

Effect of sealing strategies on the panel temperature of corn silage

A.W. Bispo¹, D. Junges¹, A. Sá Neto¹, C. Kleinshmitt², J.L.P. Daniel¹, E.H. Cabezas-Garcia¹, L.G. Nussio¹

¹University of São Paulo, Department of Animal Sciences, Piracicaba, São Paulo, Brazil

²University of Santa Catarina State, Chapecó

Email: awb@usp.br

Introduction Aerobic deterioration is the mainly factor that contributes to losses during ensiling process (Ashbell and Liska, 1988). Because the deterioration is essentially triggered by microorganisms' growth, an essential prerequisite is to minimize the presence of oxygen after sealing the silo. Anaerobic environment inhibit the presence of fungi which is responsible for the silage heating and, in turn, losses of nutrients. Thus, the plastic film is important in the set of strategies associated with sealing and anaerobiosis maintenance. The experiment aimed to measure the panel temperature in corn silage sealed with different plastic films.

Materials and Methods The experiment was carried out at the Department of Animal Science of USP/ESALQ. The treatments consisted of four sealing strategies: 1) silo covering with 200 μm v, 2) silo covering with 200 μm black-on-white polyethylene film overlaid with sugarcane bagasse (10 cm thickness), 3) silo covering with 45 μm polyamide film combined with a protective mesh tarp; 4) silo covering with 125 μm black-on-white coextruded oxygen barrier film. Plants were harvested with 35 % DM and ensiled in four bunker silos, with 75 t fresh forage capacity. Evaluations of silages were made in the panel immediately after silage feedout in the morning. Four regions of the silo panel (210 x 150 cm) were sampled: a) top side (TS), b) top center (TC), c) bottom side (BS) and d) center (C). Four samples were collected over time, with intervals of 21 days from July to September 2011. After silage removal, thermometers were placed on the panels, arranged in the width of 0, 60, 120, 180 and 240 cm from the side of the silos and the height of 0, 10, 20, 30, 70, 110 and 150 cm from the top of the silos, totaling 35 temperature collection points in each silo. From these points there were generated means for the four mentioned regions. The experimental design was randomized complete blocks, in a 4x4 factorial scheme (four sealing strategies and four sampling sites). Data were analyzed as repeated measurements by using the MIXED procedure of SAS. Means of plastic films were compared by Tukey's test ($\alpha = 5\%$). Orthogonal contrasts were used to evaluate silo zones.

Results and Discussion The higher panel temperatures were observed on the top zones, closer to the plastic film (TS and TC). As expected, these areas are more susceptible to aerobic deterioration due to the oxygen permeation and lower density. In the other hand, C and BS zones were well preserved and showed temperatures closer to the environment. The temperature difference between the warmest and coldest zones exceeded 7°C (Table 1). Overlaying the plastic film with sugarcane bagasse was effective to prevent heating (Table 2). This strategy weight down the cover and avoid directly solar radiation incidence, decreasing gas exchange between silage and environment. Polyethylene coextruded with polyamide film (treatment 4) was as effective as overlaying sugarcane bagasse in a silo sealed with polyethylene film. Black-on-white polyethylene film without any protection (treatment 1) and the polyamide film combined with a protective mesh tarp (treatment 3) showed the highest panel temperatures. Polyamide film is characterized by low oxygen permeability and in this way it was expected lower panel temperature, contrary to observed. More trials should be carried out to check this found.

Conclusion The adoption of polyethylene film overlaid with sugarcane bagasse was effective to reduce the panel temperature in corn silage stored in bunker silos.

References

Ashbell, G.; Lisker, N. Aerobic deterioration in maize silage stored in a bunker silos under farm conditions in a subtropical climate. *J. Sci. Food Agric.* 45:307–315. 1998.

Table 1. Panel temperature of silage corn under different sampling points

Zone ¹	Temperature (°C)
TS	33.47
TC	33.09
BS	27.03
C	26.28
SEM ²	0.90
Contrasts	
(TS+TC) x (BS+C) ³	<0.01
TS x BS	<0.01
TC x C	<0.01

¹TS – top side; TC – top center; BS – bottom side; C – center;

²SEM: standard error of the mean;

³Top vs. bottom contrast;

Table 2. Panel temperature of corn silage under different sealing strategies in the moment of silos opening

Treatment	Temperature (°C)
1) black-on-white polyethylene film	30.66 ^{ab}
2) black-on-white polyethylene film overlaid with sugarcane bagasse	27.80 ^b
3) polyamide film combined with a protective mesh tarp	32.33 ^a
4) black-on-white coextruded oxygen barrier film	29.09 ^b
SEM	0.93
<i>P</i>	<0.01

SEM: standard error of the mean