Fermentative losses of maize silage added with natamycin and *Lactobacillus buchneri*

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Introduction During the ensiling process, microorganisms such as yeasts and bacteria might lead to biochemical losses as gases. It may also occur due to plant cell respiration. Effluent production may also be responsible for substantial water soluble carbohydrates (WSC), protein and organic acid losses. Under anaerobiosis, viable yeasts metabolize WSC into ethanol and carbon dioxide, mostly when small amounts of oxygen are available (McDonald et al., 1991). It reduces the concentration of available substrates for lactic acid bacteria, thus decreasing their efficiency on acid production and pH lowering. Natamycin is an antifungal compound utilized for yeasts and molds control in foods, such as cheeses and salami. Recently, Schmidt et al. (2012) verified positive effect of natamycin on reduction of greenhouse gases emission from maize silages. This trial aimed to evaluate the effect of adding natamicyn and *Lactobacillus buchneri* to maize silages on dry matter and gases losses through fermentation.

Materials and Methods The trial was carried out at Centro de Pesquisas em Forragicultura (CPFOR) of Universidade Federal do Parana. Maize was harvested by self propelled chopper at a theoretical particle length of 12 mm. Four treatments were applied (wet basis): Control – no addititves (C); (LB) - *Lactobacillus buchneri* ($5x10^4$ cfu g^{-1}); (NA) - Natamicyn (8 g t^{-1}); (NLB) - *Lactobacillus buchneri* plus natamicyn at the same dosages. All treatments were diluted in distilled water (4 L t^{-1}). Forage was ensiled in 20-liter experimental silos provided with Bunsen valves for gases outflow. A plastic platform was placed in the bottom of each silo, and covered with a nylon mesh fabric and a cotton sheet. This device was used to collect the effluent. The silos were filled with 12.5 kg of forage, assuring 600 kg m^{-3}. Silos were sealed and stored for a 90-day period in a closed room. The silos were weighted for gravimetric determination of dry matter, gases and effluent losses, as stated by Jobim et al. (2007). Silages were sampled for assessing pH and dry matter. Experimental design was completely randomized with four replicates. Data were analyzed by ANOVA and means of treatment were compared by Tukey test at a probability of 0.05 with STATISTIX program (9.0).

Results and Discussion Fermentative losses, dry matter content and pH means are shown in Table 1. Control treatment showed the highest dry matter content among the treatments ($P<0.05$). The NLB treatment resulted in the lowest pH mean (3.76), which was different ($P<0.05$) from NA and control treatments. The acid production of *L. buchneri* during fermentation was probably enhanced when combined with natamycin, which is able to reduce yeasts population. Hondrodimou et al. (2011) assert that natamycin reduced competition for nutrients between two groups of microorganisms and improves fermentative process, thus lowering silage pH.

Effluent production did not differ among treatments and the values were quite low, probably due to the proper DM content. The NLB treatment caused the lowest dry matter losses (DML) among treatments. This effect was related to the lowest pH and the inhibition of yeasts growth. Siqueira et al. (2007) verified increase in dry matter recovery and decrease on gases production when chemical additives were combined with *L. buchneri* at ensiling process.

Table 1 The pH, dry matter and fermentative losses of maize silages

	Treatments[1]					
Variable[2]	C	NA	LB	NLB	Mean	SEM
Dry matter, %	36.9[a]	31.1[c]	31.7[c]	33.1[b]	33.2	0.59
pH	3.85[b]	3.85[b]	3.83[ab]	3.76[a]	3.8	0.01
DML %	6.89[b]	7.06[b]	8.88 [b]	2.10 [a]	6.2	0.70
Gases % DM	6.75[b]	6.85[b]	8.71 [b]	1.95 [a]	6.1	0.69
Effluent, kg t^{-1} of fresh matter	1.43	2.2	1.87	1.54	1.8	0.13

[1]C, control; NA, Natamycin; LB, *Lactobacillus buchneri*; NLB, Natamycin + *L. buchneri*.
[2]DML, Dry matter losses; SEM, Standard error of the mean.
Different lower case letters within a line differ by Tukey test ($P<0.05$).

Conclusion The combination of natamicyn and *Lactobacillus buchneri* promoted decrease of pH and lower dry matter losses and gases production of maize silage during fermentation.

References

Hondrodimou, O., Kourkoutas, Y. and Panagou, E.Z. 2011. Efficacy of natamycin to control fungal growth in natural black olive fermentation. Food Microbiology 28: 621-627.

Jobim, C.C., Nussio, L.G., Reis, R.A. and Schmidt, P. 2007. Avanços metodológicos na avaliação da qualidade da forragem conservada (Methodological advances in evaluation of preserved forage quality). J. Animal Science. 36: 101-120.

Mc Donald P., Henderson A.R. and Heron S.J.E. 1991. Biochemistry of silage, 2nd ed. Marlow, UK: Chalcombe Publications.

Schmidt, P.; Novinski, C.O.; Carneiro, E.W.; Bayer, C. 2012. Greenhouse gas emissions from fermentation of corn silage. Page 428 in Proc. XVI International Silage Conference. Hämeenlinna, Finland.

Siqueira, G.R., Bernardes, T.F., Reis, R.A. 2005. Instabilidade aeróbia de silagens: efeitos e possibilidades de prevenção (Aerobic instability of silages: effects and possible prevention). In: Reis, RA, Siqueira, GR and Bertipaglia, LMA. (Eds.). Forage in ruminant production. 2.ed. Jaboticabal: FUNEP, 25-60.