Changes to the fermentative profiles of Pioneiro grass (*Pennisetum purpureum* Schumach) and maize silages in different mixtures after aerobic stability

Eduardo R Scherer[A], *Tiago M Santos*[A], *Diana R Vivian*[A], *José A Freitas*[A], *Kátia F Gobbi*[B] *and Américo F Garcez Neto*[A]

[A] Federal University of Paraná - UFPR, Animal Nutrition Laboratory, Palotina, Brazil, www.ufpr.br
[B] Agricultural Institute of Paraná - IAPAR, Paranavaí Experimental Station, Paranavaí, Brazil, www.iapar.br
Contact email: americo.garcez@ufpr.br

Keywords: Additive, ensilage, fermentation, grass.

Introduction

Silages arte widely used in animal production systems to overcome the seasonality of forage production around the world. The preservation of nutritional value of silages depends on the maintenance of an anaerobic environment during the fermentation and storage phases, as well from aerobic stability during the feed out stage (Nussio, 2005). Aerobic exposure usually promotes intense activity of fungi, yeast and aerobic bacteria. If the time of aerobic exposure is long enough, huge changes can happen in the chemical composition of the silages affecting negatively their nutritional value. These changes can be followed by decreasing lactic acid concentration and increasing pH, temperature and ammonia nitrogen (Addah *et al.* 2011).

The present work was carried out to evaluate the levels of ammonia nitrogen, pH, buffer capacity and electric conductivity in silages of Pioneiro grass and maize in different mixtures at silo opening and during the first 7 and 14 days of aerobic exposure.

Methods

The study was carried out at the Federal University of Paraná, Palotina Campus, Palotina, Brazil. The materials used in the study were Pioneiro grass (*Pennisetum purpureum* Schumach) and maize. The plants were cultivated at the Research Field of the C.Vale Agroindustrial Company, Palotina, Brazil. All plants were chopped to 20mm particles and placed into PVC experimental silos under 600 kg of fresh mass/m^3. The silos were provided with upper Bunsen valves to escape of gases and bottom valves to effluent drainage.

A completely randomized design was used within a split plot scheme, with ensilage processes as main plots and times of aerobic exposure as subplots, with eight replicates. Four ensilage treatments were used (Pioneiro grass 100%; Pioneiro grass 90% + Whole plant maize 10%; Pioneiro grass 98% + Maize grain 2%; Whole plant maize 100%) and three periods of aerobic exposure (0, 7 and 14 days). The addition of whole plant maize and maize grain to the treatments was set on a fresh mass basis. A bulk sample of 200g from each replicate was taken for fermentative analysis of pH, electric conductivity (EC), buffer capacity (BC) and ammonia nitrogen (NH_3-N).

Table 1. Mean values of buffering capacity (BC) and electrical conductivity (EC) of pioneiro grass and maize in different combinations f ensiling duringaerobic exposure. (P: Pioneiro grass; PWPM: Pioneiro grass with whole plant maize; PMG: Pioneiro grass with maize grain; M: maize). Different small letters in the same row differ by SNK test at 5%.Different capital letters in the same column differ by SNK test at 5%.

Arobic exposure time (days)	BC (meq/100g DM)			
	P	PWPM	PMG	M
0	22.44 Ac	26.00 Ab	25.49 Ab	36.72 Aa
7	22.36 Aa	17.50 Ba	20.69 Ba	20.97 Ba
14	18.48 Aa	8.74 Cb	8.83 Cb	9.55 Cb
Aerobic exposure time (days)	EC (mS/cm)			
	P	PWPM	PMG	M
0	854.08 Aa	869.64 Aa	902.24 Aa	591.41 Ab
7	862.83 Aa	763.86 Bb	827.68 Bab	507.55 Bc
14	813.88 Aa	732.96 Bb	789.01 Bab	404.69 Cc

Statistical analysis was performed using the GLM procedure and test of multiple comparisons of means (SNK) at 5% of significance by the SAS software (version 9.0).

Results

There was a significant interaction between ensilage and period of fermentation on BC and EC (Table 1). Silage BC decreased (P<0.05) from 7 days of aerobic exposure, with the exception to Pioneiro grass silage. The variation of BC may be explained by the combination of organic acids, salts and proteins which can be consumed by aerobic microorganisms during fermentation (McDonald *et al.* 1991).

Electric conductivity decreased significantly after aerobic exposure, except for Pioneiro grass silage without any maize inclusion. That reduction may be due to the fact that aerobic microorganisms may still use remaining ions from the ensiled mass solution.

Table 2. Average values of ammonia nitrogen (NH3-N) for Pioneiro grass and maize in different ensiling combinations. (P: Pioneiro grass; PWPM: Pioneiro grass with whole plant maize; PMG: Pioneiro grass with maize grain; M: maize). Different letters differ by SNK test at 5%.

Ammonia N content	Silages			
	P	PWPM	PMG	M
NH_3-N	14.17 a	11.71 b	12.09 b	7.55 c

There was a significant difference of pH between the times of aerobic exposure, but without differences between silages. There was no difference (P>0.05) between the pH values at silo opening (3.97 and 3.99) for seven days of aerobic exposure. The significant difference was limited only to 14 days of aerobic exposure. The pH increase with time may be justified by the consumption of lactic acid during the multiplication of undesirable microorganisms with the aerobic deterioration (Pahlow *et al*. 2003).

The NH_3-N content is presented in the Table 2. The NH_3-N can be related to the moisture of the silage. Silages with higher dry matter content usually have lower values of ammonia nitrogen.

Conclusion

The addition of maize as grain or whole plant to Pioneiro grass silages improved the fermentation profile. The pH of these silages did not differ from the maize silage and the variation in the ammonia nitrogen may still be regarded as normal for most tropical forages.

References

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