AntiFraud Initiative

Zero Tolerance?
Residue analysis as inspection tool for the authenticity of organic products

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AntiFraud Initiative

- Founded in 2007 by Agro Eco, FIBL and GfRS

- **Main targets:**
  - Analysis of fraud cases in the organic sector
  - Deduction of consequences for the risk management of traders, control bodies and surveillance authorities
  - Risk communication

- 12 international conferences in BE, CH, DE, IT, NL, TR, UA and USA up to now

Introduction // Relevant concerns

Overall questions with regard to sampling and analysis as an inspection tool:

- What are best practices to safeguard organic integrity?
- How to detect and prevent fraud using this instrument?
- How to guide CA and CBs in their practical work?

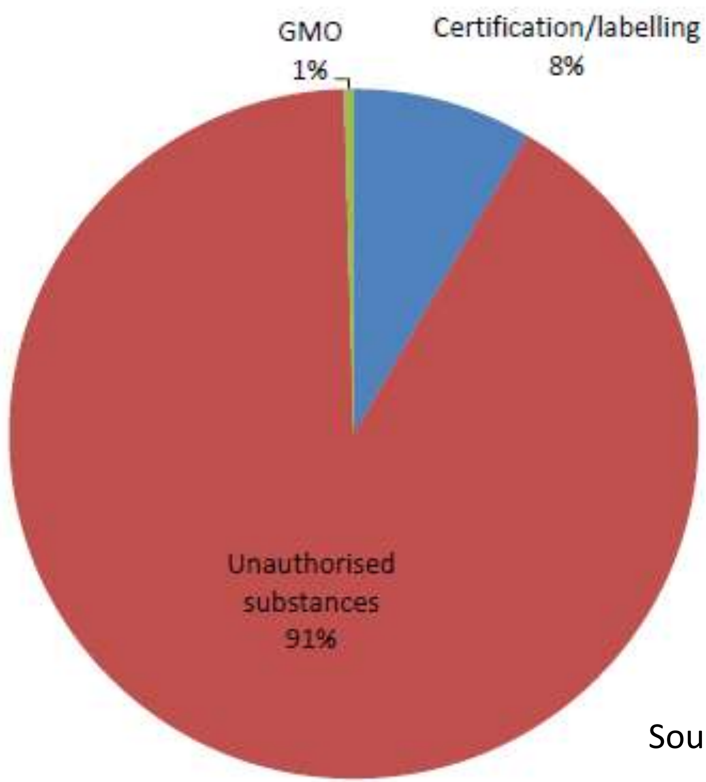
>> Is fraud the most likely root cause, when organic products contain unauthorized substances?

>> Is the detection of a non-authorized substance a suspect case or an irregularity in all cases?

>> Is a “zero tolerance residue approach” the most effective way to safeguard organic integrity or just the easiest way?

Introduction // Residues became prominent in discussion

Residues are the most relevant cause to open an OFIS case
>> this fact give residues a very prominent role



Source: OFIS statistics 2017

Objectives of this workshop

- View on the “residue discussion” from different angles
  - authority view
  - CB view
  - technical expert view
  - trader view
  - stakeholder view
- Increase the understanding of the relevance and boundaries of residue analysis for the detection of irregularities and fraud in the organic sector
- Find best practices, applicable in practical life, how to deal with residues

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The role of process-related sampling and analysis as a risk-based inspection tool

Jochen Neuendorff (GfRS) & Bernhard Speiser (FIBL)

