Thesis Title Evaluation of Net Energy and Digestibility of Rice Straw in Dairy Cattle and Sheep

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ABSTRACT

The energy value, digestibility and dry matter intake (DMI) of rice straw (RS) in cows and sheep were evaluated by regression method. Rumen degradation of rice straw was measured by the nylon bag (*in sacco*) and Gas production technique (GPT). The values obtained were used to predict energy content and dry matter intake (DMI) of dairy cows. Four crossbred cows and 6 crossbred wethers were fed 3 diets with different RS to concentrate ratios, specifically 70:30, 55:45 and 40:60. Each digestibility trial lasted 26 days during which the last 5 days were the collection period. Nylon bags (7x15 cm with 20-40 µm pore size) containing 3 g of sample each were placed in the rumen of 4 fistulated dairy cows (8 replicates) for 4, 8, 12, 24, 48, 72 and 96 hours. Dry matter (DM) and organic matter (OM) disappearance were subjected to the equation $P = A+B\ (1-e^{-ct})$. In GPT, 2 sets of samples were incubated with rumen buffer fluid. Gas volume from 200 mg sample was measured after 4, 6, 8, 12, 24, 48, 72 and 96 hours and subjected to the equation $P = a+b\ (1-e^{-ct})$ to calculate DMI and digestible DMI (DDMI). The 24 hour GPT values was used to calculate OMD, ME and NEL. After incubation for 24 hours, the residues of another set (500 mg sample) were treated with neutral detergent solution to calculate true DMD and OMD.

Rice straw contained 96.7% DM. The nutrient content on DM basis were 81.6% OM, 4.6% CP and 2.3% EE. The ash-free NDF, ADF and ADL were 64.4, 34.1 and 3.5% respectively. Feed intake, digestibility and energy values of the diets as well as nitrogen (N) balance increased as the ratio of RS decreased. The correlation was highly negative (r = -0.9). Sheep consumed more RS than cows. The predicted dry matter intake if RS will be fed as a sole diet is 1.16%BW or 53.32 g/kg$W^{0.75}$ in cows, which that of sheep is 2.90 and 60.07, respectively. Nitrogen balance was found to be negative in such condition. It indicates that N or crude protein content of rice straw is insufficient for maintenance of ruminant.

The digestibility of nutrients were similar between sheep and cows except CP that was higher in sheep and ADF and NFC that were higher in cows. In cows the digestibility of nutrients, with the exception of CP, were around 50-65% while those in sheep were 50-60%. Total digestible nutrient (TDN) and DE of RS in cows = 49.92% and 1.75 Mcal/kg compared to 48.66 and 1.82 in sheep respectively. The calculated DE, ME and NEL from TDN for cows were 2.20, 1.77 and 1.10 Mcal/kgDM which were similar to that for sheep. The direct DE measurement was lower than that calculated from TDN in both types of animals. Based on these results, sheep can be used as a model for cows in evaluating of energy in rice straw. However the prediction equation for digestibility and energy value for cows based upon sheep data have been calculated by regression.

The nylon bag results revealed that the solubility (A, 17.2%), lag time (L, 3.9 h) asymptote (A+B, 63.7%) and degradation rate (c, 0.03 % per h) of rice straw were low. These values are consistent with the low digestible nutrients and low rate of digestibility of rice straw. The gas production pattern related to those of the nylon bag. The values of OMD, ME and NEL calculated from gas volumes were 49.1%, 1.45 and 0.84 Mcal/kgDM respectively, while true DMD and OMD = 52.34 and 49.22%. The DMI and DDMI predicted from *in sacco* were 3.33 and 2.01 kg/day which were comparable to GPT (3.40 and 1.87). These low values indicated that prediction equations are invalid for this feed. GPT provides OMD and energy values therefore provide more information for feed evaluation than *in sacco*.

The average energy values of RS as averaged from *in vivo* and gas production method are 49.29%TDN, 1.98 McalDE/kgDM while that of ME and NEL is 1.50 and 0.91 respectively.