Heating after ensiling and aerobic stability of corn silage

M. Strack[1], I.Q. Carvalho[1], R.Y. Tsukahara[1] and E.G. Kochinski[1]

[1]*ABC Fundation, Castro, Paraná 84165-700, Brazil, Email: maryon@fundacaoabc.org.br, igor@fundacaoabc.org.br, rodrigo@fundacaoabc.org.br, giovanni@fundacaoabc.org.br*

Introduction The forage is the main component of ruminant diets (Senger et al., 2005). In the Campos Gerais region, Paraná, corn silage makes up 60-80% of the total dry matter of forages feed to dairy cows (Janssen, 2009). Conserved forages can have their food value changed according to the procedures used for their production and conservation (Jobim et al., 2007). The loss of aerobic stability of the silage results in spoilage and involves heat generation, loss of sugars and release of CO_2 and NH_3 (Muck et al., 2003). The objective of this work was to study the behavior of the temperature inside the silo and aerobic stability after opening.

Materials and Methods The study was conducted on a farm silo in the city of Castro, Paraná, Brazil. The corn hybrid used was P30R50H with dry matter content of 32%. The silage temperature data were collected through five temperature sensors (Model 107) connected to a data collection platform (model CR 1000, Campbell Scientific). The sensors were installed on the day of ensiling and recorded temperature values in 60 minute intervals during the period of 66 days between March 5 and May 10, 2012. The sensors were removed when they were one meter away of the silo panel. The panel temperature was measured on the day of remove of sensors with a digital thermometer type "skewer" (Incoterm brand), in a depth of 0 to 20 cm, in five points. Aerobic stability was evaluated using the methodology proposed by Borreani and Tobacco (2010). This method based on a comparison of the temperature in different parts of the silo panel, with the temperature at the midpoint of the panel, at the depth of 40 to 60 cm. Another indication of the breakdown of aerobic stability is the increase of the pH of silage exposed to air (Jobim et al., 2007). Therefore, the pH was measured on five points of the panel (0 to 20 cm) and inside the silage (40 to 60 cm).

Results and Discussion Figure 1 shows the data of temperature inside the silo (average of five points) and the external temperatures (maximum, average, and minimum). The peak of temperature was at 10 days after ensiling, reaching 39.6°C. The temperature variation inside the silo was slow and gradual and did not correlate with the external temperature (ambient).

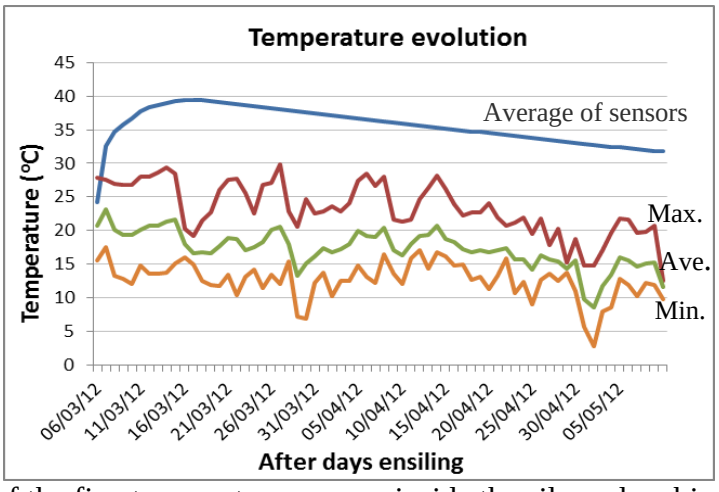

Figure 1 Average of the five temperature sensors inside the silo and ambient temperature.

Figure 2 shows the data of temperature and pH on five point of the panel and inside of the silo on the day of remove of the sensors. The lower position sensors warmed faster after closing the silo, because the silage on these points was deposited and compacted before. The central sensor took longer to dissipate the accumulated heat. The points on top were lower temperature, indicating faster heat loss to the environment.

Figure 2 Temperature and pH at the five points on the panel and inside of the silo.

After 66 days the average temperature in the five points at the panel of the silo (0 to 20 cm) was 26.5°C, above the ambient temperature of 11.5 °C. That could mean loss of stability. However, comparing the panel temperature with the internal mass of silage (40 to 60 cm), which was 33.4°C, we can conclude that the silage on the panel was not warming up, but cooling down. Borreani and Tabacco (2010) suggest that the silage temperatures above 5°C related inside of the silo have greater microbial activity, causing further deterioration of silage. The pH of the silage on the five points of panel was low (3.86 to 3.89) and did not differ with pH inside the mass of silage (3.89). The pH was not related to temperature, proving that the silage was stable without deterioration by aerobic microorganisms.

Conclusions The temperature of the silage mass has no correlation with the external temperature. With the time, dissipation of the heat accumulated in the mass of silage occurs to the environment, this effect can take months. The methodology proposed by Borreani and Tobacco (2010) was effective in evaluation of the aerobic stability of silage.

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