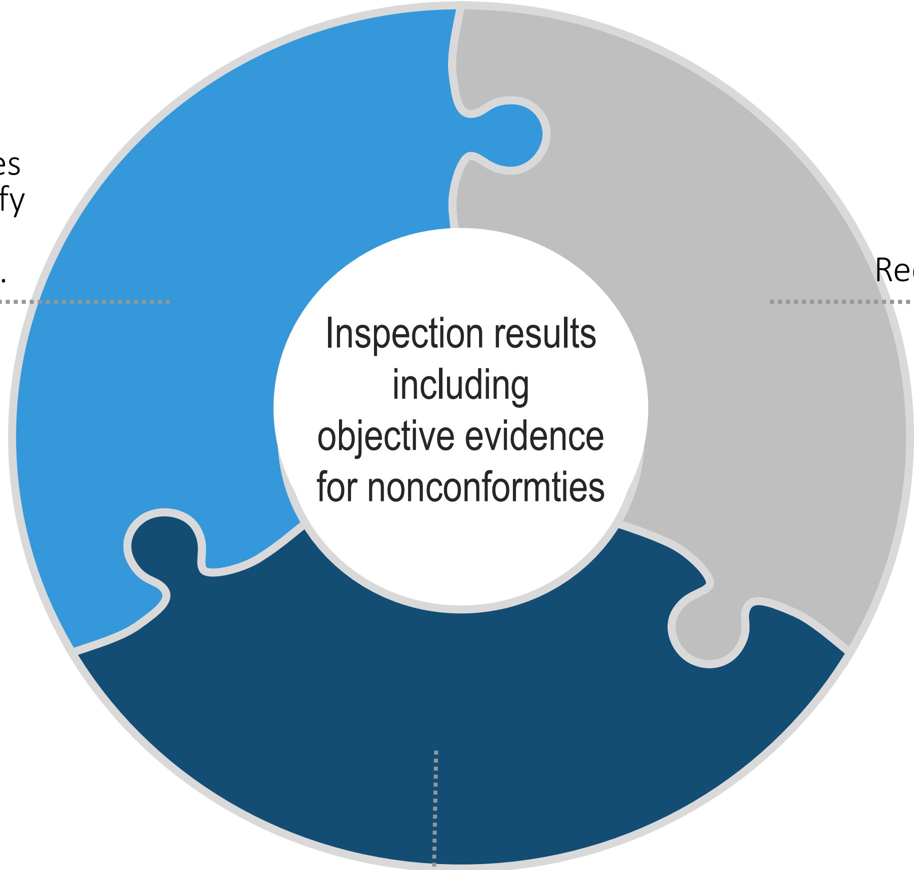
The toolbox for organic inspections

Accounting exam

… in order to check for purchases of prohibited inputs and to verify mass balance and traceability.
Requires accounting knowledge.

On-site tour

…. In order to check the plausibility of production processes.
Requires process competence.



