Evaluation of Sorghum silage submitted to different doses of a bacterial-enzymatic inoculant

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Introduction Sorghum (Sorghum bicolor) is a C4 warm-season annual grass similar to corn, except it has a panicle-type seed head with smaller grain kernels, a higher lignin content, and greater yields in low-moisture conditions. Sorghum silage may be potential alternative forage for dairy cows (Cattani et al., 2017). In order to improve the ensiling process, additives can be used to prevent secondary fermentation. Chemical silage additives normally inhibit or restrict undesirable silage fermentation or aerobic deterioration, whereas microbial inoculants stimulate fermentation. The effectiveness of additives depends on the degree of preventing such fermentation in silages (Santos et al., 2013). With the aim of evaluate the effect of different levels of enzymatic-bacterial inoculant on sorghum silage quality this experiment was carried out.

Material and methods The experiment was carried at the Núcleo de Pesquisa e Extensão da Cadeia Leiteira (NUPECLE) located at the Universidade Federal de Santa Maria. The sorghum (Advanta® ADV 2499) was sown on January 2015. Pasture was fertilized with 30 kg ha-1 of nitrogen (N). The plants were harvested and then chopped at an average particle size of 2 cm, and then 48 mini-silos weighing 10 kg each one were produced. The filling, compressing and sealing of the mini-silos were performed in 10-L plastic buckets that were internally coated with plastic bags. During the ensiling process, different doses (0; 7.5ml; 15ml and 30ml per kg of fresh matter) of enzymatic-bacterial inoculant were added to the chopped sorghum. The inoculant containing *Lactobacillus buchneri*, *Pediococcus acidilactici*, *Propionibacterium acidipropionici* and *Lactobacillus plantarum* was previously diluted in distilled water according to the manufacturer's recommendations. After opening the silos (40 days after the ensiling process), samples were collected and analyzed by near-infrared spectroscopy (NIRS). For the pH analysis, it was used a digital phmeter. The dry matter recovery, losses through gases and effluents were estimated by the equations described by Jobim et al (2007). The experimental design was the completely randomized with 4 treatments with 12 replications per treatment. The data were subjected to analysis of variance and an alpha level of 0.05 was used to test the statistical significance. Means were compared by the Tukey test. All statistical analyses were performed using Minitab (2017) statistical software.

Results and discussion The doses of inoculant did not affect ($P > 0.05$) the losses by gases, total dry matter, sugars and VFAs. The pH decreased ($P < 0.05$) only when the recommended dose (7.5 ml) was added. However, the observed values are within the range considered as desirable for silage conservation. The addition of inoculant significantly decreased ($P < 0.05$) the effluent loss when compared to the control. Effluent production is associated with the dry

matter content of ensiled forage. Lower losses represent a benefit to the silage quality, since it is related to the nutrients concentration and, consequently, nutritional value. In addition, effluents losses may cause environmental pollution (Nussio et al., 2002). As a consequence of lower effluent losses, dry matter recovery was exponentially increased in response to inoculants levels (Figure 1). Homofermentative bacteria, such as *Lactobacillus plantarum*, inhibit the development of undesirable microorganisms, reduce losses, and promote a higher recovery of DM (Santos et al., 2013). This translates not only to less waste, but also to better feed quality.

Conclusions

The addition of inoculant improve silage quality and may reduce environmental pollution through its effects on effluent losses. However, higher levels of this additive did not affect silage characteristics.

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References

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Table 1. Qualitative parameters of sorghum silage submitted to increasing inoculant levels

	Treatments (ml/kg of fresh matter)					
	0	7,5	15	30	SD	Prob.
pH	4,07[a]	3,91[b]	4,01[ab]	4,08[a]	0,11	0,01
Effluent losses, kg/ton	9,22[a]	6,58[b]	7,21[b]	6,77[b]	1,54	0,00
Gas losses, % of DM	2,92	2,70	2,71	2,08	0,83	0,16
Dry matter recovery, %	94,94[b]	96,33[ab]	98,48[a]	99,52[a]	2,30	0,00
Total dry matter, %	31,20	30,50	30,29	29,61	1,84	0,24
Sugars, % of DM	0,69	0,61	0,71	0,53	0,52	0,85
Acetic, % of DM	0,25	0,20	0,11	0,30	0,29	0,21
Butyric, % of DM	0,07	0,04	0,04	0,07	0,07	0,55
Lactic, % of DM	4,29	5,98	4,80	4,83	2,34	0,36

SD, Standard deviation; Prob., probability; DM, dry matter

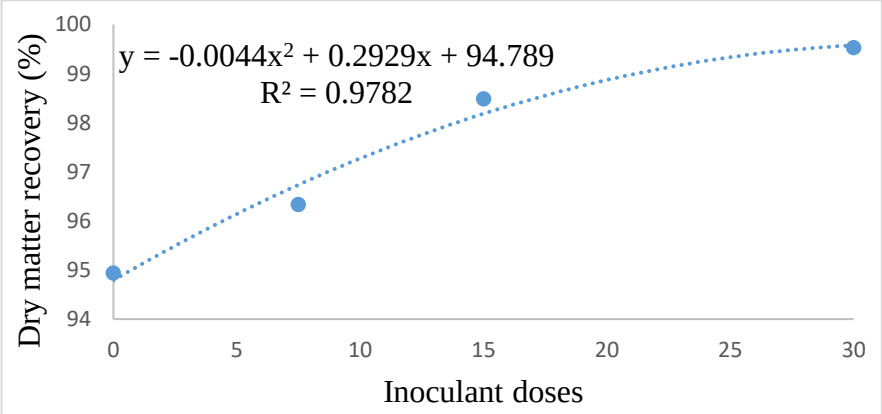

Figure 1. Response of dry matter recovery to increasing inoculant levels (7.5, 15 and 30ml/kg of fresh matter)