Tracking nature

The usage of stable isotopes to prove the authenticity of organic food, especially organic eggs and organic beef

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Analytical problem:

Assumption: no Pestizide detectable

Products from conventional and organic farming

are equal concerning:

- **main ingredients**
- **nutritional value**

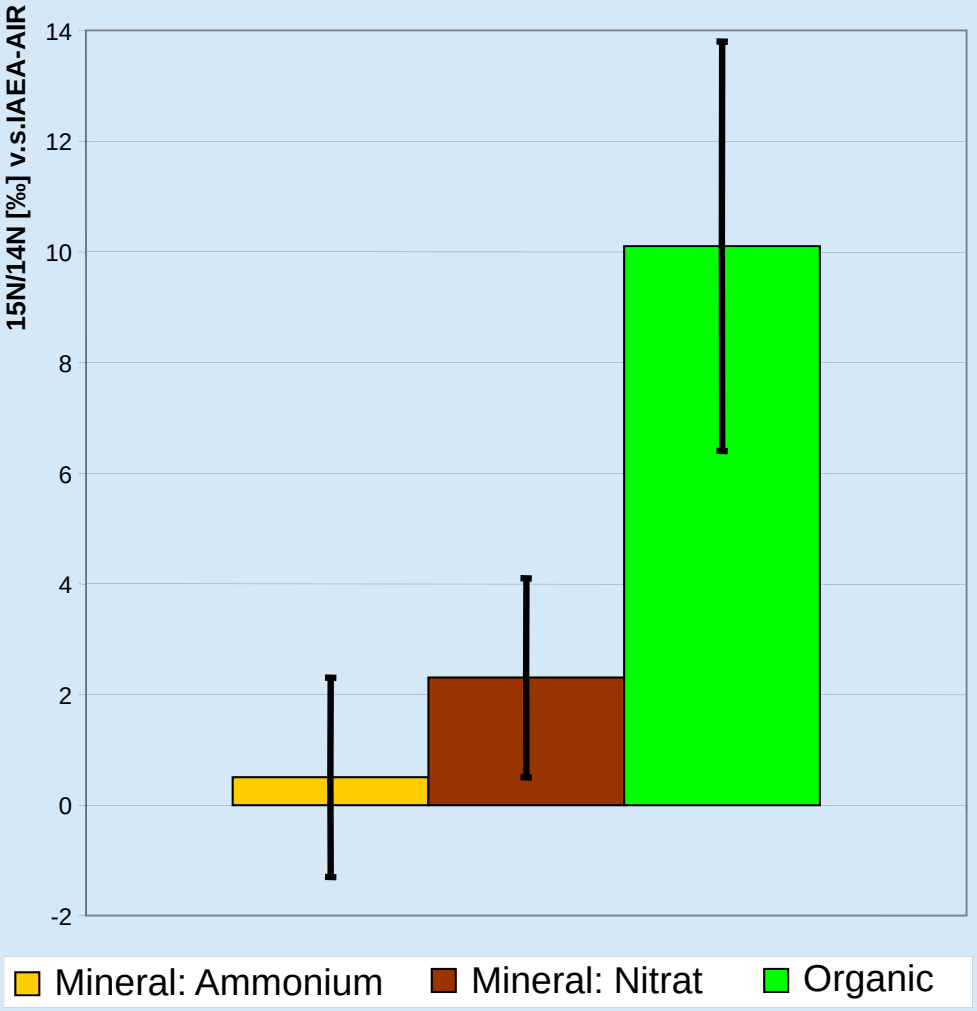
** K. Woese et all, A comparison of organically and conventionally grown foods – Results of a review of the relevant literature, J. Sci. Food. Agric 1997, 74, 281-293*

Solution / Possibility:

Indirect proof:

checking the causation of the fertilisation using 15N/14N isotopes

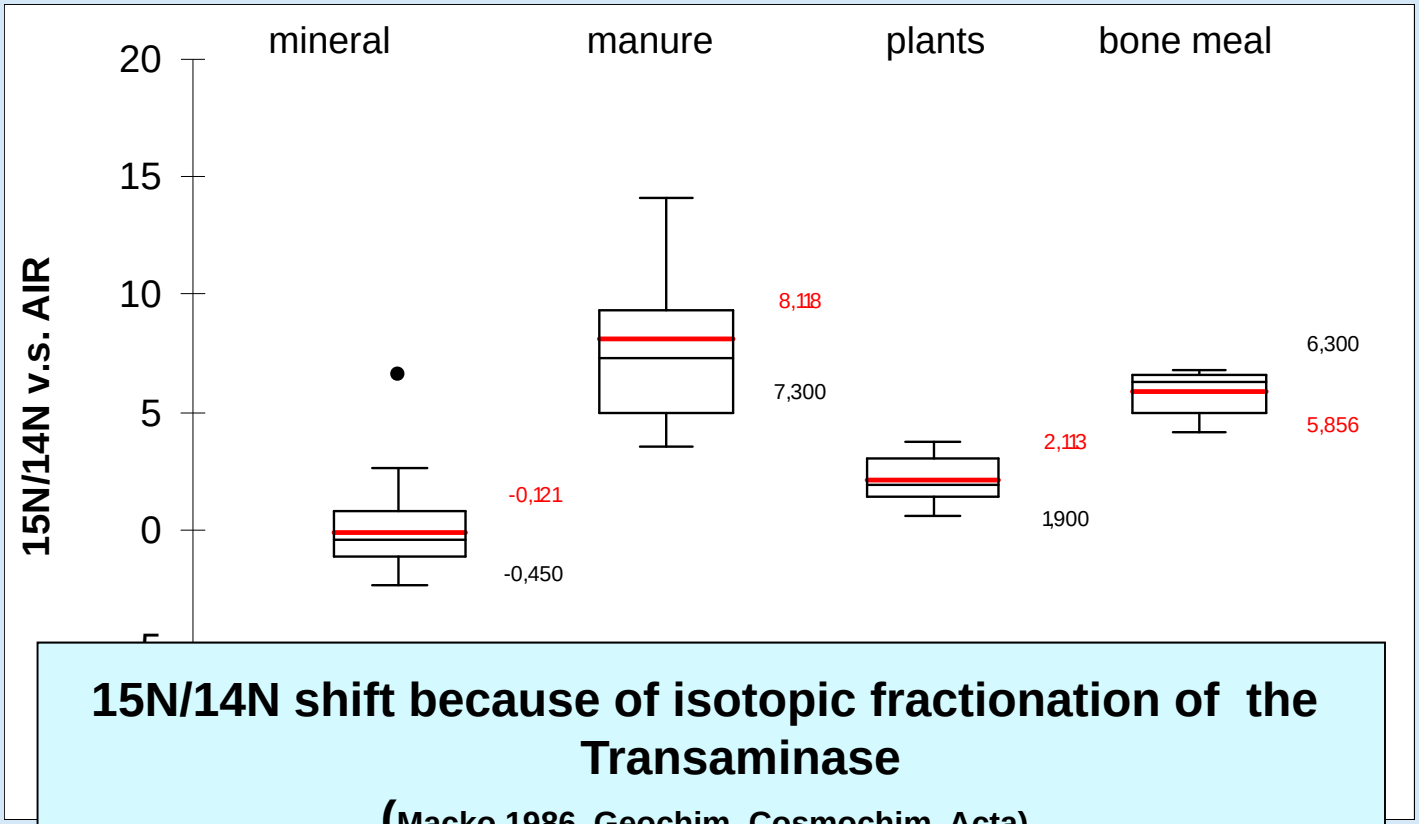
Differentiation of conventional and organic fertilizer



Shearer G.B.; Kohl D.H.; Commoner B. (1974). Soil Science. 118, 308-314.