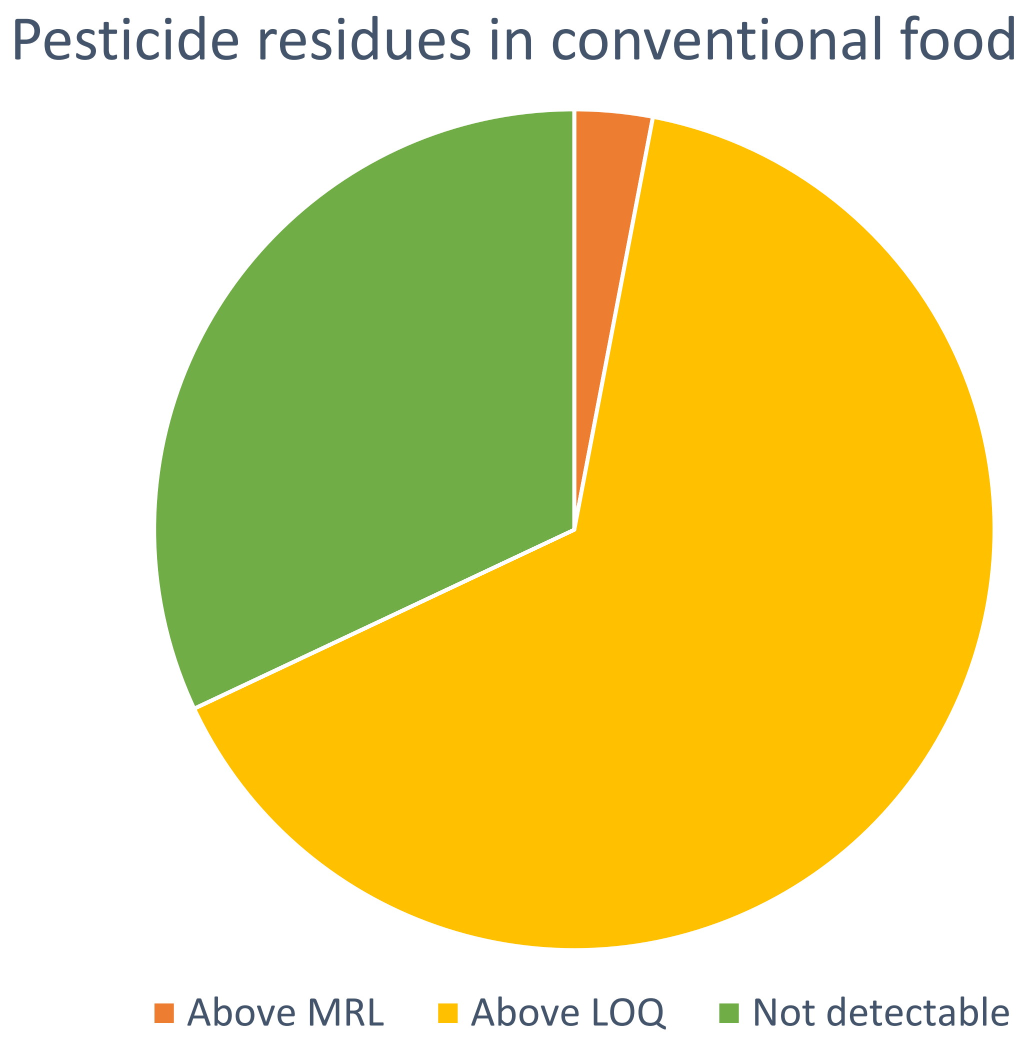
Sampling and analysis

…. In order to identify potential use of prohibited inputs and insufficient preventive measures.
Requires sampling and analytical competence

Sampling and analysis in Organic Production: Many options for ist use as an inspection tool

