EFFECT OF SLURRY APPLICATION ON CELL WALL COMPONENTS AND SILAGE INTAKE BY SHEEP OF ITALIAN RYEGRASS AND TRITICALE.

H. Kawamoto[1], N. Shimizu[2], R. Uegaki[1] and R. Kobayashi[1]

[1]National Grassland Research Institute, Nishinasuno-machi, Tochigi, 329-27 Japan

[2] National Institute of Agro-Environmental Sciences, Kannondai, Tsukuba, 305 Japan

ABSTRACT

The study was to elucidate the effect of application of slurry manure from dairy cows on chemical components, the rumen degradation characteristics and silage intake by sheep of Italian ryegrass (*Lolium multiflorum* Lam.) and Triticale (rye-wheat hybrid). The amounts of application of slurry were 0, 50, 100 and 150 t/ha. The increasing level of slurry application resulted in a decrease of lower digestible cell wall and an increase of degradation rate. The silage of 150 t /ha treatment was significantly more consumed by sheep than the other treatments ($p<0.05$). The changes in cell wall components in both quantity and quality by the slurry application were advantageous to the increase of voluntary dry matter intake of the forage.

KEYWORDS

slurry, Italian ryegrass, Triticale, silage, intake, sheep, cell wall

INTRODUCTION

Many studies on changes in the digestibility of forage by the levels of fertilizer application have been conducted. But there is little information on the effect of fertilizer application level on forage intake. The purpose of this study was to determine the effect of the application of slurry manure on cell wall components and the silage intake by sheep fed with Italian ryegrass and Triticale.

MATERIALS AND METHODS

Mixed seed of Italian ryegrass and Triticale were sown on the 15th of October, 1994, on Brown Lowland Soils in Tochigi, Japan. Triticale was used for the prevention of lodging. The amounts of seeding of Italian ryegrass and Triticale were 15 kg and 50 kg /ha, respectively. N, P_2O_5 and K_2O were applied at the time of seeding at a rate of 30 kg /ha. The application of slurry manure from dairy cows (moisture 91.4%, pH 7.9, total-nitrogen 0.49%, ammonium-nitrogen 0.27% and sodium 0.29%) was done by a randomized complete design with four replicates of four treatments: 0, 50, 100 and 150 t /ha. The treatments were established on plots 3 X 20 m in early-March, 1995. These plots were mowed on the 22nd of May, 1995, by a mower conditioner (VICON KM281) and dried on a field under the fine weather. The wilted grass of four replicates were put together and baled by a round-baler (New Holland 848) and wrapped by a wrapping machine (Yoshimoto Pole YE2010) on the second day. Before the harvest, parts of the grass were hand cut from each plot and Italian ryegrass and Triticale in it were separated, then representation samples (forage samples) were taken for analysis. After one month, the baled silage were opened and chopped into 10 mm lengths. The chopped silage was subdivided into single meals and placed in plastic bags that were vaccuum packed, then stored under 4½C until fed to the animals. The voluntary dry matter intake of four kinds of silage was measured with eight sheep in two 4 X 4 Latin squares. The experimental periods consisted of an initial two week adjustment and one week measurement. The samples were dried in an oven at 60oC and ground to be passed through a 1 mm screen for chemical analysis and in situ degradability. Nitrate nitrogen (NO3-N) and crude protein (CP) were determined by the CATALDO method and Kjeidahl method, respectively. Organic cell wall (OCW) and Organic b fraction (Ob) which represents a lower digestible cell wall was determined by the method of Abe *et al* (1979). Acid-detergent lignin (ADL) was determined by the method of Goering and Van Soest (1970). The rumen degradation characteristics were determined by in situ technique of Orskov *et al* (1988).

RESULTS AND DISCUSSION

The chemical composition in forage samples at different slurry levels is shown in Table 1. Increasing the level of slurry application resulted in a higher NO3 -N and CP content in both grasses. On the other hand OCW and Ob content were decreased with an increasing level of slurry application. The Ob content was decreased significantly and greatly decreased in Italian ryegrass. But the effect of slurry level on ADL content was little or less clear. The Ob mainly consists of lignified or crystallized structural carbohydrates. These results suggested that the extent of crystallization of non-lignified structural carbohydrates might be affected by the rate of slurry application. Masaoka *et al*.(1987) indicated that the change of the cell wall digestibility is greater than the change of the amount of cell wall of forage at different nitrogen application levels. A similar result was obtained from the present study.

