Studies on the Increasing Nutritive Values of Rice Straws by Chemical Treatment

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Summary

Four Korean native male goats, weighing approximately 22kg each, were equipped with rumen cannulas to study the effect of different levels of NaOH and Ca(OH)$_2$ treatments, of rumen suspension time and of different kinds on “nylon bag dry matter diegstibility (NBDMD, %)” and “nylon bag organic matter digestibility (NBOMD, %)” of rice straws. The goat was housed individually in pen and was fed 600 grams (concentrate) daily, and fed rice straw and rincal blocks _ad libitum_.

Three grams of dried samples by grinding with 2.45 mm screen (Wiley mill) were put into a bag 9 X 14 cm made of 100 mesh nylon. These bags were put into the ventral sac of the rumen and taken out at the end of 24, 48 and 72 hours (Experiment 1) and 72 hours only (Experiments 2 and 3). They were washed, dried in an oven at 105°C for 24 hours and weighed “NBDMD” and ashed in an muffle furnace at 600°C for 2 hours and weighed “NBOMD”.

The results which were obtained with three experiments were as follows:

1. Nylon bag dry matter digestibility (NBDMD, %) and Nylon bag organic matter digestibility (NBOMD, %) of NaOH-treated straws were highly significant different (P < 0.01) in different levels of NaOH treatment, of rumen incubation time and of different kinds of rice straws.
2. NBDMD (%) and NBOMD (%) of Ca(OH)$_2$-treated straws were highly significant different (P < 0.01) in different levels of Ca(OH)$_2$ treatment and of different kinds of rice straws.
3. The relationship between mean NBDMD (%; Y$_1$) of 5 kinds of rice straws and NaOH concentration (%) X$_1$ and Ca(OH)$_2$ concentration (%) X$_2$ at 72 hour rumen suspension was:
   - Experiment 2 : $Y_1 = 2.93X_1 + 42.32$ (r = 0.97**)
   - Experiment 3 : $Y_1 = 1.51X_2 + 41.36$ (r = 0.97**)
4. The relationship between mean NBOMD (%, Y₂) of 5 kinds of rice straws and NaOH concentration (% , X₁) and Ca(OH)₂ concentration(%, X₂) at 72 hour rumen suspension was:

Experiment 2: \( Y_2 = 2.76X_1 + 41.32 \ (r = 0.96^{**}) \)

Experiment 3: \( Y_2 = 1.36X_2 + 41.02 \ (r = 0.95^{*}) \)

5. The orders of NBDMD (%) and NBOMD (%) for 5 kinds of rice straws were Yooshin, Suwon 264, Milyang 23, Tongil and Aikibare. Therefore it is necessary to study more on the utilization of NaOH-treated new-bred rice straws for animal performance than old-bred rice straw as Aikibare.

6. The optimal level of NaOH (%) for improving NBDMD and NBOMD from 5 kinds of rice straw on the basis of Dr. McCullough's theory was as follows: 6% NaOH for Yooshin, Suwon 264 and Milyang 23; 7% NaOH for Tongil and 8% for Aikibare.

7. Calcium hydroxide did not improve the NBDMD (%) and NBOMD (%) of rice straws as compared with sodium hydroxide.

8. The NBDMD (%) and NBOMD (%) of 5 kinds of rice straws were about 60% improved by 6% NaOH treatment as compared with control (0% NaOH) in this study. This means that 6% NaOH-treated rice straw has about the same dry matter digestibility as compared with grass hay, so rice straw will be a great roughage resource for Korean dairy industry in the near future.

I. 統論

酪農を促進するため、毎年20,000頭の乳牛を外国から導入し、国内で繁殖を促進するために充実した牧草栽培が必要である。利用する牧草は、牛の健康と生産性に影響を及ぼす重要な資源である。したがって、適切な牧草の選択と利用方法が重要である。

粗飼料の管理にあたっては、Ca(OH)₂やNaOHなどの化学的処理が用いられる。Ca(OH)₂の利用では、pHの上昇が見られるが、これにより粗飼料の消化性が向上することが知られている。

また、粗飼料の栄養価を向上させるために、牧草の選択も重要である。日本での場合、低質粗飼料の利用も増加しており、これにより飼料の利用効率が向上している。

一方、利用する牧草の選択は、地域の気候や土壌条件、利用目的に応じて適切な種類を選び、飼料の供給が安定するよう努めることが重要である。