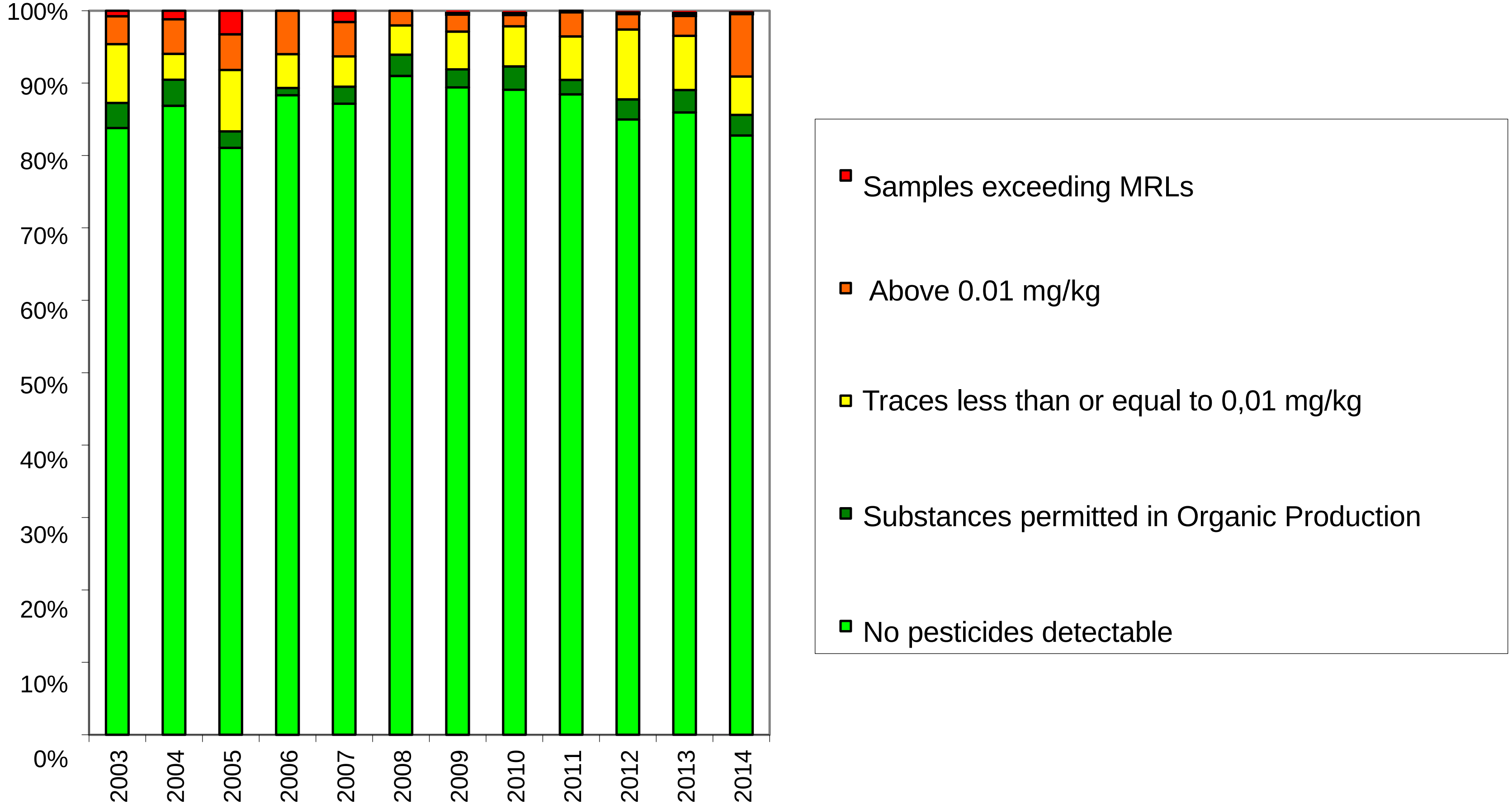
- Prohibited use of pesticides
- Prohibited use of nitrogen fertilizers
- Prohibited use of certain ingredients and processing aids
- Prohibited use of certain food compounds
- Ineffective cleaning prior to organic production runs

