

## **Seasonality of Oxygen isotope composition in cow (*Bos taurus*) hair and its model interpretation**

Guo Chen, Hans Schnyder, and Karl Auerswald

Lehrstuhl für Grünlandlehre, Technische Universität München, Alte Akademie 12, Freising-Weihenstephan 85354, Germany.

Oxygen isotopes in animal and human tissues are expected to be good recorders of geographical origin and migration histories based on the isotopic relationship between hair oxygen and annual precipitation and the well-known spatial pattern of oxygen isotope composition in meteoric water. However, seasonal variation of oxygen isotope composition may diminish the origin information in the tissues. Here the seasonality of oxygen isotope composition in tail hair was investigated in a domestic suckler cow (*Bos taurus*) that underwent different ambient conditions, physiological states, and keeping and feeding strategies during five years. A detailed mechanistic model involving in ambient conditions, soil properties and animal physiology was built to explain this variation. The measured oxygen isotope composition in hair was significantly related ( $p < 0.05$ ) to the isotope composition in meteoric water in a regression analysis. Modelling suggested that this relation was only partly derived from the direct influence of feed moisture. Ambient conditions (temperature, moisture) did not only influence the isotopic signal of precipitation but also affected the animal itself (drinking water demand, transcutaneous vapor etc.). The clear temporal variation thus resulted from complex interactions with multiple influences. The twofold influence of ambient conditions via the feed and via the animal itself is advantageous for tracing the geographic origin because the oxygen isotope composition is then less influenced by variations in moisture uptake; however, it is unfavorable for indicating the production system, e.g. to distinguish between milk produced from fresh grass or from silage.