Tropical Agricultural Research Vol. 13: 395-400 (2001)

Effect of Caged Layer Manure and Molasses on Ensiling Characteristics and Composition of Guinea (*Panicum maximum*, Jacq.) Ecotype 'A'

E.S.D. Samaraweera, L.P. Silva[1] and S. Premaratne[1]

Postgraduate Institute of Agriculture
University of Peradeniya
Peradeniya, Sri Lanka

ABSTRACT. *An experiment was conducted to find out the effect of caged layer manure and molasses on ensiling characteristics and composition of Guinea grass (Panicum maximum, Jacq.). Guinea 'A' grass was cut at three weeks of age, wilted, chopped and ensiled with four levels (0, 5, 10 and 15% fresh weight) of fresh caged layer manure (CLM) combined with two levels (0 or 5% fresh weight) of molasses in laboratory silos (4 × 2 × 4 reps; CRD). Silage samples were analyzed for physical and chemical properties after 30 days of ensiling. Aroma was strong, pungent, ammonia like for 10 and 15% CLM with 0% molasses silage, while it was pleasant fruity smell for the silage with same CLM level with 5% molasses. The moldiness was increased with the addition of CLM and was absent with addition of 5% molasses. Crude protein (CP) contents in 5, 10 and 15% CLM with 5% molasses treatments were higher (P<0.05) (12.4, 12.8 and 15.4% respectively) compared to the control (0% additives) (11.1%). Volatile fatty acid content in 10 and 15% CLM with 5% molasses silage were 156.9 and 185.3 mg/100 g compared to 30.7 mg/100 g in the control. The pH and dry matter contents increased (P<0.05) with increasing levels of CLM. The values are satisfactory for tropical silage. According to the results, addition of 10% CLM and 5% molasses can be used to produce good quality Guinea 'A' silage.*

INTRODUCTION

Seasonality of fodder production, smaller farm size, high cost of labour and high price of concentrates together has lead to high cost of feeding in most of the farming systems. Improvement of poor quality pastures and crop residues is therefore of great importance for the survival of the dairy industry in Sri Lanka.

Guinea 'A' (*Panicum maximum*, Jacq. Ecotype 'A') is one of the most common wild growing grasses found in mid and low country regions of Sri Lanka and it is left unutilized mainly due to the poor nutritive value. Low crude protein level in Guinea 'A' is one of the most limiting factors in direct feeding (Jayawardana *et al.*, 1974; Panditharatne, 1984) to animals. Low water-soluble carbohydrates, in guinea (Xande, 1978; Panditharatne, 1984) also have been identified as a limiting factor in effective conservation as silage.

Both poultry excreta and litter had been used to improve the crude protein level in ensiled Guinea grass (Mson and Sangodoyin, 1995) and other grasses (Walagamba, 1992) whereas, molasses is a source of soluble carbohydrate, which can be used in silage making. Therefore, main objective of the present study was to investigate the effect of

[1] Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka.

MATERIALS AND METHODS

A Guinea 'A' grass stand grown under unfertilized, rain-fed conditions at Veterinary Research Institute, Peradeniya (longitude 80°29' E, latitude 7°13' N, Elevation 485 m) was used in this study. During this period, mild rains were reported from the experimental area. Grass was defoliated at the beginning of the trial to a height of 15 cm above the ground level. Three weeks after the initial defoliation, grass was harvested again, wilted for about one hour, chopped to a length of 2-4 cm and, ensiled in small laboratory silos. Four levels (0, 5, 10 or 15%) of fresh caged layer manure (CLM) (one-month collection from 40 weeks old caged layer flock, anaerobicaly stored for one day after separation of maggots) and two levels (0 or 5%) of molasses fresh weight basis were used in making silage. The 2 × 4 factorial (8 treatments) experiment was arranged in a complete randomized design with 4 replicates. The mixture was filled in to double line polyethylene bags, pressed to expel the air inside the bag before sealing and, weighed. Samples of molasses and CLM were taken and stored in the refrigerator for laboratory analysis.

After 30 days, silos were weighed and opened. Top 5 cm of silage was discarded and physical characteristics of material such as colour, flavour, texture and mouldiness were recorded. Water extracts of the silage samples were used for measurement of pH (electrometrically), and volatile fatty acids (VFA) (Markham, 1942). Samples of CLM, grass, molasses and silage were dried in an oven at 60°C and dry matter (DM) contents were calculated. Samples were ground to pass a 1 mm sieve and used to measure the nitrogen content by Kjeldhal method (AOAC, 1980) and then crude protein (CP) content was estimated. CLM and grass were analysed for crude fibre (CF) content (AOAC, 1980).

The data were statistically analysed using the analysis of variance by SAS (1982). The mean separation was done using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Proximate composition of pre-ensiled material

Table 1 presents the chemical composition of pre-ensiled material used in the study.