A unidirectional focus on pesticide residues in final products might lead to wrong conclusions



LgL, 2017

Results 2003 - 2016



Can sampling be „representative“?

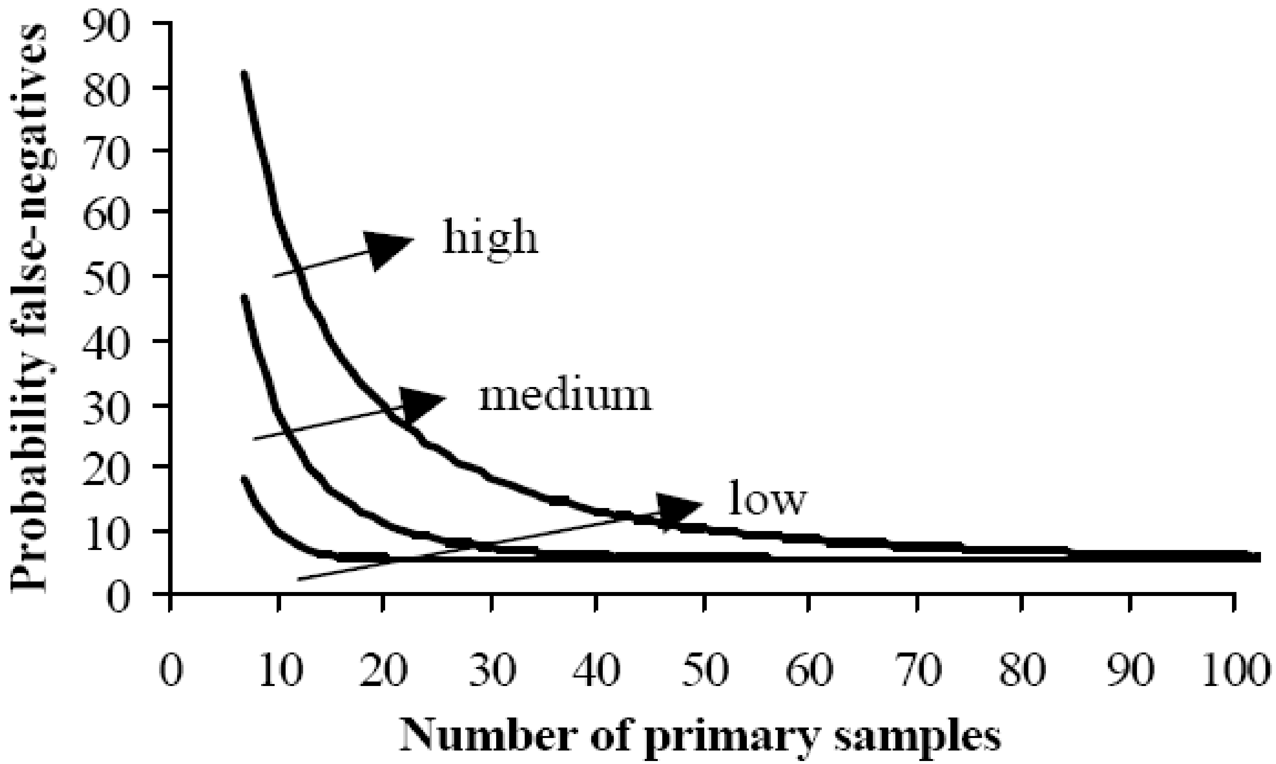


Figure 4. Probability false-negative bulk samples for 3 heterogeneity levels

KeLDA-Study, 2013

Factors to consider

1. **Origins of pesticide residues**
   - pesticide application
   - other causes

2. **Measurement of pesticide residues**
   - sampling
   - analysis
   - is ‘zero residues’ possible?

3. **Evaluation of analytical results**
   - what can we conclude from residues?
   - consequences

Origins of pesticide residues (1): Pesticide application

- Pesticide application often leads to residues, but…
- certain types of pesticide application cause no residues, and
- the level of residues varies greatly, and
- some residues disappear quickly, and
- some systemic pesticides show irregular patterns over time.

Origins of pesticide residues (1): Pesticide application

- Pesticide application often leads to residues, but…
- certain types of application cause no residues, and
- the level of residues varies greatly, and
- some residues disappear quickly, and
- some systemic pesticides show irregular pat ver time.

Examples:

- slug pellets
- herbicide spray around fruit tree stems
- ‘winter sprays’ in perennial crops

Origins of pesticide residues (1): pesticide application

- Pesticide application often leads to residues, but…
- certain types of application cause no residues, and
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- some systemic pesticides show irre terns over time.

Calculated levels on fruits, immediately after application:

- Deltamethrin: 0.02 mg/kg
- Fluazinam: 0.5 mg/kg
- Folpet: 3.7 mg/kg
- Metamitrone: 8 mg/kg

Origins of pesticide residues (1): pesticide application

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Examples for half-lives:

- Cymoxanil: 1.6 days
- Deltamethrin: 3.8 days
- Folpet: 5.2 days
- Dithianon: 11.7 days

Origins of pesticide residues (1): pesticide application

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  - some systemic pesticides show irregular patterns over time.

Example: phosphonates

- summer: translocated from leaves to fruit
- autumn: translocated to roots and stored
- next spring: translocated to leaves and later to fruit again.

As a result, phosphonate residues persist in crops for several years.

Origins of pesticide residues (2): Other causes

- Pesticide residues may also be due to…
- drift from conventional fields, or
- ‘heritage chemicals’/environmental contaminants, or
- post-harvest contamination, or
- substances with multiple origins/uses (pesticide and other)

Origins of pesticide residues (2): other causes

- Pesticide residues may also be due to…
  - drift from conventional fields, or
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  - post-harvest con on, or
  - substances origins/uses (pesticide and other)

Details on drift

- Drift decreases exponentially with distance.
- With field sprayers, the following zones are at greatest risk:
  - 10 m from conventional vegetables, arable crops and grapevines
  - 30 m from conventional fruits
- For airplane and helicopter applications, different values apply

Origins of pesticide residues (2): other causes

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- substances with m ns/uses (pesticide and other)

Long-distance drift (several km or even more)
Known only for a few pesticides / situations
- Pendimethalin (in Europe)
- Glyphosate (in North America)

Origins of pesticide residues (2): other causes

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  - drift from conventional fields, or
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Best-known example: organochlorine pesticides
- DDT, dieldrin, lindane, endosulfan…
- used from the 1950ies until max 2001
- persistent in soils until today
- uptake by cucumbers, zucchini, pumpkins…

Origins of pesticide residues (2): other causes

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  - drift from conventional fields, or
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Sites of contamination:

- packaging (boxes, bags…)
- transport (containers, trucks…)
- storage (silos …)
- processing (conveyor belts, tubes, brushes, filters or other machinery/equipment)
- via air, dust, washing water (CIPC, phosphine…)

Origins of pesticide residues (2): other causes

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Example 1: bromide

- It can be an indicator of fumigation with methyl bromide, but
- it is also a natural constituent of all crops and foods and
- elevated levels may have natural reasons, e.g. close to sea shore (naturally present in sea water).