15N/14N isotope ratios of various fertilizers

A. Bateman et all, Fertilizer nitrogen isotope signatures, 2007, Env. Health Studies



15N/14N shift because of isotopic fractionation of the Transaminase

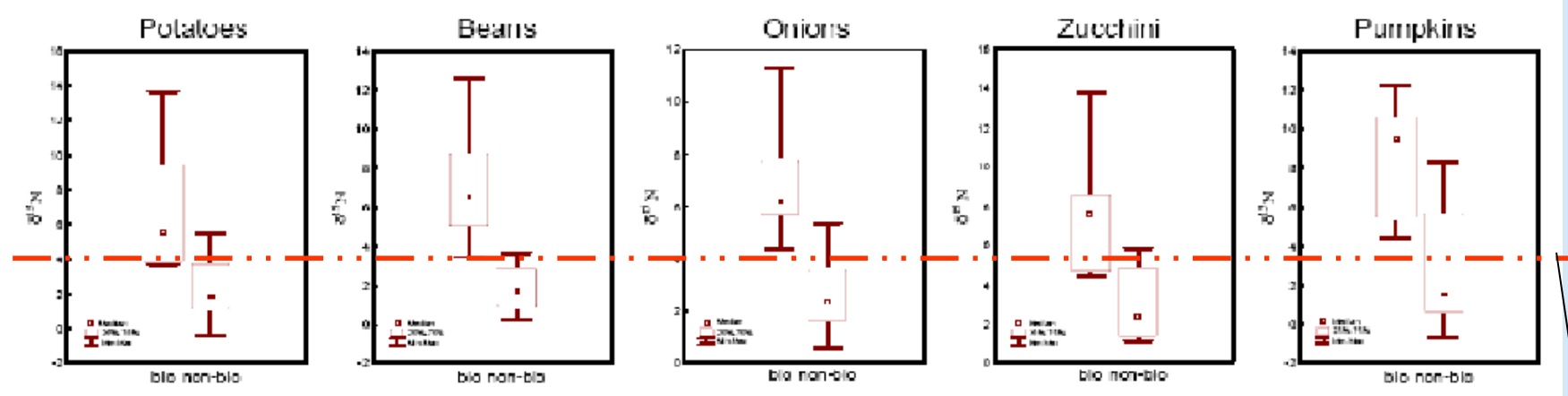
(Macko 1986, Geochim. Cosmochim. Acta)

Study 2004

Differentiation of organic and conventional farming

Execution:

Euopean Commission
DG Joint Research Centre
Institute for Health and Consumer Protection



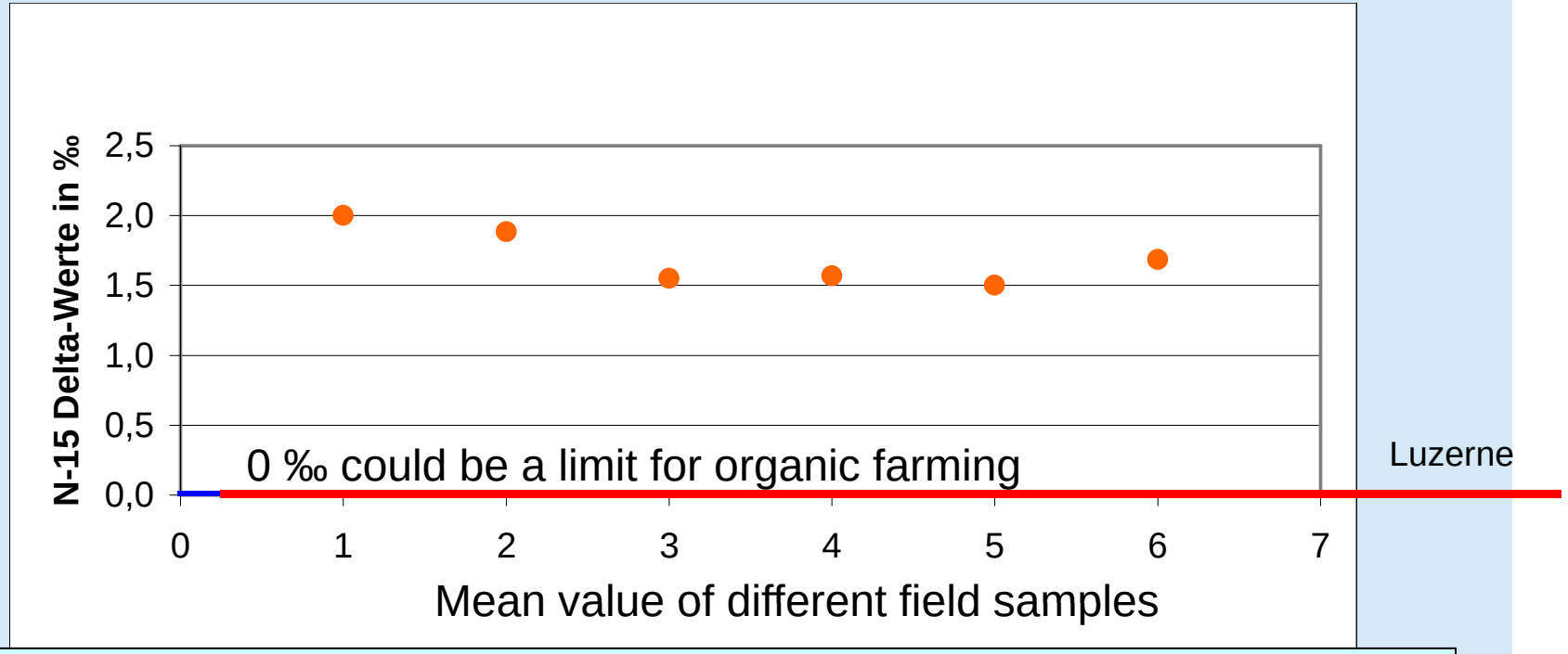
4 ‰ Limit: org. <> conv.

Problem: neglecting the fertilisation with plants (legumes)

15N/14N isotopic ratio in organic wheat

history: 4 years of applications of lucerne as fertilizer

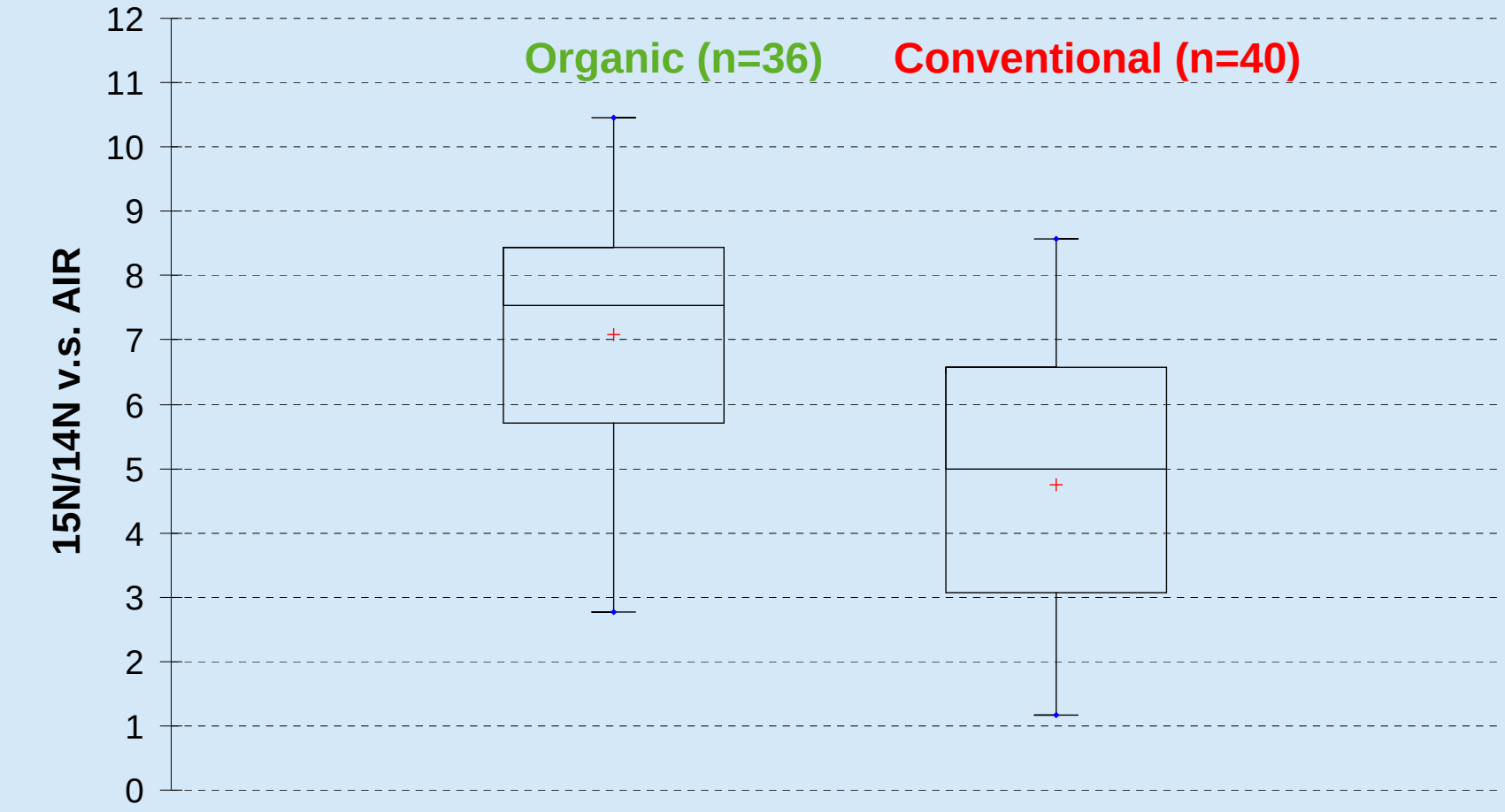
Result: using plants (legumes) as fertilizer generate 15N/14N ratios over +1 ‰ in the plants



