**Aerobic stability varies in different silage layers**

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**Introduction** Aerobic stability (AS) is a variable measured in several laboratory scale experiments, and this variable is defined as the moment when silage temperature exceeds two degrees above ambient temperature. However, when measuring this variable, it is usually used only one data logger in the center of the evaluated mass, taking this measure as a representation of the whole. Based on this, the objective of this study was to evaluate if there is a difference in aerobic stability performed in corn silage, in different layers (top, center, bottom) versus one layer (center).

**Materials and Methods** The study was carried out at the Centro de Pesquisa em Forragicultura (CPFOR) located at the Canguiri Experimental Farm of the Federal University of Paraná. Corn was planted in September 2017 and harvested in March 2018, with 35.05 % DM and pH 6.17, ensiled in experimental silos with a capacity of 20L and a density of 600 $m^3$, and stored for 400 days at room temperature. The silos were opened and homogenized under plastic canvas and DM and pH samples were collected, with values of 33.63% DM and 3.47, respectively. The AS was performed based on the methodology of Moran et al. (1996), where 4 kg of silage were allocated in uncapped 20 L buckets, divided into three layers by two mesh stainless steel mesh and a temperature sensor was fixed in the center of each layer analyzed (top, center and bottom), in a total of 7 repetitions. The buckets remained in a temperature-controlled room at 25°C for 240 hours, with chipping USB data loggers, scheduled for measurements every 5 min. At the end of 240 hours each layer was removed and homogenized individually for DM and pH collection. DM samples were performed according to AOAC (2001), and for pH 25 g were collected from samples of each layer and added 225 mL of distilled water, homogenized with glass rod for one minute and the values measured in a GEHAKA digital pHmeter. The AS was defined as the moment that the silage heats up two degrees above room temperature, for 30 consecutive minutes; the accumulated temperature (Tacum) as the sum of the temperature over 240 hours and the maximum temperature (Tmax) was the peak temperature recorded on each layer. The experimental design used was a completely randomized design with the mini-silos considered as repetition and the layer (top, center and bottom) as treatments. Data normality tests were performed, and when they were not normal, the non-parametric paired Wilcoxon test was performed, while for the normal variables the paired T-test was performed.

**Results and Discussion** The variable that most differed between the layers was the dry matter content. This difference was about 8% between each of the layers (Table 1). Yeasts are usually the initiating microorganisms of aerobic deterioration, consuming soluble carbohydrates and acids produced during fermentation, consequently raising the pH and temperature of the ensiled mass (Pahlow et al., 2003). The pH values of this experiment are in agreement with the

literature (Junges, 2014) the same author also demonstrates that Tmax is in line with the literature, and as storage time increases, it decreases.

**Table 1** Values and standard error (SE) of the dry matter (DM), pH and maximum temperature (Tmax) in top, center and bottom evaluated during aerobic stability.

| Variables | Top | | Center | | Bottom | |
|---|---|---|---|---|---|---|
| | Mean | SE | Mean | SE | Mean | SE |
| DM, % | 35.53[a] | 0.334 | 33.79[b] | 0.419 | 32.61[c] | 0.141 |
| pH | 3.75[c] | 0.072 | 3.89[b] | 0.123 | 3.99[a] | 0.043 |
| Tmax, ºC | 25.64[c] | 0.923 | 28.21[a] | 1.459 | 25.85[b] | 1.335 |

[a-c]Means followed by different lowercase letters in the row differ at 5%.

Accumulates temperature (Tacum) had a difference of more than 1000°C comparing the center with the other layers, which is correlated with AS, the lower the accumulated temperature higher the aerobic stability (Table 2). Although the top of the mass was 6 hours more stable than the bottom layer, it had intermediate values of Tacum, the center had intermediate Tacum values, the center of the bucket escapes from the literature, where the highest Tacum is related to higher AS Table 2. These differences may be correlated with air penetration within the mass and microbiological growth. Another observation found in this assay was that as AS breakdown occurs, the temperature difference is greater layers mainly between top and bottom The DM and pH variables may have this difference minimized with homogeneous sampling at the end of the AS, but the temperature variables may be underestimated or overestimated in the assays that use them. By increasing the number of measurement points during AS assays, it is possible to increase the accuracy of the results obtained.

**Table 2** Median and e coefficient of variation (CV), aerobic stability (AS) and accumulated temperature (Tacum) in different layers during aerobic stability (top, center and bottom).

| Variables | Top | | Center | | Bottom | |
|---|---|---|---|---|---|---|
| | Mean | CV | Mean | CV | Mean | CV |
| AS, hours | 162.08[a] | 0.087 | 152.83[c] | 0.108 | 155.75[b] | 0.106 |
| Tacum, ºC | 5329.3[b] | 0.399 | 6816.8[a] | 0.736 | 5241.8[c] | 0.778 |

[a-c]Means followed by different lowercase letters in the row differ at 5%.

**Conclusions** Under the conditions of this experiment it was possible to observe that there is a difference in evaluating the AS in different layers compared to the central layer, suggesting further studies or improvement of methodologies used to evaluate AS in laboratory scale silos, since this analyses have great importance, especially when the experiments have the objective to estimate the aerobic deterioration during exposure to air and the use of additives.