Origins of pesticide residues (2): other causes

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Example 2: anthraquinone

- It was a seed treatment against birds (EU: not in use since 10 years), but
- it is also a natural constituent of wood fires.
- It is usually found in tea (traditional drying method: wood fire).

Origins of pesticide residues (2): other causes

- Pesticide residues may also be due to…
  - drift from conventional fields, or
  - ‘heritage chemicals’/environmental contaminants, or
  - post-harvest contamination, or
  - substances with multiple origins/uses (pesticide and other)

Several other examples:
- chlorate
- biphenyl
- copper
- …

Measurement of pesticide residues

- Modern analytical methods are highly sensitive, but…
- which materials should be sampled?
- where, when and how should the sample be taken?
- which substances should be searched for?

Measurement of pesticide residues

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- which materials should be sampled?
- where, when and how should the san… be taken?
- which substances should be searched…

- «Should I sample the soil, the leaves, the apples or the pears?»
- Risk-based decision.
- Sampling choices are not trivial, and require highly specialized know-how.
- It can be assumed that not all CB have equally good know-how in this field.

Measurement of pesticide residues

- Modern analytical methods are highly sensitive, but...
  - which materials should be sampled?
  - where, when and how should the sample be taken?
  - which substances should be searched for?

Sampling problem with cereals:

- Only automatic sampling with a high frequency leads to better representativeness, but it takes place after unloading, where secondary contaminations may occur.
- Before / during unloading, only manual sampling possible.

Measurement of pesticide residues

- Modern analytical methods are highly sensitive, but...
- which materials should be sampled?
- where, when and how should the sample be taken?
- which substances should be searched for?

Which analyses should I ask for:

- pesticide screening?
- chlormequat and mepiquat?
- glyphosate and glufosinate?
- ethephone?
- ...

(lab methods evolve constantly)

Measurement: is ‘zero residues’ possible?

- **‘Zero residues’** is an oversimplification, which cannot be achieved.

- What is possible: **‘no residues detected’…**
- within the scope of the analytical method, and
- with the limit of detection specified by the lab, and
- with the measurement uncertainty specified by the lab, and
- for the sample sent to the lab

- Note: Analytical methods become more and more sensitive. Thus, ‘zero residues’ is getting stricter over time.

Consequences of pesticide detections

- In practice, we observe the following consequences of residues:

1. Residue indicates fraud (proven or suspected): decertification

2. Residue caused by insufficient care: often decertification

3. Residue 'technically unavoidable':
   - Some authorities argue that the consumer is mislead: decertification.
   - Some retailers have a policy not to market organic products with any residues ('zero tolerance').
   - Other retailers apply an orientation value for their marketing decision.

- 'Technically unavoidable' is sometimes subject to interpretation.
- Example: What/how much must a farmer do to prevent drift from his neighbour?

Evaluation of pesticide residues

- Possible causes for the presence of a residue:

Conduct of the operator

- organic crop treated with synthetic pesticide
- conventional crop sold as organic

fraud

- insufficient cleaning / separation

insufficient care

- drift
- ‘heritage chemicals’/environmental contaminants

technically unavoidable

- substance with multiple origins

(depends on investigations)

Evaluation of pesticide residues, example 1

- 0.025 mg/kg dieldrin detected in cucumbers.

- Hypotheses to consider:
- organic crop treated with synthetic pesticide?
- conventional crop sold as organic?
- insufficient cleaning / separation?
- drift?
- ‘heritage chemical’/environmental contaminant
- substance with multiple origins?

Evaluation of pesticide residues, example 1

- 0.025 mg/kg dieldrin detected in cucumbers.

- Hypotheses to consider:
  - organic crop treated with synthetic pesticide? – very unlikely
  - conventional crop sold as organic? – very unlikely
  - insufficient cleaning / separation? – very unlikely
  - drift? – very unlikely
  - ‘heritage chemical’/environmental contaminant – very likely
  - substance with multiple origins? – no

- Cause clear. No violation of organic production rules.
- But: MRL exceeded – no safe food.

Evaluation of pesticide residues, example 2

- Guava pulp (from many smallholder fruit growers):
  0.011 mg/kg carbendazim, 0.014 mg/kg acetamiprid and 0.022 mg/kg dimethoate detected.

