Using plant physiological stable oxygen isotope models to counter food fraud

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4627517
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Year 2021
Title Using plant physiological stable oxygen isotope models to counter food fraud
Journal Scientific reports
Volume 11
Number 1
Pages / Article-Number 17314
Fraudulent food products, especially regarding false claims of geographic origin, impose economic damages of $30-$40 billion per year. Stable isotope methods, using oxygen isotopes (δ 18 O) in particular, are the leading forensic tools for identifying these crimes. Plant physiological stable oxygen isotope models simulate how precipitation δ 18 O values and climatic variables shape the δ 18 O values of water and organic compounds in plants. These models have the potential to simplify, speed up, and improve conventional stable isotope applications and produce temporally resolved, accurate, and precise region-of-origin assignments for agricultural food products. However, the validation of these models and thus the best choice of model parameters and input variables have limited the application of the models for the origin identification of food. In our study we test model predictions against a unique 11-year European strawberry δ 18 O reference dataset to evaluate how choices of input variable sources and model parameterization impact the prediction skill of the model. Our results show that modifying leaf-based model parameters specifically for fruit and with product-independent, but growth time specific environmental input data, plant physiological isotope models offer a new and dynamic method that can accurately predict the geographic origin of a plant product and can advance the field of stable isotope analysis to counter food fraud.
ISSN/ISBN 2045-2322
edoc-URL https://edoc.unibas.ch/84975/
Full Text on edoc No;
Digital Object Identifier DOI 10.1038/s41598-021-96722-9
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/34453087
ISI-Number 000691009100008
Document type (ISI) Journal Article