G.L. Tuner, F.H. Bergersen, “Natural enrichment of 15N during decomposition of plant material in soil”, Soil Biol. Biochem., 2: 495 (1983):

Differentiation of conventional and organic carrots using 15N/14N isotopes

BLE-Projekt, Start: 05.2009



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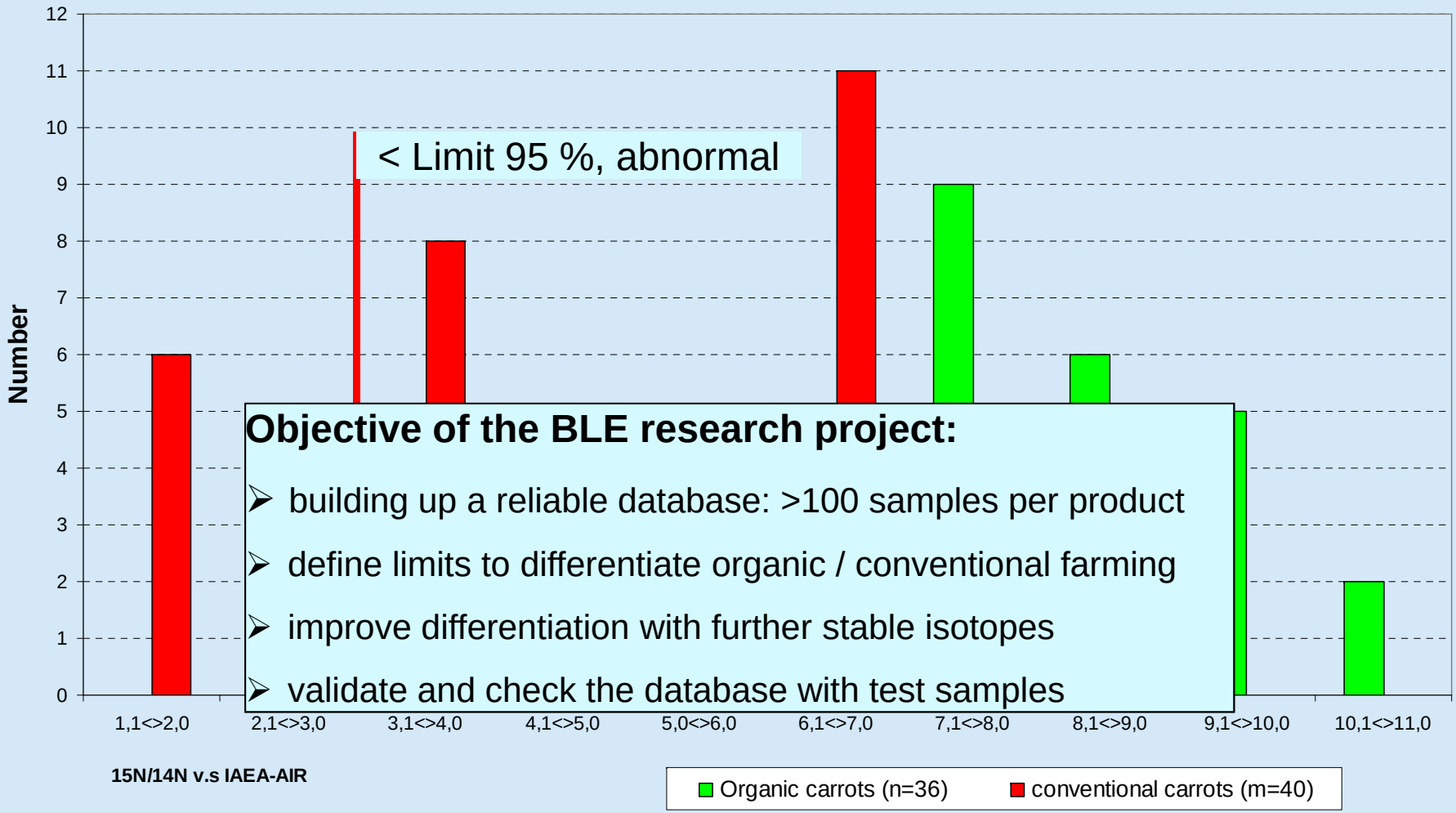
Distribution of the 15N/14N ratios in carrots

BLE-Projekt: Start: 05.2009



Objective of the BLE research project:

- building up a reliable database: >100 samples per product
- define limits to differentiate organic / conventional farming
- improve differentiation with further stable isotopes
- validate and check the database with test samples

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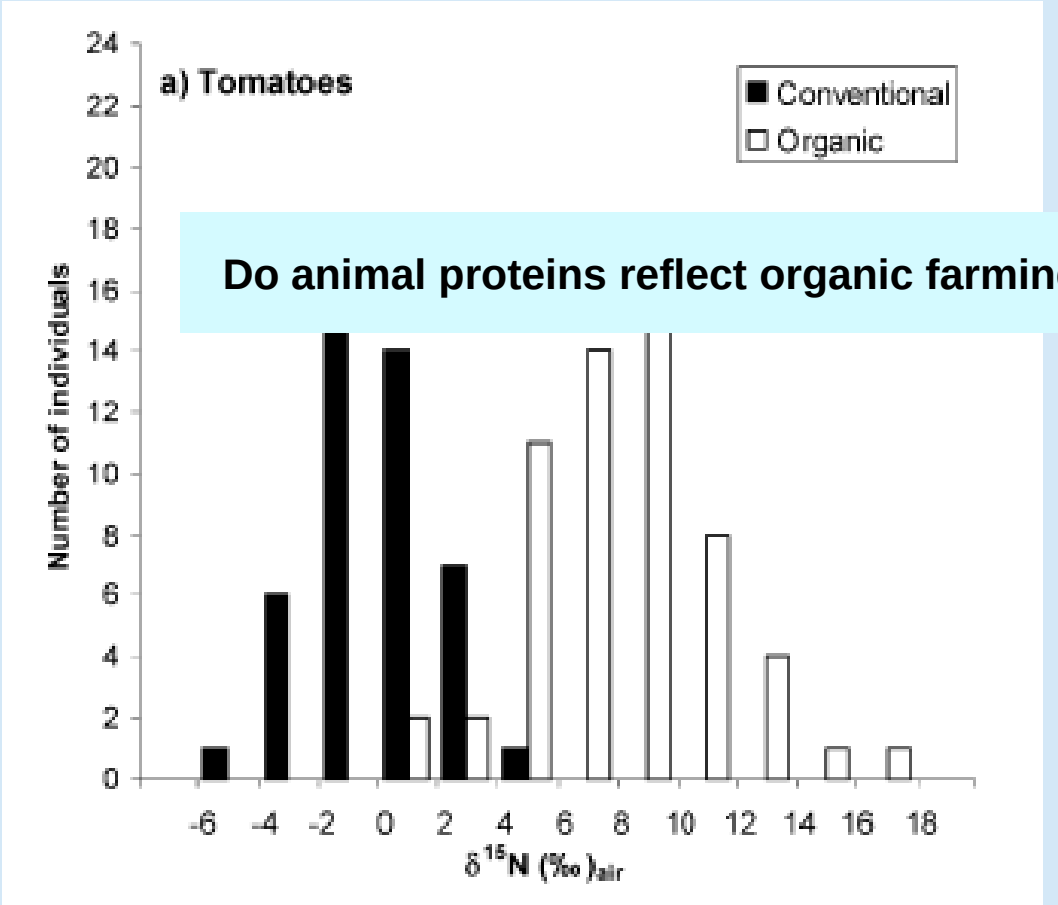
Basic principle of using stable isotopes to check organic farming

- stable isotopes give often only a hint of abnormal organic samples
- abnormal samples have always to be verified with information
- the information confirms the stable isotope analysis or refute it

Conclusion: Stable isotopes are only a helpful tool to differentiate organic farming, whether information is available to verify the analysis.