- Hypotheses to consider:

- organic crop treated with synthetic pesticide?
- conventional crop sold as organic?
- insufficient cleaning of machinery / separation?
- drift?
- 'heritage chemical'/environmental contaminant
- substance with multiple origins?

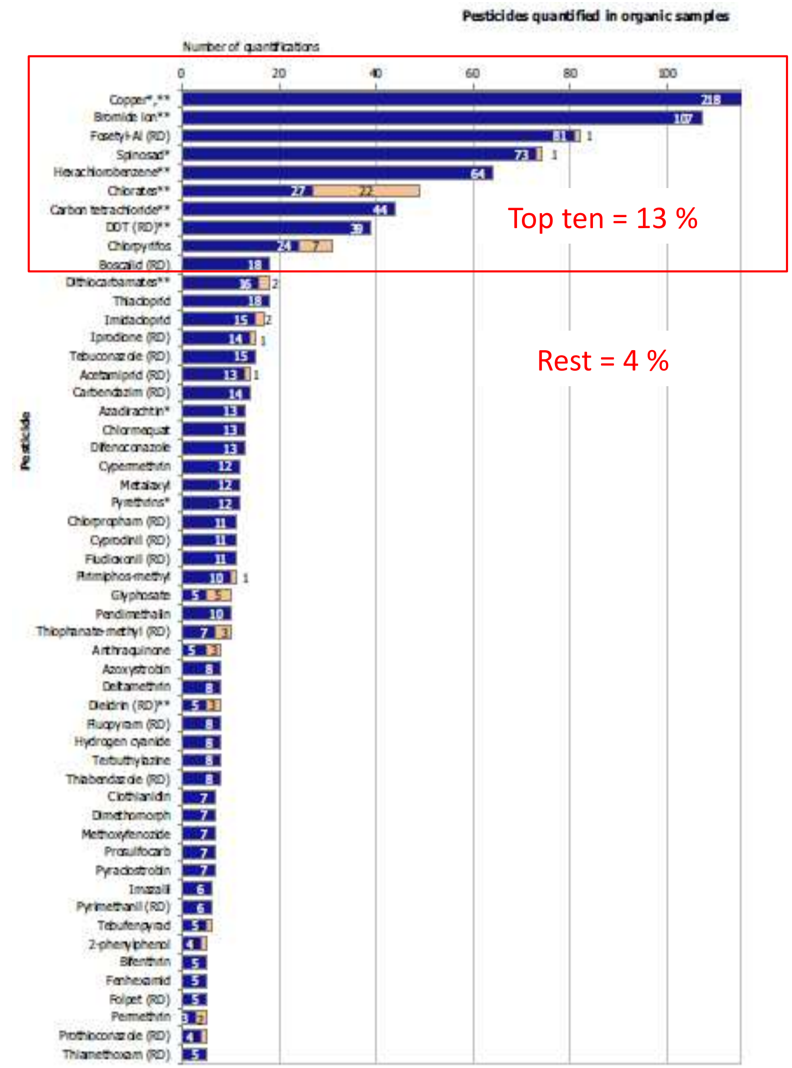
Evaluation of pesticide residues, example 2

- Guava pulp (from many smallholder fruit growers): 0.011 mg/kg carbendazim, 0.014 mg/kg acetamiprid and 0.022 mg/kg dimethoate detected.

- organic crop treated with synthetic pesticide? – cannot be excluded
- conventional crop sold as organic? – unlikely according to certifier
- insufficient cleaning of machinery / separation? – likely
- drift? – cannot be excluded
- 'heritage chemical'/environmental contaminant – no
- substance with multiple origins? – no
- More investigation would be needed to determine cause(s),
- Unclear whether the causes can be determined with certainty.

