combined with constant amounts of hay in Rusitec.