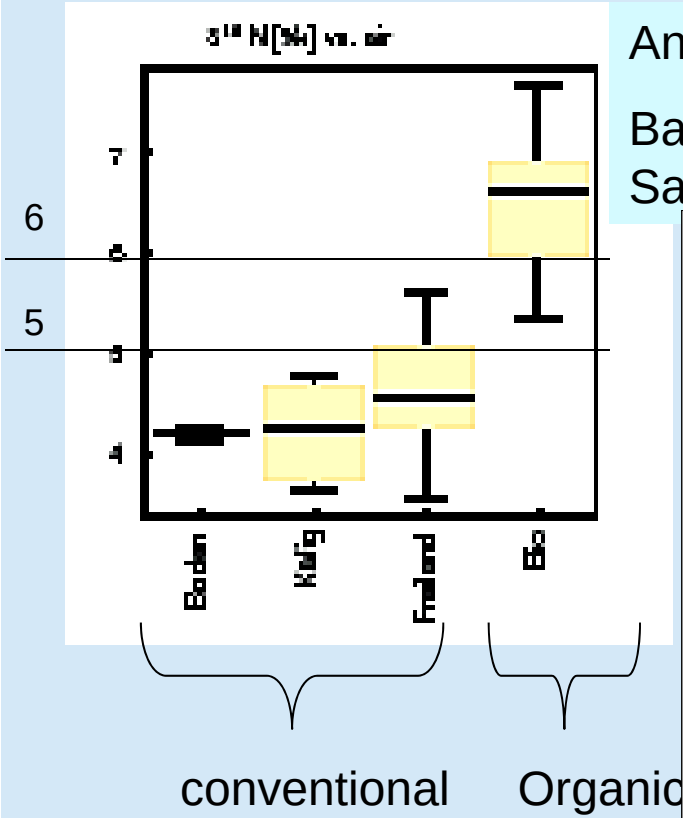
Differentiation of conventional and organic farming, e.g. tomatoes

A. Bateman, S . Kelly, Nitrogen Isotope composition of organically and conventionally grown corps, J. Agric. Food Chem. 2007



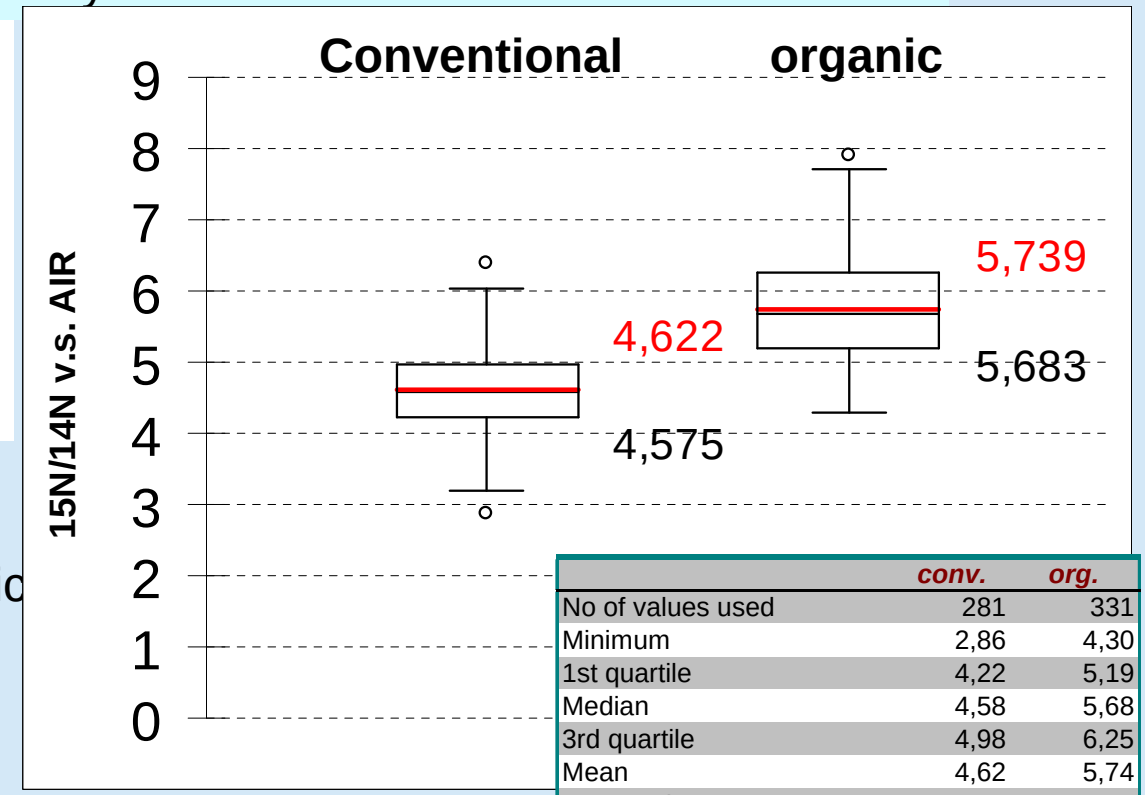
Do animal proteins reflect organic farming as well ?

Differentiation of eggs:



Annual report 2004,

Bavarian Authority for Health and Food Safety



	conv.	org.
No of values used	281	331
Minimum	2,86	4,30
1st quartile	4,22	5,19
Median	4,58	5,68
3rd quartile	4,98	6,25
Mean	4,62	5,74
Geometric mean	4,58	5,70
Sample standard deviation	0,60	0,70

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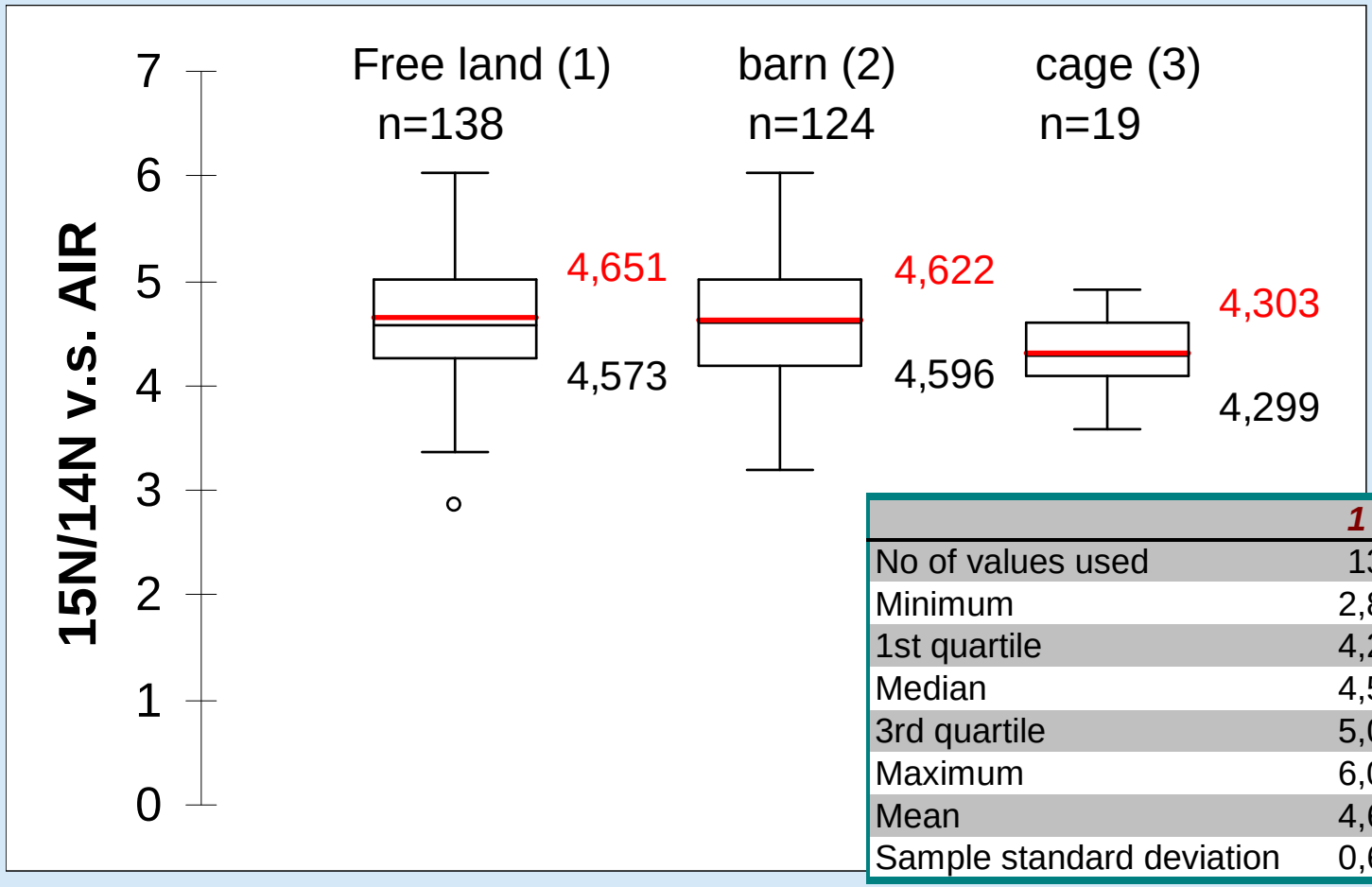
Detail overview:

