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Effect of different additives on fermentation characteristics of fodder sorghum [*Sorghum bicolor* (L) Moench] compared to CO-3 (*Pennisetum perpureum* x *Pennisetum americarnum*).

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Introduction

Milk production plays a vital role to overcome the nutritional poverty in all aged groups of people. But there are many kinds of constraints to sustainable milk production in Sri Lanka. The biggest problem is high cost of feeding of dairy animals due to high price of compounded feeds, lack of knowledge on methods of low-cost feed supplementation and seasonal fluctuations in ruminant feed resources. Less availability of good quality green forages has led to low productivity from national dairy herd of Sri Lanka during the dry season (Premaratne and Premalal, 2006). Silage production is one of the most popular as well as cheap and effective method of forage conservation to increase the feed availability for dairy cattle during the dry season. Sorghum (*Sorghum bicolor* (L) Moench) and CO-3 (*Pennisetum perpureum x Pennisetum americarnum*) are some of the crop varieties which can be effectively used for silage making. Therefore, the objective of the present study was to find out the effect of different additives on fermentation characteristics of fodder sorghum and CO-3.

Materials and Methods

Fodder samples: Fodder Sorghum was harvested at flowering stage where as CO-3 was harvested at the age of 45 days. Both fodder Sorghum and CO-3 were cut to a height of 10cm above ground level. Harvested crops were cut in to small pieces (3-4cm in length) using a grass chopper.

Inoculum preparation: Freshly cut fodder was chopped into small pieces (3-4cm). 500g of chopped crop, 50g of sucrose and approximately 250ml of distilled water were put in to a plastic container. Plastic containers were closed tightly to prevent contamination of air. Containers were shaked well and kept for 2 days.

Silage preparation: Harvested forage samples were cut in to small pieces (3-4cm in length) and ensiled with or without additives in small silos. Four additives namely, Control (no additives), 1% Molasses, 1% Inoculum or 1% Molasses plus 1% Inoculum were used as treatments and ensiled with Sorghum or CO-3. The experimental design was a 2×4 factorial, Complete Randomized Design with 8 treatments and 3 replicates per treatment. The ensiling of silage was carried out for 60 days.

After 60 days, silos were opened and top layer of the silage was removed. Samples were transferred to trays and texture, color, aroma and mold formation of each silo were recorded. Dry Matter (DM) content, Crude Protein (CP), Ash and Crude Fiber (CF) contents of forage before ensiling were determined according to AOAC (1995). Dry Matter (DM) content and Crude Protein (CP) content of silage were also determined according to AOAC (1995). In addition, pH of different silage was measured using a pH meter. Lactic acid content was analyzed using a spectrophotometer (Barnett, 1951). Ammonia Nitrogen content of silage was measured using the spectrophotometer (Parsons *et al.*, 1984).

Statistical analysis: All the data were subjected to analysis of variance (ANOVA) using SAS software package (Version 9.1). Mean comparisons were done by Duncan's Multiple Range Test (DMRT).

Results and Discussion

All silos were free from molds and had a pleasant fruity aroma. Light brown and greenish brown colours were observed in CO-3 silage and Sorghum silage respectively.

Table 1: Proximate composition of silage, %*

Treatment	DM	CP
CO-3		
Control	18.61 ± 0.19[f]	13.34 ± 0.11[b]
C + 1% Molasses	26.36 ± 0.86[c]	14.69 ± 0.10[a]
C + 1% Inoculum	24.22 ± 0.38[d]	14.37 ± 0.25[a]
C + 1% Molasses + 1% Inoculum	15.71 ± 0.28[g]	14.71 ± 0.10[a]
Sorghum		
Control	35.71 ± 0.65[a]	9.57 ± 0.34[e]
C + 1% Molasses	30.72 ± 0.53[b]	10.5 ± 0.15[d]
C + 1% Inoculum	22.29 ± 0.16[e]	11.27 ± 0.12[c]
C + 1% Molasses + 1% Inoculum	18.48 ± 0.09[f]	10.38 ± 0.17[d]

*Data are presented as Mean± SE

[a, b, c, d, e, f, g] Means within a column with different superscripts are significantly different ($p<0.05$)

The DM content of CO-3 silage was lower ($P<0.05$) as compared to fodder Sorghum silage (Table 1). This may be related to lower dry matter content (15.07%) in CO-3 prior to ensiling compared to fodder Sorghum (19.39%). Crude protein content of Sorghum silage was much lower ($P<0.05$) than that of CO-3 silage (Table 1). Inclusion of additives increased ($P<0.05$) the CP content of silage in both crops. According to Bilal (2009), the CP content of silage increased with addition of molasses due to protein sparing activity in fermentation process.

Fermentation characteristics of silage: pH of Sorghum silage was lower ($P<0.05$) as compared to that of CO-3 silage (Table 2). Inclusion of molasses plus Inoculums decreased ($P<0.05$) the pH of both Sorghum and CO-3 silage compared to the control. According to Bilal, (2009) the sugars provide substrate for lactic acid bacteria fermentation and that will increase accumulation of lactic acid, resulting in low pH of silage. Amer *et al.,* (2012) also reported that initial Water Soluble Content had a major effect on declining of pH during ensiling. The lowest ($P<0.05$) lactic acid content was observed in CO-3 control silage compared to other treatments (Table 2). Addition of additives increased ($P<0.05$) the LA content of both silage types. The highest ($P<0.05$) LA % was observed in silage prepared with 1% molasses plus 1% inoculum in both crops (Table 2). Addition of molasses must have increased the availability of carbohydrates for fermentation of microbes and thereby increased the lactic acid content in silage. The Ammonia Nitrogen content of CO-3 silage was much higher ($P<0.05$) than that of Sorghum silage (Table 2). This may be related with the high amount of CP in CO-3 as compared to Sorghum silage (Table 1) and fermentation of that protein with the addition of inoculum.

Table 2: Effects of treatments on fermentation characteristics of silage*

Parameter	pH	LA%	NH_3-N%
Treatment			
CO-3			
Control	5.37 ± 0.01[b]	3.5 ± 0.03[f]	8.06 ±0.08[a]
C + 1% Molasses	5.52 ± 0.02[a]	7.09 ± 0.17[d,e]	5.88 ± 0.34[b]
C + 1% Inoculum	5.38 ± 0.02[b]	6.77 ± 0.37[e]	6.03 ± 0.23[b]
C+ 1% Molasses + 1%Inoculum	4.42 ± 0.01[c]	13.29 ± 0.24[a]	3.63 ±0.19[d]
Sorghum			
Control	4.47 ± 0.04[c]	7.85 ± 0.22[c,d]	2.60 ± 0.00[e]
C + 1% Molasses	4.37 ± 0.01[c,d]	7.54 ± 0.19[c,d]	2.60 ± 0.12[e]
C + 1% Inoculum	4.30 ± 0.02[d,e]	8.16 ±0.34[c]	4.63 ± 0.19[c]
C+1% Molasses + 1% Inoculum	4.23 ± 0.01[e]	12.54±0.22[b]	6.01 ± 0.19[b]

*Data are presented as Mean± SE; on dry matter basis.

[a, b, c, d, e] Means within a column with different superscripts are significantly different ($p<0.05$)

Conclusion

According to the results, it is possible to prepare fodder Sorghum and CO-3 as silage either alone or with additives under local conditions. Addition of molasses and inoculum had positive effects on some of the fermentation characteristics of fodder Sorghum and CO-3 compared to the control.

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