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IsoTrace

- an efficient and flexible way of analysing origin -

Basis:

The elements of life - hydrogen, oxygen, carbon, nitrogen and sulphur - exist in different heavy forms, the so-called isotopes. They differ only in the number of neutrons in the atomic nucleus. If the number of neutrons is too high, the atomic nucleus is unstable and decays (radioactivity), as is known, for example, with carbon ^{14}C.

However, other isotopes with a higher number of neutrons are stable and do not decay, such as ^{13}C. Therefore, these are called stable isotopes. The number of heavy isotopes varies from material to material and from region to region.

Every biomass, thus also every food, thus has a natural marking, the so-called "isotopic fingerprint". This fingerprint is not visible and cannot be changed.

Differences in nature occur due to incomplete processes (fractionation) in which the light isotope, e.g. ^{12}C, is preferred. In nature, hydrological (water cycle), geological, climatic and biochemical fractionations are known.

They leave significant patterns in organic materials in plants as well as animals and humans, which can be used to trace the country of origin, the region, even the field, or to verify the type of agriculture (organic/conventional).

Accordingly, stable isotope analysis is now the standard method for proving the origin of agricultural products and is even used in legal proceedings.

Origin database and Isotrace

In order to trace back or differentiate the isotope patterns, it is necessary to build up an isotope database based on references of the country of origin, the region and the fields according to the required request.
Therefore, Agroisolab holds more than 120 different product databases.
These are used to clarify specific questions, such as the origin or type of cultivation (organic/conventional).
A more refined, systemic approach for the customer uses pre-samples from the supplier to be able to break down the causality even down to the field (**I**so**T**race) or the wider region / country.
In practice, pre-samples are matched with the later delivery batches in the isotope pattern. In this way, a comparison can also be made all the way to country, region and to the field (Figure 1).

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This was successfully demonstrated, for example, in the watermark project of the BLE (Federal Office for Agriculture and Food).

The samples are not lost after matching, but are stored long-term in the Agroisolab archive.
With a steadily growing number of samples over several harvest years, the knowledge about the cultivation regions also grows steadily, so that in addition to the refined differentiation of origin, statements about cultivation conditions can also be provided. The finely ground and degreased samples are also available for other types of analysis (heavy metal contamination, variety) in the long term.

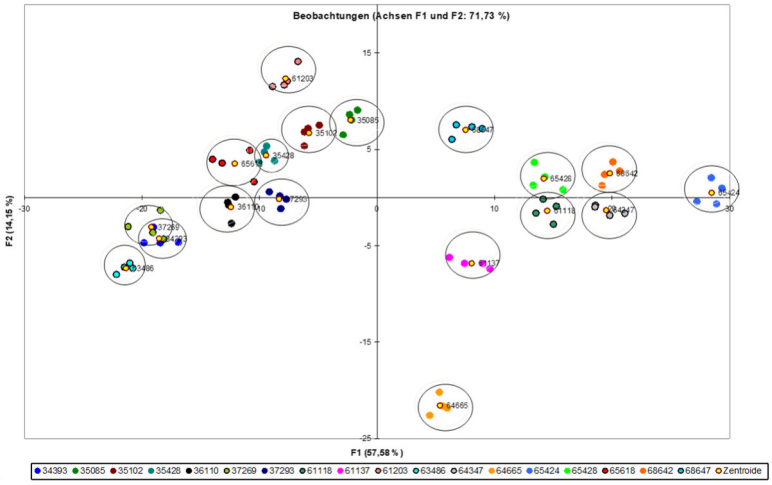

Figure 1: Mapping of carrot fields in Hesse with stable isotopes (COHNS) to check the field origin

The **I**so**T**race system enables the customer to work flexibly and closely with Agroisolab. The IsoTrace system is usually set up on a customer-specific basis; in overview, the following key points can be summarised:

- Storage of samples for comparison with commercial/product batches
  ➔ Narrow-meshed differentiation of origin possible.
- The growing client database is the property of the client and can only be used for further questions after consultation.
- On request, all isotope signatures of the reference samples and / or test samples are provided in an online database for the customer. The online database is password protected.
- After completion of the job, the test samples and preliminary samples are added to the Agroisolab sample archive. All samples (test sample and reference sample) are available in the long term for later investigations both for isotope analysis and other types of analysis (e.g. variety).

The use of IsoTrace brings a high psychological benefit, because similar to an "anti-doping database", the supplier is aware that long-term references are available for verification.

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