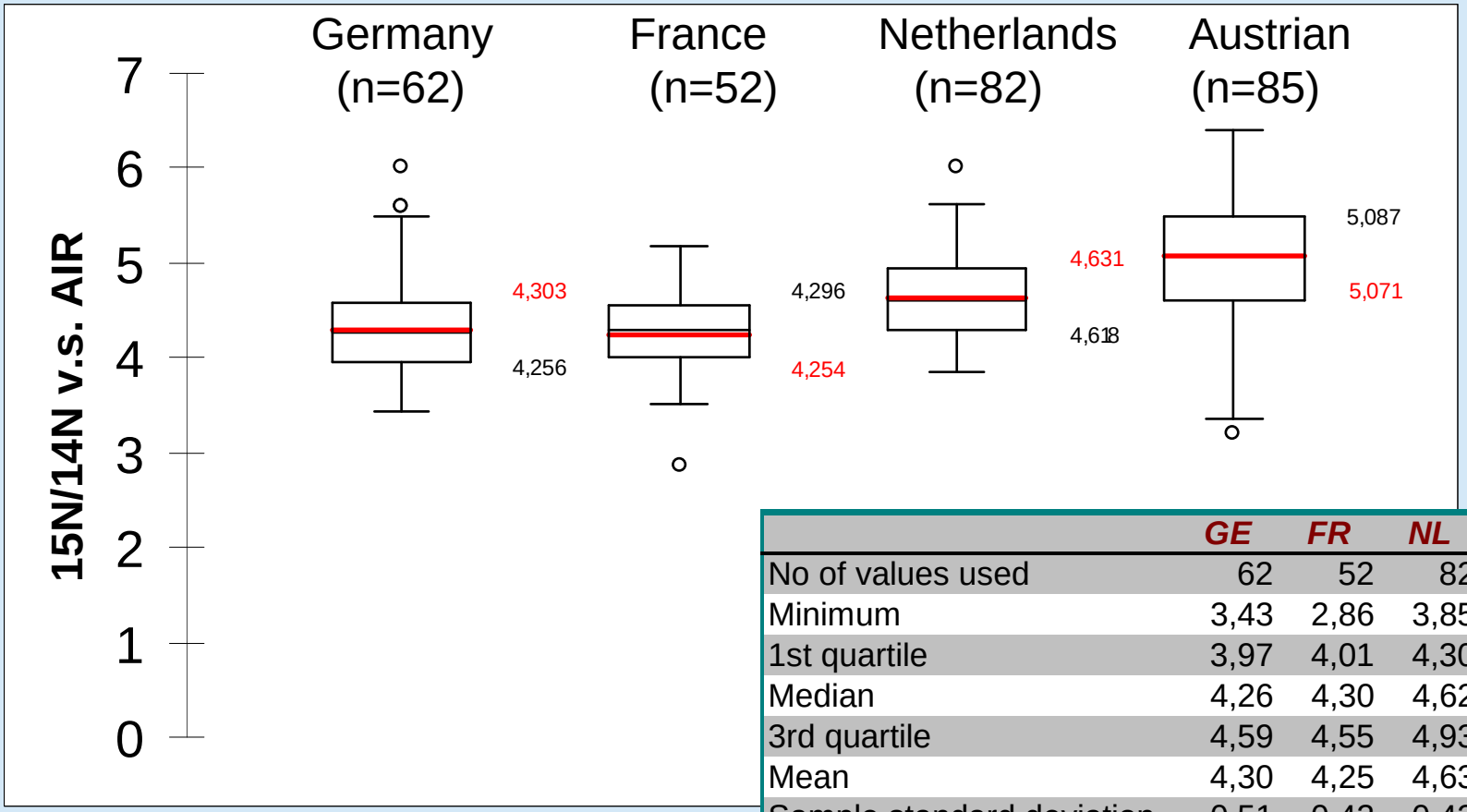
Animal Breeding (conventional eggs):



	1	2	3
No of values used	138	124	19
Minimum	2,86	3,19	3,59
1st quartile	4,26	4,19	4,10
Median	4,57	4,60	4,30
3rd quartile	5,00	5,01	4,59
Maximum	6,04	6,03	4,92
Mean	4,65	4,62	4,30
Sample standard deviation	0,61	0,59	0,31

Detail overview II:

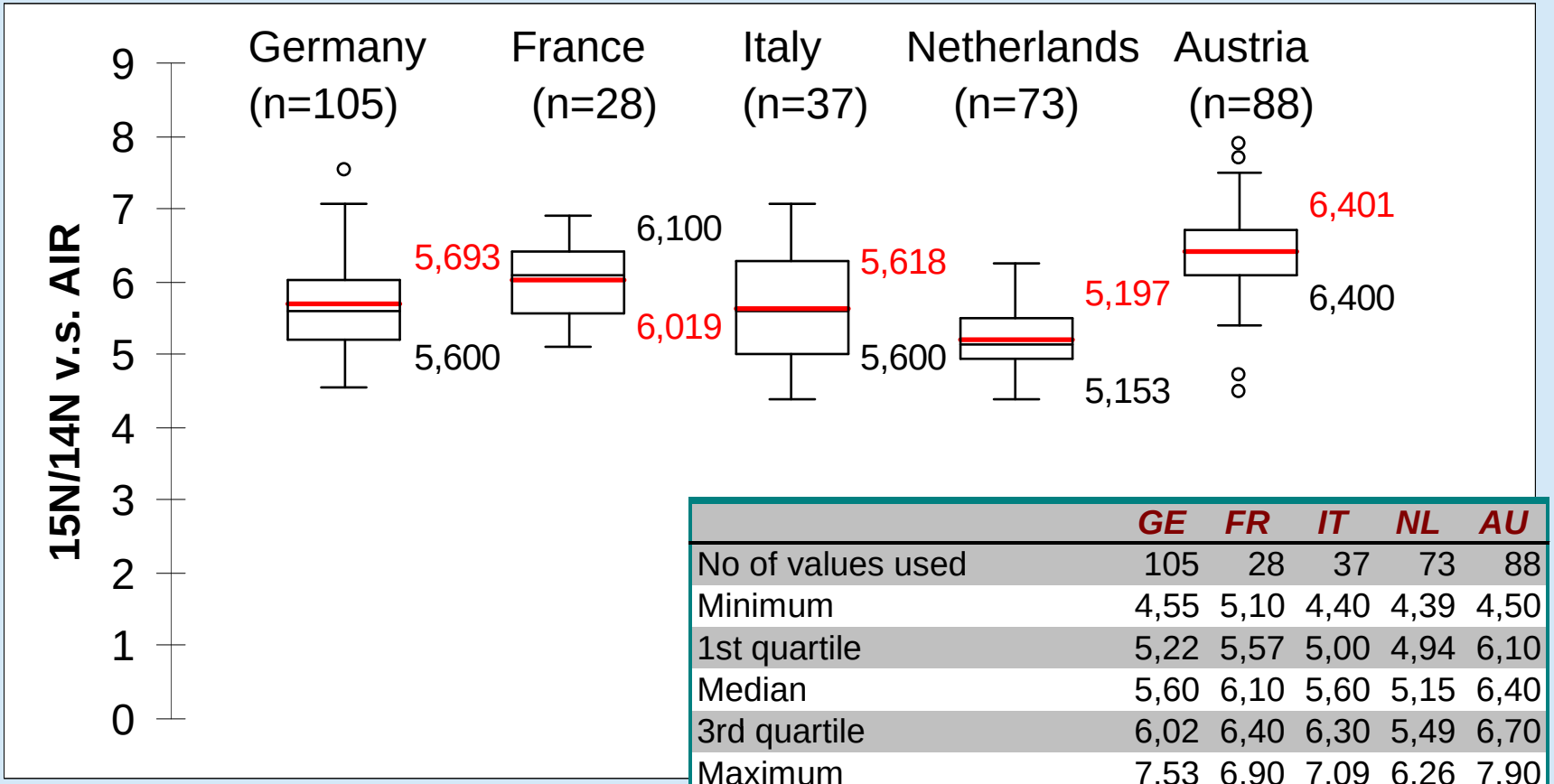
Country origin (conventional eggs):



