Relation among loss, physical and chemical characteristics of corn silage

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Introduction The production of silage of high nutritional quality with minimum possible losses is of interest to producers because it allows increased animal productivity and cost reduction. Thus, this study was carried out to evaluate the physical and nutritional characteristics of corn silages in relation to effluent losses, deteriorated layer and silage disposal.

Materials and Methods From March to July, 2011, 95 properties from eight cities in the region of Campos Gerais, Paraná were visited and 108 silos used in animal feeding were evaluated. The density (DEN) of the silage was determined according to the methodology proposed by D'Amours and Savoie (2005). At the time of sampling, the temperature of the silage was measured with a pen shape digital thermometer, at 0-15 cm in depth, and at five points in the silo panel. To assess the aerobic stability, silage samples were collected and placed in 20 liters buckets at 25 °C ± 2 °C for 120 hours. Aerobic stability was broken when the temperature of the silage increased by 2 °C compared to ambient temperature (Moran, 1996). For all silages, the content of dry matter (DM), crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), total digestible nutrients (TDN), relative nutritional value (RNV), in vitro dry matter digestibility (IVDMD), starch, hydrogen potential (pH), zearalenone mycotoxin, distribution (sieves 1, 2, 3 and 4) and average particle size (APS) were determined using Penn State sieves. For data analysis the Pearson correlation test was performed between the three variable responses and the physical and chemical characteristics of the silage. The statistical program used was the SAS 9.3, through the Proc Corr procedure.

Results and Discussion The dry matter density, aerobic stability, CP, ADF, NDF, TDN, starch, sieves (1, 2 and 4), RNV, IVDMD and zearalenone variables were not associated with the losses. The DM and pH variables had a negative correlation with the effluent losses, that is, the greater the losses, the lower the DM content and the pH of the silage (Table 1). According to (Schmidt et al., 2011), the effluent volume is influenced by the DM content, particle size, degree of compression, type of silo and characteristics of the plant itself. Silages with higher effluent losses were more acid (lower pH). This is due to premature harvest of the plants with higher levels of sugar and water, thereby facilitating the development of bacteria responsible for producing lactic acid which lowers the pH.

None of the assessed variables was related to the deteriorated layer. This might have occurred because the analysis was made on samples taken in the silo panel, below this layer. However, in many situations the length of the deteriorated layer may be associated with poorly fermented silages, impairing the quality due to infiltration or the presence of oxygen (Borreani et al. 2007).

Losses due to the disposal of the silage had a negative correlation with the density of the silage (NMDE) and the retained extract in sieve 3 (PennState 1.18 to 8.0 mm), and a positive correlation with the temperature of the silage in the silo and the particles average size (PAS). The density of the silage was favored by the smaller average particle size and a greater amount of them retained in sieve 3. The higher compaction results in increased silage density, reducing the porosity (Holmes, 2009) and the development of undesirable micro-organisms, which cause the temperature rise and the decomposition of the silage (Bolsen et al. 1993).

Table 1 Correlation between losses agents and the quality of the silage.

Variable	Effluent		Deteriorated Layer		Silage Disposal	
	r	p > f	r	p > f	r	p > f
NMDE	0.0932	0.3376	0.0612	0.5294	**-0.2055**	**0.0329**
T0	0.1199	0.2163	0.1718	0.0755	**0.3096**	**0.0011**
DM	**-0.2233**	**0.0202**	-0.0669	0.4917	0.0508	0.6019
pH	**-0.2472**	**0.0099**	-0.0875	0.3679	-0.0004	0.9967
Sieve 3	-0.0677	0.4865	-0.1296	0.1814	**-0.2161**	**0.0247**
PAV	0.0189	0.8462	0.1609	0.0963	**0.2196**	**0.0224**

NMDE: natural matter density; T0: temperature of the silo panel; DM: dry matter; pH: potential hydrogen; Sieve 3, 1.18 to 8 mm; PAV: particles average size.

Conclusion The effluent losses are higher when the DM content and silage pH are lower. The losses due to silage disposal are higher when the particle size is bigger and the density of the natural material is lower, which results in higher temperature in the silo panel. The physical and chemical characteristics of the silo panel have no relation to the losses through the deteriorated layer below the tarp.

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