

Model-based research for the risk and prediction of silage bale deterioration suffered from aerobic impact

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Abstract: The conservation of grass in silage bales has been developed as an alternative operating technique to clamp silos. Due to the improvement of the technology in regard to higher throughput and increased density the baling technique is often used for the whole grass conservation on dairy farms from 60 to 100 cows in Central Europe. To reduce energy and nutrition losses in animal production the baling technique gets into the focus of preserving fodder even in China.

The effect of reheating at the opened siloface is avoided by the closed cover of every single bale as long as the stretch film is free of damages. Many users are convinced of lower feedlosses and better silage quality in bales compared to clamp silos as alternative system. Previous investigations have proved good fermenting quality in bales.

Bulk density is an important factor also in bales because of different effects. A high crop density leads to mechanical stable shape and reduces film- and transport costs. Regarding silage quality during feedout a compact pressed bale minimises losses in case of small damages at the film surface.

Silage reheating is responsible for energy and nutrition losses in preserved staple fodder, potentially leading to a complete deterioration of the silage and endangering animals` health. It is effected by microorganisms (especially yeasts), the fermenting products and physical parameters like bulk density, particle size and dry matter.

The SinoGerman cooperation project pursues the qualitative and quantitative measurement and evaluation of the physically influencing factors (bulk density, dry matter content, oxygenation, air permeability) on the aerobic-induced reheating process of silage bales.

A test bench (developed by the cooperation) was used, which is measuring physical parameters like crop density, dry matter and temperature across the whole bale volume. It works with a penetrometer measuring the bale`s resistance against a cone according to the depth.

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To measure the temperature inside the intact bale a sensing element implemented into the cone is placed precise at defined points in the bale volume. The measured data of density and temperature is visualized by two and three-dimensional maps.

To get data about the dynamic of reheating in different depth of the surface under controlled conditions the same crop pressed into bales is ensiled in 60l tons and 1.5l glasses. The heating process in the tons is observed by sensing elements and thermography. The fermenting products and the aerobic stability of the silage are tested in standard laboratory analysis.

Crop density and dry matter are adjusted in three steps in tons and bales. The prediction of reheating and feedlosses by a first model based on the executed tests is one objective in the project.

In the presentation the multi-sensor experimental equipment as well as material and methods will be demonstrated. Statistical results will be illustrated by two- and three-dimensional mapping.

Keywords: silage, grass conservation, baling technique, aerobic-induced silage reheating, bulk density, test bench

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