	GE	FR	NL	AU
No of values used	62	52	82	85
Minimum	3,43	2,86	3,85	3,19
1st quartile	3,97	4,01	4,30	4,61
Median	4,26	4,30	4,62	5,09
3rd quartile	4,59	4,55	4,93	5,50
Mean	4,30	4,25	4,63	5,07
Sample standard deviation	0,51	0,42	0,43	0,60

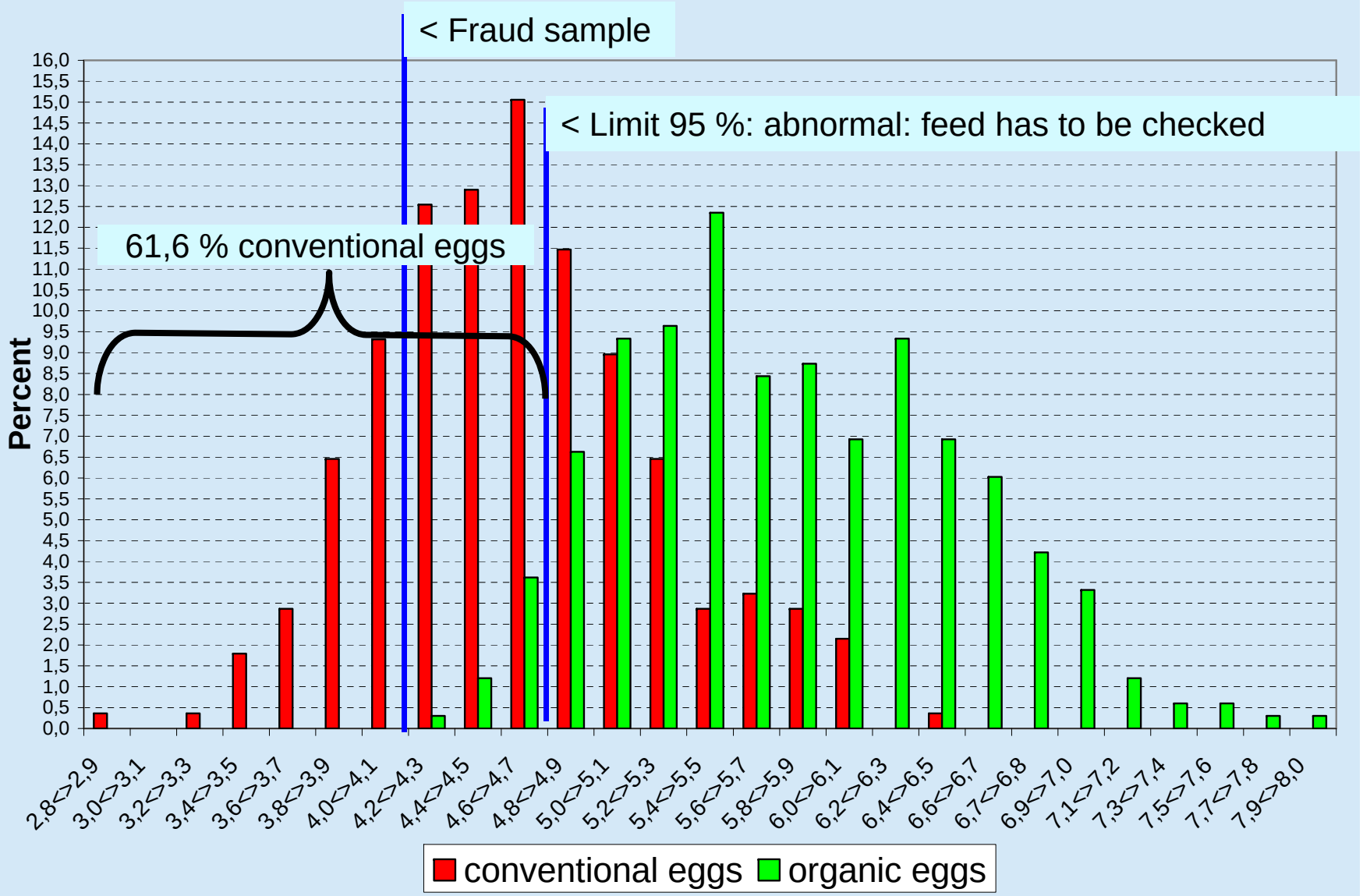
Detail overview II:

Country origin (organic eggs):



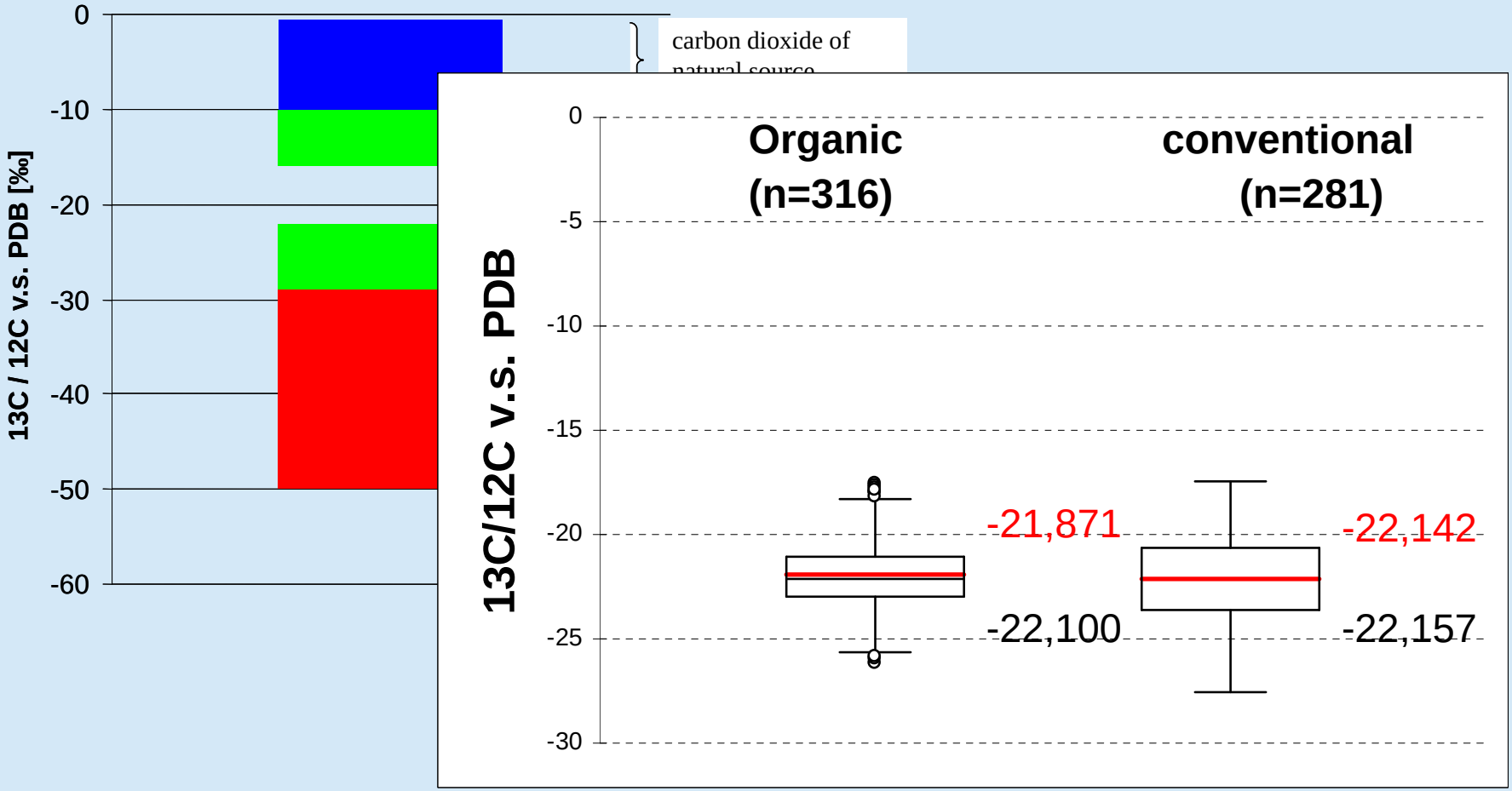
	GE	FR	IT	NL	AU
No of values used	105	28	37	73	88
Minimum	4,55	5,10	4,40	4,39	4,50
1st quartile	5,22	5,57	5,00	4,94	6,10
Median	5,60	6,10	5,60	5,15	6,40
3rd quartile	6,02	6,40	6,30	5,49	6,70
Maximum	7,53	6,90	7,09	6,26	7,90
Mean	5,69	6,02	5,62	5,20	6,40
Sample standard deviation	0,62	0,50	0,76	0,38	0,54

