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Tracking regional authenticity of foodstuffs by means of stable isotopes

Xenia Gatzert (1,2), Markus Boner (3), Robert Hermanowski (1), Rolf Mäder (1), Andreas Gattinger (2), and Natalie Orlowski (4)

(1) FiBL (Research Institute of Organic Agriculture) (xenia.gatzert@fibl.org), (2) Institute for Plant Production and Plant Breeding II – Organic Farming with Focus on Sustainable Soil Use, Justus Liebig University Giessen, Germany, (3) Agroisolab GmbH, Germany, (4) Chair of Hydrology, University of Freiburg, Germany

Tracking the regional authenticity of food is a rapidly developing field due to growing public awareness concerning food quality and safety. The analysis of different stable isotopes has become a popular tool for determining the origin of foodstuffs. The measurement of stable carbon (δ13C), nitrogen (δ15N) and sulphur (δ34S) isotopes in tissues of organisms reflects their assimilated diet, whereas stable hydrogen (δ2H) and oxygen (δ18O) isotope measurements provide information on local environmental water uptake by organisms.
In a cooperation project of Agroisolab and FiBL data of oxygen, hydrogen, carbon, nitrogen and sulphur isotope values of over 450 agricultural plant and animal products from Hesse (Germany) were collected. The data was compared against blank samples to test whether we can determine their regional authenticity on a postcodes area level.
Furthermore, an independent statistical evaluation of the data has been initiated in 2018 to draw up the relevant parameters of tracking the different goods. It could be verified that not all isotopes were equally helpful when determining regional authenticity of foodstuffs.
For potatoes, δ15N and δ13C values, for wheat δ18O and for apples δ2H values were suitable indicators for proofing their regional authenticity. For beef, we found that δ15N and δ34S values worked best to trace its regional origin, whereas for milk all isotopes except for sulphur were useful. For pork and eggs, only δ2H and δ13C values were able to distinguish best between postcode areas of the products. This shows the need to perform multi isotope studies, when the origin of a product should be determined on a postcodes area level. When isotope measurements should become a major tool for determining product origin, there is an urgent need for a broad reference database. However, when reference data in terms of blank samples are available, stable isotope measurements are a valuable tool to support traceability systems and to verify product origin.