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Effects of Feeding Preserved Italian Ryegrass on Organic Matter Digestion, Methane Emission and Nitrogen Utilisation by Goats

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An increase in grass maturity at harvesting stage of Italian ryegrass (IRG) resulted in high fibre and low nitrogen (N) and the latter may limit animal productivity. The efficiency of N capture in the rumen of N-rich silages harvested at an early stage of growth is poor (Taminga, 1992). Moreover, early-cut grass resulted in a greater N loss than the late-cut grass (Rinne *et al.*, 1997) which increases in global N pollution. However, the low N and fibre of low quality forages can be improved using different additives such as cellulase, lactic acid bacteria (LAB), urea and molasses, which might result in higher utilisation of advanced maturity IRG. Research on different additives and supplements in improving low nutrient forages have been investigated, but detailed calorimetric study on nutrient utilisation and methane (CH_4) production is scarce. Therefore, this study examined the effects of cellulase, LAB, urea and molasses on nutrient utilisation with an emphasis on CH_4 and N utilisation as these are important global pollutants.

Harvested IRG at late-bloom stage was kept wilted for 24h at grassland. The wilted IRG was preserved for 60d in metal 200L drums after homogenous mixing, without any preservative (Control), with 13.3% molasses (T_1), 4.0% urea (T_2), 0.02% cellulase (T_3), and 0.02% cellulase + 0.02% LAB (T_4). The silages were then nutritionally evaluated using standard techniques. Eight castrated Japanese goats (mean 34kg) were used in two periods in a randomised block design to evaluate the silages. Goats were offered fixed diets consisting of IRG, corn and soybean meal at 1.1 X TDN requirement for maintenance. Ration digestibilities and data for gas exchange were obtained from open circuit respiration chambers. Islam *et al.* (2000) earlier discussed the methods of analysis.

Highest ($P<0.05$) OM digestibility was observed with T_1 followed by T_4, T_2 and T_3. All resulted in higher digestible OM intakes when compared with controls (Table 1). Total CH_4 produced was higher with all treated silages, but the CH_4 per kg digestible OM intake (DOMI) was lower with all treated silages compared to that of control. Cellulase and LAB mixed silages had the lowest CH_4 per kg DOMI. Urea treated IRG had a higher ($P<0.05$) volatile ammonia nitrogen (NH_3N 57%) compared to other silages. Goats consumed similar N in all treated silages except the urea treated group ($P>0.05$). Goats consuming treated silages produced higher ($P<0.01$) urinary N than that of controls, but CP digestibilities were almost the same ($P>0.05$). Goats consuming urea treated IRG however, had a high digestible N, but negative retained N due to a higher ($P<0.01$) urinary N (97%). The volatile N in feed and total N loss were highest in the urea treated group. Results showed that ensiling IRG with the preservatives increased the OM and N intakes and digestibilities, this resulted in higher digestible nutrients intake, but mixing with urea resulted in an increased total N losses through feed, faeces and urine.

Ensiling with cellulase and LAB with cellulase reduced the CH_4 emission rate. Urea treatment however increased the digestible OM and N intake, but the higher N losses could enhance global N pollution. However, IRG treated with molasses could increase the digestible OM and N intake besides reducing CH_4.

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Table 1. Intake and digestibility of OM, CH_4 emission and N utilisation of goats fed on different IRG silages

Item	Control	IRG+Molasses	IRG+Urea	IRG+Cellulase	IRG+Ce+LAB	s.e.d
Total DMI ($g.day^{-1}$)	518	616	588	580	619	52.5
OMD (%)	60.8	63.9	63.1	58.9	63.5	1.49
Total DOMI($g.day^{-1}$)	280	351	327	298	352	34.5
CH_4 ($g.day^{-1}$)	9.87	11.66	10.80	9.67	11.26	1.18
CH_4 ($g.kgDOMI^{-1}$)	35.26	33.18	33.14	32.45	32.09	1.56
NH_3N of silage ($mg.10g^{-1}$)	46.0	27.1	193.5	34.0	28.3	0.45
Nitrogen intake ($g.day^{-1}$)	13.36	14.72	19.81	15.28	15.50	1.70
Fecal nitrogen ($g.day^{-1}$)	3.21	4.09	4.08	3.62	3.64	0.24
Urinary nitrogen ($g.day^{-1}$)	5.30	10.00	19.05	10.10	12.01	1.33
Retained N ($g.day^{-1}$)	4.85	0.64	-3.32	1.56	-0.15	0.95

Roughage: concentrate of Control, T_1, T_2, T_3 and T_4 were 3.77, 3.93, 3.91, 3.98 and 3.95, respectively. Ce. Cellulase