Distribution of 15N/14N ratios in organic and conventional eggs



Other possibilities:

Assumption: more corn (C4) in conventional feed, reflected in the 13C/12C ratio of the eggs



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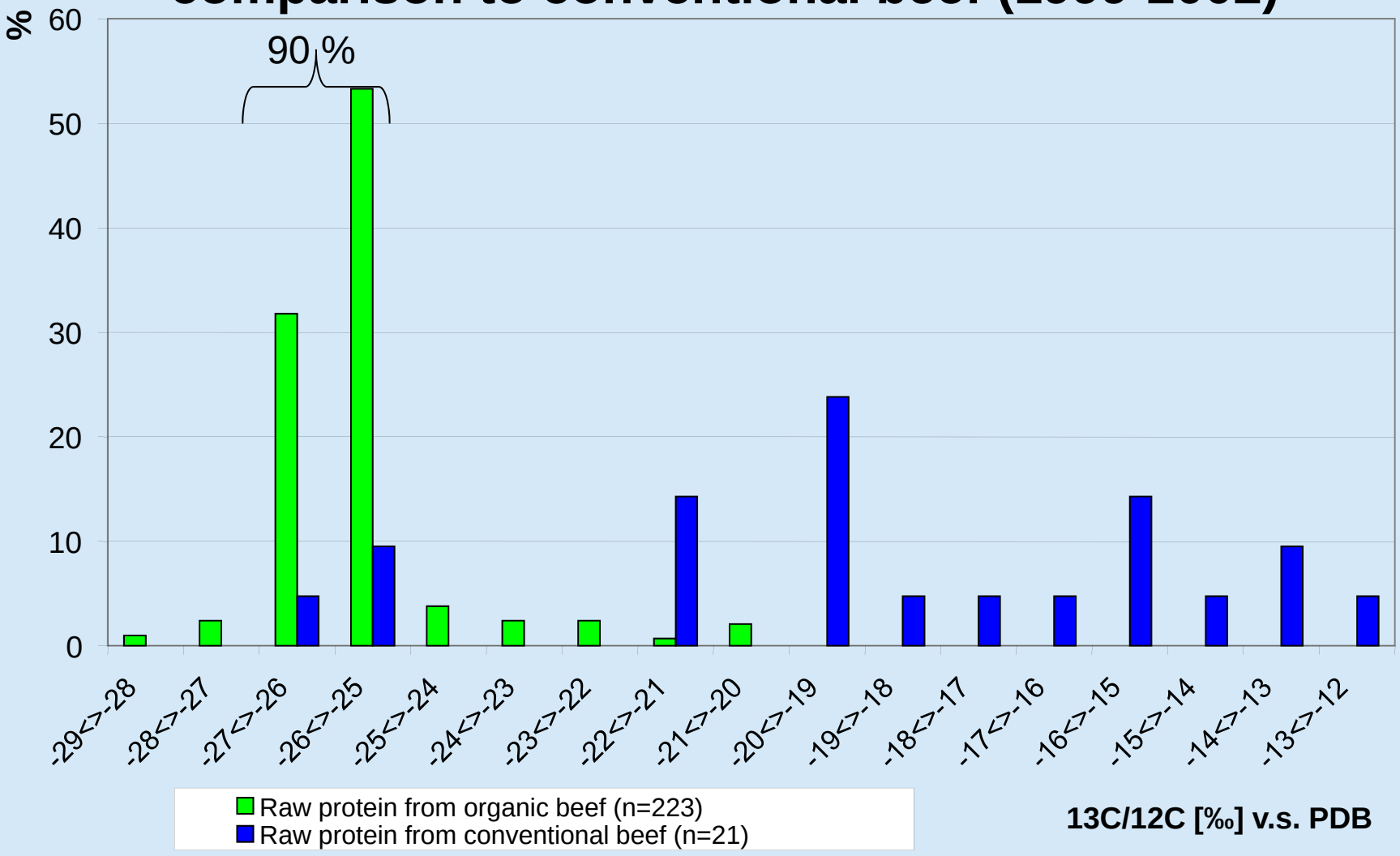
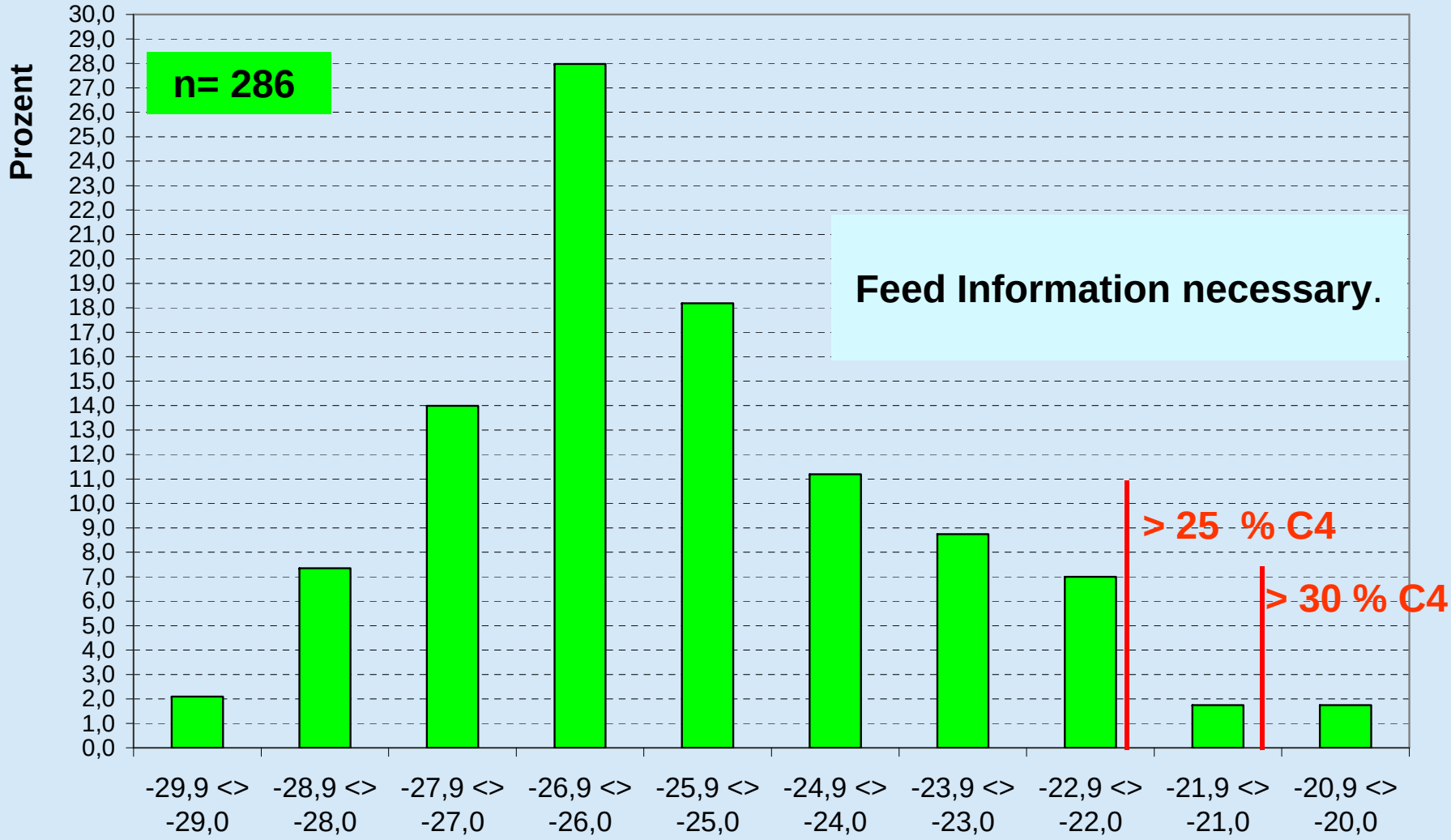
13C/12C ratio of raw protein from organic beef in comparison to conventional beef (1999-2002)



13C/12C ratio of organic milk products



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Alternative: Traceability using stable isotopes

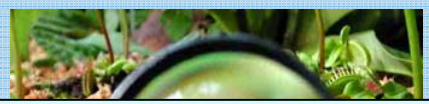
Country level

The D/
and 18
ratios depending on the water / rainfall cycle could differentiate a wide region

Regional level:

87Sr/86Sr (strontium) as a geological parameter could differentiate a closer region..

