Fermentation profile of Tifton-85 (*Cynodon* spp.) haylage

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Introduction Silages with high dry matter content, called haylages, are widely used in animal feeding in several countries in Europe, including equine diets as an alternative do hay, as reported by Müller and Udén (2007). The purpose of haylage is to preserve the fodder plant pre-dried and packed under vacuum (Bergero et al., 2002). The method or pre-drying before ensilage favors the fermentation process since it inhibits the growth of undesirable bacteria given that clostridia are particularly sensitive and require damp conditions to develop, while lactic acid bacteria are resistant to low moisture and are able to take over fermentation in these conditions (McDonald et al., 1991). The goal of this study was to assess the fermentation profile (at 0 [fresh grass], 1, 3, 7, 14, 28, and 56 days) of Tifton-85 (*Cynodon* spp.) haylage produced in tropical conditions.

Materials and Methods The grass plant was harvested at 30 days of growth and wilted until it reached 70% of dry matter, which was determined through sampling in a microwave oven. After drying, the forage was immediately collected and inoculated with a biological additive containing *Lactobacillus plantarum* and *Pediococcus pentosaceus* according to the manufacturer's recommendations. In order to make the haylages, 1.3 kg of green matter were stored in polyethylene bags, which were then vacuum-sealed according to the technique recommended by Kung Jr. et al. (2010). Each sample was mixed with distilled water at a 1:1 ratio and frozen for 24 hours so that the aqueous fraction was obtained. After this period, the material was thawed and the liquid was extracted with the use of a hydraulic press. The levels of volatile fatty acids (acetate, butyrate, and propionate), lactic acid, pH, and ammoniacal nitrogen ($N\text{-}NH_3$) were determined. The study followed a completely randomized design with four repetitions. The statistical model $Y_{ij} = \mu + T_i + e_{ij}$ was adopted, where Y_{ij} = observation of treatment "i" in repetition "j"; μ = overall average; T_i = effect of the time of opening, being "i" = 0, 1, 3, 7, 14, 28, and 56 days; e_{ij} = experimental error. The formula $\log_{10} x + 100$ was used to transform the data of acetic, propionic, and lactic acids. Duncan's test ($P<0.05$) was used for VFA data and lactic acid and SNK ($P<0.05$) was used for pH and $N\text{-}NH_3$.

Results and Discussion Although pH was high, no differences were found ($P>0.05$). However, it must be pointed out that haylage pH cannot be compared to that of other silages since the dry matter is very limiting to the bacterial fermenting ability, although this resistance to pH reduction must also be considered along with other factors such as the buffer ability of fodder plants. In the current research, the high dry matter content led to higher resistance to pH reduction by limiting bacterial activity. Therefore, the wilting down to 70% of dry matter determined the lower intensity of the fermentation process. This result matches those of McDonald et al. (1991), who stated that the increase in pH that takes place due to the increase in dry matter content has a direct effect on the total count of lactic acid bacteria and the fermentation rate. According to Müller (2005), pH means only a restriction in fermentation and is not related to low quality silage. Higher acetic acid levels were found at 56 days, which was similar ($P>0.05$) at 14 days. This

result is likely associated to the activity of heterofermentative bacteria at this stage of the silage and these concentrations are important to maintain haylage quality after the bag is opened since acetic acid has antifungal properties. The lactic acid content was higher (P<0.05) after 28 days of silage, again showing the slowing down of the fermentation processes as a consequence of the high dry matter content. According to Andrade and Melotti (2003), the more lactic acid in relation to acetic and butyric acids is produced, the less energy is spent to produce heat and form gases and the more pleasant to the animals the ensiled forage is regarding flavor and aroma. Butyric acid levels close to zero were found in the haylage, which indicates good quality, although the levels of this acid is not the only parameter to assess ensiled forage quality. Müller (2005) points out that haylages with high dry matter content have low levels of organic acids and high pH when compared to haylages with low DM content, and that these can be considered indicators of bad preservation. Thus, the standard used to evaluate haylage fermentation parameters must be different of those recommended for silages with high moisture content.

Conclusions Tifton-85 (*Cynodon* spp.) haylage had good fermentation quality over the period assessed, having adequate preservation status.

References

Andrade, S.J.T. and Melotti, L. Inoculantes bacterianos na silage do capim elefante (*Pennisetum purpureum, Schum*). 2003. Braz. J. Vet. Res. Anim. Sci., 40: 219-223.

Bergero, D., Peiritti, P. G. and Cola, E. 2002. Intake and apparent digestibility of perennial *haylage*s fed to ponies either at maintence or at work. Livest. Prod. Sci. 77: 325-329.

McDonald, P., Henderson, A.R. and Heron, S.J.E. 1991. Biochemistry of silage. 2.ed. Marlow: Chalcombe Publication, 340p.

Müller, C. and Udén, P. Preference of horses for grass conserved as hay, *haylage* or silage. 2007. Anim. Feed Sci. and Technol.132: 66–78.

Müller, C. Fermentation patterns of small-bale silage and *haylage* produced as a feed for horse. 2005. Grass and Forage Sci. 60:109-118.

Table 1 Fermentation profile of Tifton-85 (*Cynodon spp.*) haylage

Variable	Treatment (days)							CV
	Fresh grass	1	3	7	14	28	56	(%)
% N-NH_3/ total N†	0.39 c	0.41 c	0.67 bc	0.73 bc	1.04 ab	1.24 a	1.10 ab	29.81
pH†	5.48 a	6.08 a	5.19 a	5.53 a	5.37 a	5.42 a	5.21 a	7.41
Acetic acid* (g kg^{-1} DM)	0.91 b	1.17 b	0.60 b	2.02 b	2.14 ab	1.85 b	2.79 a	34.54
Propionic acid* (g kg^{-1} DM)	0.27 a	0.10 b	0.03 b	0.11 b	0.08 b	0.10 b	0.08 b	66.67
Butyric acid* (g kg^{-1} DM)	0.77 a	0.70 ab	0.18 c	0. 36 c	0.42 bc	0.23 c	0.20 c	50.14
Lactic acid* (g kg^{-1} DM)	2.26 cd	0.35 d	3.01 cd	10.24 bc	11.44 ab	16.16 a	26.06 a	46.62

† Different letters in the line differ by SNK test (P<0.05).

* Different letters in the line differ by Duncan's test (P<0.05).

CV = coefficient of variation