Acid lactic bacteria inoculation in corn silage and fermentative losses evaluation at different opening times

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Introduction During the corn silage fermentation process, losses can overcome 20% of ensiled mass. The use of additives aims to guarantee that lactic acid bacteria dominates the fermentation process, resulting in a well preserved forage, with high nutritional value (McDonald et al., 1991). According to Kung Jr. (2009) inoculating microbial additives in corn silage results in variable effects. In some studies, a higher acid lactic production and better recovery of dry matter after fermentation were observed, while consistent results were not detected in other ones. The objective of this study was to verify the effects of an additive containing lactic acid bacteria strains in the dry matter recovery, effluent losses and gas losses in corn silages at different silo opening periods.

Materials and Methods This study was carried out at East Santa Catarina, Lajeado city. The samples were analyzed at the University of Santa Catarina State, in the Animal Nutrition Laboratory (UDESC). The corn was harvested with 42.14% dry matter (DM) content, with a harvester coupled to a tractor and chopped to a 20 mm mean particle size. Two treatments were applied: 1) control (no additive) and 2) microbial inoculant containing the following acid lactic bacteria: *Lactobacillus plantarum, Pediococcus pentosaceus, Pediococcus acidilactici, Enterococcus faecium, Lactobacillus casei, Treptococcus lactis, Aspergillus oryzae* and *Bacillus subtillis,* in a dose to reach 2.5×10^9 cfu/g of fresh forage. There were used four replications and three silo opening times (days 30, 60 and 90). The inoculant was diluted in distillated water and homogeneously applied to the fresh forage. The experimental silos consisted of 20L plastic buckets with Bunsen valves for gas losses evaluations. Forage compaction was done expecting to reach 580 kg/m^3 density. The gas losses (% DM) were calculated by the difference of the initial and final DM weight of the experimental silos, and effluent production by the difference of initial and final weights of the silos containing sand, plastic screen and cotton cloth, as proposed Jobim et al. (2007). Total DM losses were calculated by the difference between initial forage DM weight, placed in each experimental silo, and the forage DM weight at the opening day, deducting the produced effluent. Statistical analyses were done using the GLM procedure of SAS, and means compared by the Student "t" test, with 5% significance.

Results and Discussion The effluent losses did not differ (P>0.05) between opening times, indicating that the effluent losses occur with more intensity at the beginning of the fermentation process. However it was observed a lower (P<0.05) effluent production per ton of fresh forage for the additive treatment (18.8 kg/t) in comparison to control treatment (21.3 kg/t), 90 days after ensiling (Table 1). According to Balieiro Neto et al. (2005), reductions in dry matter losses, during the storage process, are observed when there is a lower leaching by the additive effect or when significant changes happen at the fermentation process. Nevertheless, this effect was not observed in this study because there was no difference (P>0.05) in the dry matter recovery between treatments or opening periods. Dry matter recovery means, considering all the opening periods, were 86.9 and 86.6 for additive and control, respectively. The gas production was affected (P<0.05) by the additives on days 30 and 60, with the lowest values observed for the control treatment. Higher losses, in elevated storing times, can be related to secondary fermentation, usually mediated by the heterolactic bacteria, who presents slower fermentative metabolism. These microorganisms are featured by the CO_2 production during the lactic acid and carbohydrates conversion to acetic and propionic acids, resulting in dry matter losses (McDonald et al., 1991).

Conclusion According to the study conditions, the microbial additive was efficient only to reduce corn silage effluent production on day 90, with no significant effects on the fermentation process.

References

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Table 1. Corn silage effluent production (kg of effluent/t fresh forage) on different opening periods, using a microbial additive

Period	Day 30	Day 60	Day 90
Additive	17.5^{B}	16.6^{B}	18.8^{B}
Control	19.2^{B}	18.3^{B}	21.3^{A}

Means followed by same capital letters in columns, do not differ Student “t” test, 5% significance.

Table 2. Corn silage gas losses (% DM) on different opening periods, using a microbial additive

Period	Day 30	Day 60	Day 90
Additive	1.3^{bC}	1.7^{bB}	2.4^{aA}
Control	1.0^{aC}	1.4^{aB}	1.9^{aB}

Means followed by same capital letters in columns and lowercase in lines, do not differ Student “t” test, 5% significance.