Table 1. Chemical composition (% on DM basis) of materials used in ensiling.

Component	Guinea 'A'	Caged layer manure	Molasses
Dry matter	23.8	50.6	79.3
Crude protein	11.5	17.8	5.6
Crude fibre	28.8	13.7	-

Guinea grass used in this experiment represent the average composition of naturally grown guinea when harvested at early growth stage under mild rain conditions. Therefore, CP content was higher compared to the mature guinea grass available for farmers under field conditions.

Dry matter content of CLM was 50.6%, whereas Rajaguru (1986) reported a value of 32% for fresh manure. According to Miller (1969), bio degradation of manure in caged layer houses reduces the moisture content from 75-50%. CLM had a CP level of 17.8% (Table 1), which was fairly low compared to the levels given by Ibrahim (1988) for air dried fresh manure. The lower CP content of CLM in this study may have been due to bio-degradation of proteins. The level of bio-degradation vary with the duration of collection and this is the only available source of CLM for processing, as daily basis collection is not practical under field situations in Sri Lanka. However, it was comparable to the values given by Teotia and Miller (1974), for biologically digested manure. In addition, oven drying during sample preparation may also have reduced the N content in CLM.

Physical properties of silage

Physical parameters of all silage samples were satisfactory when they were opened after 30 days. Colour of all silage samples was almost similar and had a dirty green colour, except for the control (silage made without any additives), which was yellowish green. In the absence of both additives, the entrapped air was used for oxidation of the fresh forages, and lead to yellowish colour silage. Aroma of silage was slightly pungent in treatments with 10 and 15% of CLM without molasses. Addition of 5% molasses for all levels of CLM treatments produced silage with pleasant aroma, mild pungency along with wood-apple smell compared to other silages. Addition of molasses improved the fermentation by more desirable bacteria therefore, resulting in good quality silage compared to other treatments.

No effluent or sliminess was found in any of the silage samples. No visible growth of mould was observed in any of the silage samples preserved with 5% molasses and they retained the fresh appearance. Samples with 10 and 15% CLM and no molasses have shown a very little growth of mould to form black spots. Inclusion of molasses increased the production of lactic and volatile fatty acids, which reduced the pH of silage and mould growth was inhibited in those treatments.

Chemical composition of silage

Addition of CLM and molasses increased ($P<0.05$) the dry matter content of silage compared to the control (Table 2). This observation is in accordance with the results reported by Mson and Sangodoyin (1995) in Nigeria where caged layer excreta were ensiled with Guinea grass, at 10, 30 and 50% levels.

Addition of CLM increased the CP level of silage compared to control (Table2). This may be due to the higher level of N in CLM. Molasses did not have any significant effect on the CP of control or 5% CLM silage, however CP content was increased in 10 and 15% CLM silage. Molasses has been used widely in ensiling of forages with various animal wastes due to this favourable effect. The non-protein nitrogen, *i.e.*, NH_3 and true

Table 2. Effect of caged layer manure (CLM) and molasses on dry matter content and crude protein level of silage*.

Treatment		Dry mater content %	Crude protein content %
CLM %	Molasses %		
0	0	21.19 ± 0.88[a]	11.09 ± 0.32[a]
	5	23.57 ± 0.64[b]	11.37 ± 0.07[a]
5	0	23.18 ± 0.09[b]	12.23 ± 0.27[b]
	5	23.78 ± 1.06[b]	12.40 ± 0.21[b]
10	0	25.25 ± 0.86[c]	12.40 ± 0.22[b]
	5	26.64 ± 1.12[d]	12.82 ± 0.12[c]
15	0	27.32 ± 0.68[d]	13.45 ± 0.15[d]
	5	27.92 ± 0.24[e]	15.38 ± 0.14[e]

*Means followed by a different superscript in a column differ ($P<0.05$).

proteins in CLM have been better utilized by the bacteria responsible for the fermentation during ensiling in the presence of molasses, where soluble carbohydrate content is fairly low otherwise in Guinea grass.

Volatile fatty acid contents were increased ($P<0.05$) with the increase in both CLM and molasses (Table 3). According to Tepal *et al.* (1992), addition of 30% dried poultry litter and 5% molasses on dry matter basis increased the VFA content during ensiling.

Table 3. Effect of caged layer manure (CLM) and molasses on total volatile fatty acid content and pH of silage*.

Treatment		Volatile fatty acid (mg/100 g)	pH
CLM %	Molasses %		
0	0	30.67 ± 8.3[a]	5.12 ± 0.07[c]
	5	91.22 ± 24.0[b]	4.27 ± 0.04[a]
5	0	104.05 ± 9.2[b]	5.92 ± 0.39[d]
	5	112.80 ± 18.0[b]	4.57 ± 0.09[b]
10	0	146.72 ± 12.2[c]	6.23 ± 0.17[e]
	5	156.90 ± 9.4[c]	5.04 ± 0.16[c]
15	0	166.87 ± 14.3[c]	6.56 ± 0.31[f]
	5	185.30 ± 16.7[d]	5.14 ± 0.05[c]

*Means followed by a different superscript in a column differ ($P<0.05$).