The rumen degradation characteristics and intake of silage at different slurry rates are shown in Table 2. The increasing level of slurry application resulted in a higher silage intake. Goto *et al*. (1986) observed that the high concentration of nitrate nitrogen seems to be the important factor on the decrease of acceptability of forage. But our data indicated that the silage of 150 t /ha treatment was significantly consumed more than the other treatment, although it had higher NO3-N. The simulation of Mertens and Ely (1979) demonstrated that a 1.0% decrease in digestion rates results in a 0.6% increase in dry matter intake and a 1.0% decrease in the indigestible fraction results in a 1.0% increase in dry matter intake. The result of in situ degradability in this experiment indicated that the increasing level of slurry application resulted in a higher degradation rate and that the silage of 150 t /ha treatment had the highest potential degradability. These results indicated that increasing the slurry application resulted in an increase of the degradability and the rate of degradation of forage in the rumen.

It was suggested that the lower crystalization of cell wall in forage induced by increasing the level of slurry manure application might result in higher voluntary intake by sheep.

REFERENCE

Abe, A., S.Horii and K.Kameoka. 1979. Application of enzymatic analysis with glucoamylaze, pronase and cellulase to various feeds for cattle. J. Anim. Sci., **48** : 1483-1490.

Goerring, H.K. and P.J. Van Soest. 1970. Forage fiber analysis. Agricultural Handbook, US Department of Agriculture, No 379.

Ørskov, E.R., G.W.Reid and M.Kay. 1988. Prediction of intake by cattle from degradation characteristics of roughages. Anim. Prod., **46** : 29-34

Masaoka, Y. N., N. Takano, K. Ohta and M. Ochi. 1987. Effects of soil moisture and mineral supplements on the in vitro cell wall digestibility in warm-season forage crops. J.Japan. Grassl. Sci. **32:** 389-394

Goto, M., E. Simada and K. Sugawara. 1986. The relation between palatability and chemical composition of herbages cultivated in the shading condition. Bull. Fac. Agr. Mie Univ., Tsu Japan, **72:** 81-85

Mertens, E.R. and L. O. Ely. 1979. A dynamic model of fiber digestion and passage in the ruminant for evaluating forage quality. J. Anim. Sci. **49:** 1085-1095

Table 1
The dry matter yield and the chemical composition of Italian ryegrass and Triticale (forage sample) at different slurry application levels

	slurry t /ha	DM yield kg /ha	dry matter basis(%) NO3-N	CP	OCW	Ob	ADL	Ash
	0	1510 a	0.025 a	9.1 a	73.1a	59.1 a	5.8 a	9.3 a
Itarian	50	2135 a	0.046 b	10.4 ab	73.5 a	55.3 ab	5.9 a	10.6 a
ryegrass	100	2232 a	0.241 c	12.8 bc	70.9 a	52.0 ab	5.7 a	11.2 a
	150	2388 a	0.360 d	14.4 c	70.7 a	50.5 bc	5.6 a	11.6 a
	0	5543 a	0.023 a	8.7 a	76.2 a	59.7 a	5.8 a	8.0 a
Triticale	50	4159 a	0.085 a	10.7 a	74.5 a	56.3 a	5.8 a	10.9 a
	100	4589 a	0.227 a	12.6 a	72.1 a	52.7 a	5.7 a	10.3 a
	150	4585 a	0.329 a	13.0 a	72.1 a	53.4 a	5.6 a	10.5 a

a, b, c and d indicate significance ($p<0.05$) by TUKEY method.

Table 2
The composition, rumen degradation characteristics and intake of silage ofItalian ryegrass and Triticale

Slurry ha	Italian ryegrass%	silage DM%	degradation characteristics 1) NO3-N	(a)	(b)	(c)	silage intake 2)
0t	20.7	49.4	0.05	26.6	51.7	0.0367	62.1a
50t	32.4	49.8	0.08	26.6	51.4	0.0403	63.6a
100t	33.6	42.7	0.19	26.7	51.3	0.0472	67.6a
150t	34.3	41.0	0.23	26.4	53.6	0.0449	74.9 b

1) (a) represents the immediately soluble material, (b) is the insoluble but degradable material and (c) the rate of degradation in the rumen.
2) dry matter intake g/day/kg metabolic liveweight. a, b indicate significance ($p<0.05$) by TUKEY method.