Local / soil level: :

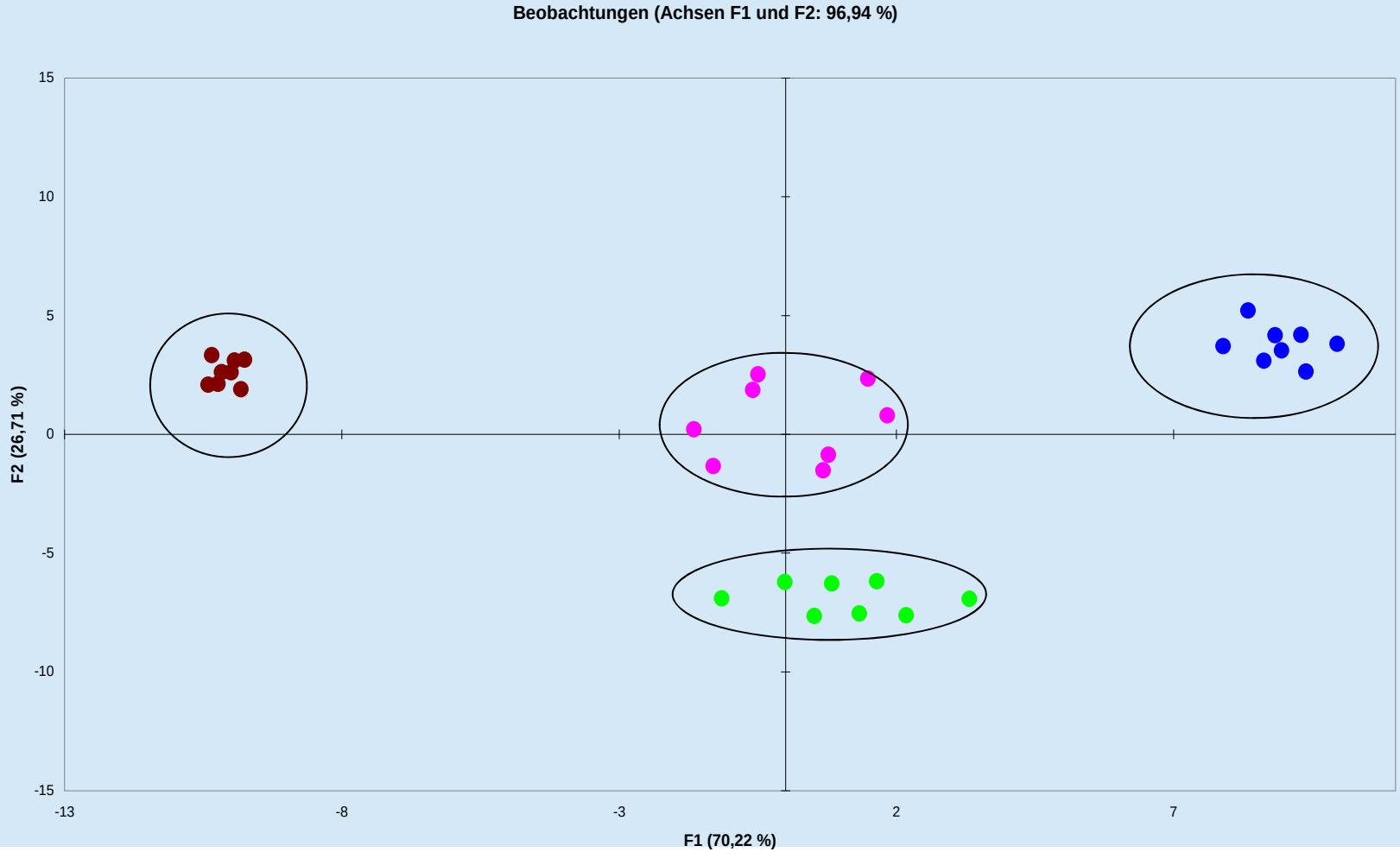


15N/14N (nitrogen) as geological parameter reflect the local soil

Building up a scientific tracking tool to check the origin and confirm the documentation

Example 1:

Discrimination of different organic banana fields using stable isotopes of life



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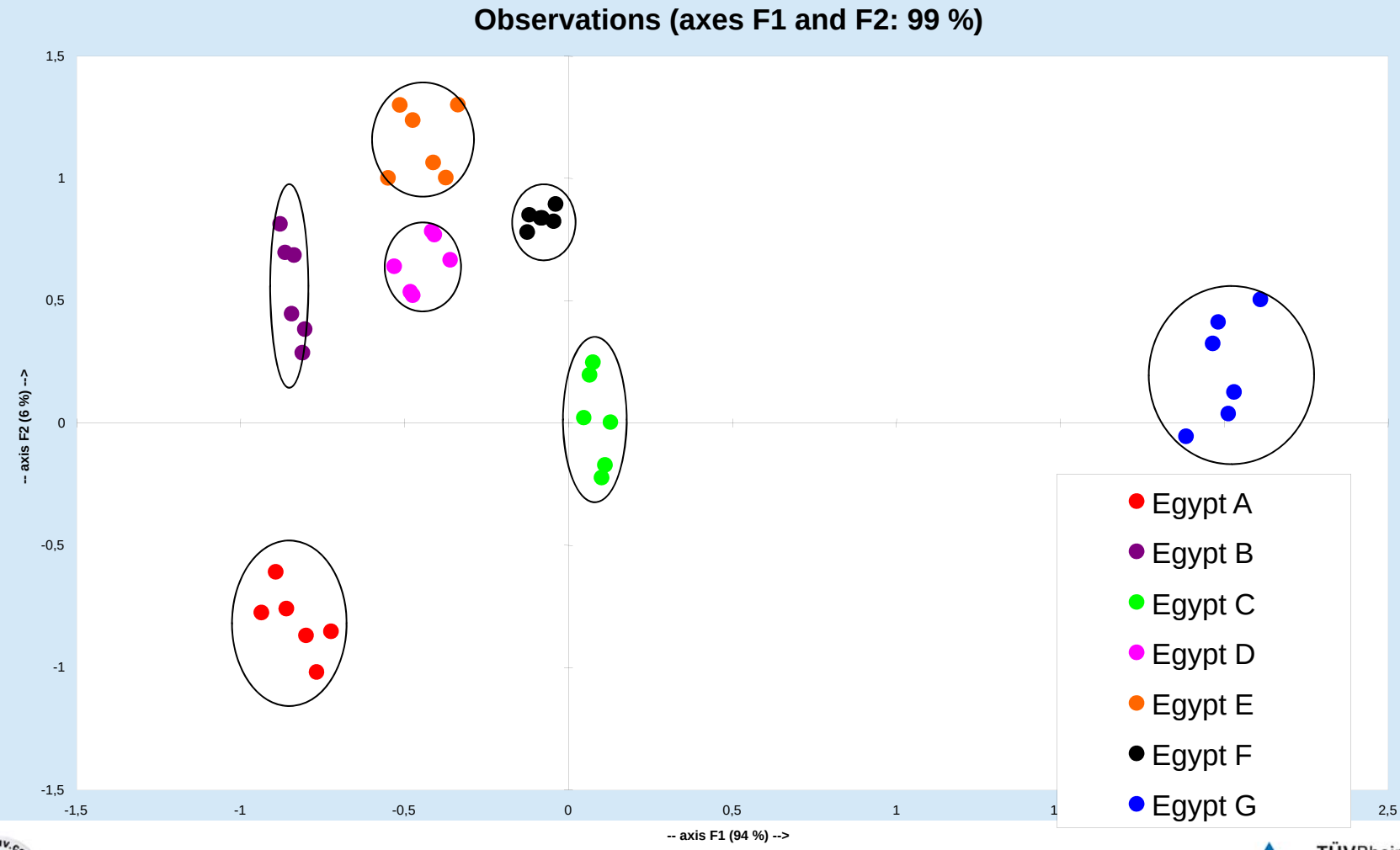
Example 2:

Discrimination of different potatoe fields using stable isotopes of life



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Summary

- Stable isotopes deliver various possibility to check or track back organic product
- It is always necessary to build up a database for the organic product
- It is possible to define limits to differentiate organic and conventional farming
- As the stable isotopes describe the nature, it is always necessary to verify abnormal samples with background information

TÜV Rheinland Agroisolab.
Thank you for your attention.

For more information please contact us.

Contact:

Dr. Markus Boner
Tel. +49 2461 93134 0
Markus.boner@de.tuv.com

TÜV Rheinland
Agroisolab GmbH
Prof.-Rehm-Strasse 6
D-52428 Jülich
Germany
www.tuv.com
www.agroisolab.de