

Ammoniated rice straw as feed for ruminants

Muhammad Rusdy

Department of Forage Science and Grassland Management
Faculty of Animal Science, Hasanuddin University, Indonesia

Introduction: Rice straw is the most abundant agricultural byproduct in rice producing countries, including Indonesia. Although it is produced in large quantities, however, its utilization is low. Only about 20% of rice straw produced is used for industrial and domestic purposes, including as animal feed. Most of remaining rice straws are left in paddy field, serving as mulch, ploughed into the soil or burned. As animal feed, the main constraint for its high utilization is low palatability, low voluntary intake, low digestibility and low nutritive value. Physical, chemical and biological pre-treatments have been studied to upgrade nutritional value of rice straw. In this article, improving nutritional value of rice straw by chemical method using ammonia gas or urea was chosen for review.

Methods : To generate information useful for better utilization of rice straw as animal feed, literatures concerning nutritive value of un-treated rice straw and ammoniated rice straw and their relation to animal's requirement in Google Scholar, PubMed, Scopus, CABI, Crossref and Web of Science were elaborated and reviewed. From those databases, effects of ammoniation using ammonia gas and urea on nutritive value of rice straw were elaborated and discussed. Means for enhancing animal production using ammoniated rice straw as basal diets were presented and reviewed.

Results: Results showed that untreated rice straw has low nutritive value, voluntary intake and digestibility. Crude protein contents of rice straw ranged from 2.4 to 5.4%, the values that insufficient for requirement of rumen bacteria to ferment feed efficiently. Fiber content of rice straw is also high. NDF ranged from 75 to 79%, ADF ranged from 41 – 56%. The high NDF and ADF contents reduced voluntary intake and digestibility of untreated rice straw, respectively. Dry matter digestibility of rice straw is also low (45 to 50%) that contributes to its limited energy and nutrients utilization. Digestibility of leaves is lower than stems, as caused by their higher silica contents. Rumen degradability of urea un-treated rice straw is also low; at 96 hereof rumen incubation, degradability was only about 500 g/kg. Mineral contents of rice straw generally is low and

unbalanced. Calcium and phosphorus contents of rice straw could not meet the requirement of ruminants, but it is also influenced by soil fertility. Untreated rice straw has high potentials as feed sources but because of low nutritive value, digestibility and degradability, it does not provide sufficient nutrients even for maintenance of animals. Ammoniation of rice straw can double or triple protein content, as caused by addition of ammonia. Dry matter digestibility of rice straw increased from 8 to 15% percentage unit and dry matter intake increased up to 20 - 25%. NDF, ADF and other nutrient digestibility also increased by rice straw ammoniation. Ammoniation increases digestibility by breaking lignin – structural carbohydrate bonds in cell wall that allows swelling of plant tissue for greater microbial activity. Improved dry matter intake and nutrient digestibility and increased rate of passage boost feed intake by animals fed ammoniated straw, but ammoniation of high quality of grass hay is not recommended because it can results in ammonia toxicity. Results of many studies indicate that ammoniated rice straw can only yield low levels of animal production. The higher levels of animal production fed ammoniated straw can be attained by supplementation with fermentable carbohydrates and protein bypass sources. Without supplementation with sufficient fermentable energy, ammonia may accumulate in the rumen that eventually lost via urine. By supplementing with protein bypass sources, ratio of rumen degradable protein to rumen undegradable protein will decrease and this reduces N urinary lost and increase efficiency of feed utilization and growth of animals fed ammoniated rice straw.

Conclusion: The main constraint for use of rice straw as animal feed are low intake, low digestibility and low fermentable N. Ammoniation with urea or ammonia gas can increase feed intake, digestibility and fermentable N content of rice straw. Because fermentable N is not limiting in ammoniated rice straw, greater attention should be given to rumen undegradable protein that may increase protein bypass. Tanniferous forage may be fed to animals to protect protein from ruminal degradation and increasing animal production.