Addition of CLM increased the pH whereas addition of molasses decreased the pH of silage (P<0.05) (Table 3). Release of ammonia by CLM makes the silage more alkaline whereas addition of molasses increases acid production and thereby reduced the pH of silage. These are in agreement with previous work (Ramirez *et al.*, 1993; Mson and Sangodoyin, 1995). Muller (1980) has suggested that when animal wastes are used in ensiling of grass or crop residues, it is necessary to add molasses (1-3%) or other sources of fermentable carbohydrates to ensure desirable pH levels. However, pH of tropical silage is usually higher compared to temperate silage (McDonald, 1981; Panditharathne, 1984), and values reported in this study are in agreement with previous work.

CONCLUSIONS

Ensiling of Guinea 'A' grass with 5, 10 and 15% of caged layer manure and 5% molasses improved the nutritive value and ensiling characteristics of silage compared to control, without additives. Dry matter, crude protein and volatile fatty acid contents were significantly increased with increasing levels of both caged layer manure and molasses. The pH of silage significantly increased with the addition of caged layer manure while it decreased with the addition of molasses to the satisfactory level. Colour and texture of silage were not affected either by the level of caged layer manure or molasses to the satisfactory level. Aroma of silage was strong, pungent and fishy with the addition of 10 and 15% of caged layer manure while addition of 5% molasses enable to overcome it, by giving a pleasant fruity smell even at 10 and 15% of caged layer manure added silage. According to the results, addition of 10% caged layer manure and 5% molasses produced good quality silage.

ACKNOWLEDGEMENTS

Financial assistance provided by the Postgraduate Institute of Agriculture, University of Peradeniya is gratefully acknowledged.

REFERENCES

AOAC. (1980). Official Methods of Analysis (12th Edition) Association of Official Analytical Chemists, Washington. D.C.

Ibrahim. M.N.M. (1988). Feeding Tables for Ruminants in Sri Lanka. Fibrous Feed Utilization Project. Kandy Offset Printers Ltd., Kandy, Sri Lanka. Pp. 20.

Jayawardana. A.B.P., Pathirana. K.K., Siriwardana. J.A. De S. and Sundarananda. P. (1974). Evaluation of common Guinea grass for dairy production. Ceylon Assoc. Advancement of Sci. Proceed. 30: 54 (Abstract).

Markham. R (1942). A steam distillation apparatus suitable for micro-Kjeldahl analysis. Biochem. J. 36: 790.

McDonald. P. (1981). Silage additives. *In*: Biochemistry of Silage. Jone Willy and Sons Ltd., New York. pp. 129-167.

Miller. B.F. (1969). Biological digestion of manure by Diptera. Feed Stuff. 41(51): 32-33.

Mson, R. and Sangodoyin. A.Y. (1995). Conservation and enrichment of forages by ensiling with poultry excreta. Comm. Soil Sc. and Plant Anal. 26(15/16): 2683-2695.

Muller, Z.O. (1980). Feed from Animal Waste: State of Knowledge. FAO Animal Production of Health. Paper 18. FAO Agriculture Organization, UN Rome. 60-65. 112-117.

Panditharathne, S. (1984). Ensiling characteristics, digestibility and palatability of tropical grasses as affected by growth stage, chopping length and additives. Unpublished PhD thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA.

Rajaguru, A.S.B. (1986). Field Crop and Livestock Integration. Proceeding of National Agricultural Council of Sri Lanka, Faculty of Agriculture, University of Peradeniya. April 4, 1986.

Ramirez, V.F., Gonzalez, M.S. and Barcenu, G.R. (1993). Chemical characteristics and digestibility *in-situ* of maize stover ensiled with animal manures. Archivos- Lantinoamericanos-de-Produccion-Animal. 1(2): 203-210.

SAS. (1982). SAS user guide. Statistical Analysis System Institute, Inc., Cary, NC.

Teotia, J.S. and Miller. B.F. (1974). Nutritive content of housefly pupae manures residue. Brit. Poultry Sci. 15: 177-182.

Tepal, C.J., Carvajal, A.J. and Casteellanos, R.A. (1992). Some factors important in fermentation of Taiwan grass. Tecnica-Pecuaria-en-Mexico. 30(1): 71-75.

Walagamba, R.S. (1992). Ensiling characteristics and nutritive value of Guathamala grass ensiled with different levels of poultry droppings. Practicum Report, Post Graduate Institute of Agriculture. AH/92/7: 21-25.

Xande, A. (1978). Ensiling of grass, a conservation technique for obviating the food shortage of ruminants during dry season. 1. Theoretical and practical aspects particularities of tropical forages. 4(2): 63-80.