APPLICATIONS BRIEF 30399

EA-IRMS: Detecting organic grown vegetables

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Goal

Detect organic grown vegetables using nitrogen isotopes.

Introduction

Organic grown products, such as fruits and vegetables, attract higher prices on the market because they are healthier and safer for consumers and the farming practices are cleaner and more environmentally friendly.[1,2,3] The higher consumer cost is directly related to greater costs in growth and production of organic fruits and vegetables, and in the certification process that allows produce to be labeled and certified as organic. The certification process follows a set of standards (EC Council Regulation No 834/2007)[4] and excludes the use of synthetic fertilizer during plant growth.

As organic fruit and vegetables attract a higher price on the market, this can lead to economically motivated fraud through mislabeling produce as “organic” when they have been grown using synthetic fertilizer. The identification of mislabeled fruit and vegetables represents a challenge as laboratories need a technique that identifies fruits and vegetables grown using organic fertilizers and synthetic fertilizers with full confidence in results. The identification of mislabeled products subsequently protects consumer confidence, brand market reputation related revenue-generating capabilities.

In this application brief we show nitrogen isotope measurements on tomato samples and are able to conclude which tomatoes were grown using organic fertilizers and which tomatoes were grown using synthetic fertilizers.

Analytical configuration

For EA-IRMS sample analysis, using a system such as the Thermo Scientific™ EA IsoLink™ IRMS System, around 5 mg of dried, homogenized tomato samples were weighed into tin capsules. Samples were introduced to the combustion reactor from the Thermo Scientific™ MAS Plus Autosampler, where they were combusted in the presence of oxygen and the N_2 gas produced after reduction over hot copper, before being analyzed by the Thermo Scientific™ DELTA V™ Isotope Ratio Mass Spectrometer. Analysis time is less than 5 minutes, using 0.4 liters of helium per sample.

The nitrogen isotope fingerprint of vegetables

The nitrogen isotope fingerprints of vegetables are used to differentiate whether the fertilizer used for plant growth was organic or synthetic.[2,3,5] Vegetables grown using organic fertilizers, such as peat, sewage sludge and animal manure, tend to have nitrogen isotope values between +8‰ to +20‰.[2,3] Vegetables grown using synthetic fertilizers, such as potash and ammonia, tend to have nitrogen isotope values of +3‰ to +6‰.[2,3] This differentiation provides a framework to detect vegetables grown using organic or synthetic fertilizers thanks to a strong ^{15}N isotope resulting from ammonia volatilization, denitrification, nitrification and other N transformation processes prior to plant uptake.[3,5]

Are my vegetables organic grown?

In Table 1 and Figure 1, we show data from tomatoes that have been grown using organic and synthetic fertilizers. The nitrogen isotope fingerprint of the tomatoes shows a clear difference between tomatoes grown using organic fertilizers and synthetic fertilizers. The EA IsoLink IRMS System can therefore detect organic grown vegetables.

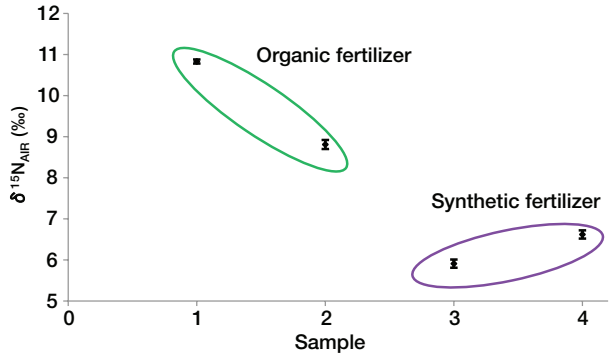

Figure 1. Nitrogen isotope fingerprints detect organic grown tomatoes.

Summary

The correct labeling of fruit and vegetable produce as "organic" affects consumer health and confidence, food integrity and brand reputation and revenue.

Laboratories need an analytical technique that can differentiate organic and non-organic grown fruit and vegetables: this can be achieved using the nitrogen isotope fingerprints measured using the EA IsoLink IRMS System.

By using Thermo Scientific EA IsoLink IRMS System, laboratories gain:

- Reliable, unique isotope fingerprint data to detect mislabeled fruits and vegetables.
- Fast and low cost sample analysis.
- Complete automation, reducing user intensity.

References

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Table 1. Nitrogen isotope fingerprints of tomato samples.

Sample Type	n	Sample weight (mg)	$\delta^{15}N_{AIR}$ ± 1SD (‰)	Organic or Non-organic
Citrus Leaves (internal reference)	4	1.74	4.85 ± 0.13	n/a
Tomato (FD1)	4	5.53	10.83 ± 0.05	Organic
Tomato (FD2)	4	5.27	8.81 ± 0.11	Organic
Tomato (FU1)	4	5.37	5.91 ± 0.10	Non-organic
Tomato (FU2)	4	5.23	6.62 ± 0.10	Non-organic

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