Frequent pesticide residues in organic food

- EFSA report on pesticides in food 2016:
- 5495 organic food samples analyzed
- 17 % contained ‘pesticide residues’
- 151 substances were detected, but 10 substances make up 75 % of all residue cases



Top ten pesticide residues in organic food

Top ten	Typical origins
1: copper	use (allowed)
2: bromide	
3: fosethyl-Al	
4: spinosad	use (allowed)
5: hexachlorobenzene	
6: chlorates	
7: carbon tetrachloride	
8: DDT	
9: chlorpyrifos	
10: boscalid	

Top ten pesticide residues in organic food

Top ten

Typical origins

1: copper

2: bromide

3: fosethyl-Al

4: spinosad

often natural origin; fumigation cannot be ruled in all countries (consider additional evidence)

5: hexachlorobenzene

6: chlorates

7: carbon tetrachloride

8: DDT

no use as pesticides any more usually contaminants (soil, processing)

9: chlorpyrifos

10: boscalid

Top ten pesticide residues in organic food

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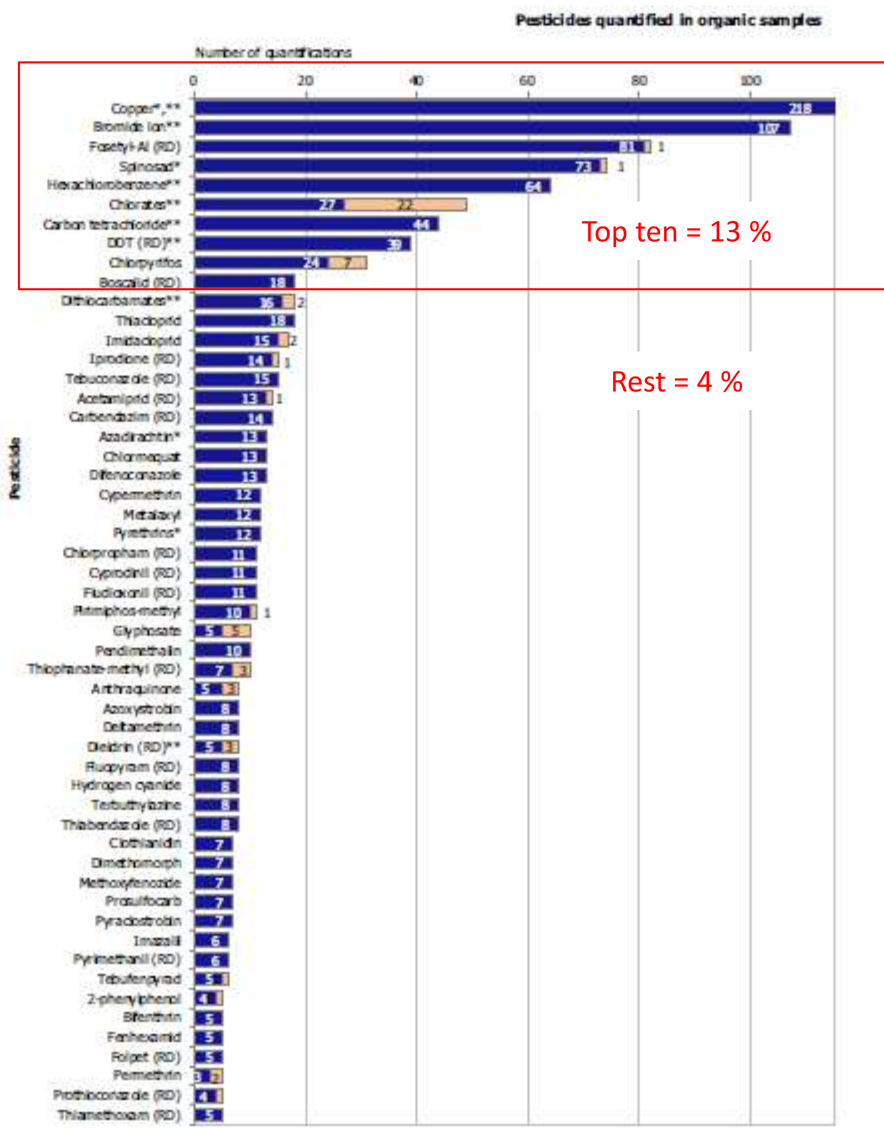
Typical origins

carry-over from young plants or before conversion; undeclared presence in inputs; use

use; post-harvest contamination

use; contaminated irrigation water?

Frequent residues in organic food



From a fraud prevention point of view, certifiers should concentrate their efforts to those cases where illegal use is most likely.

Conclusions (I)

- The EU-Regulation defines **inspections** as the primary method to check compliance of organic operators. Sampling and analysis is one of the inspection tools available in the organic inspection toolbox and should be applied in the combination with other tools.

- Process-related sampling and analysis is much more relevant for the verification of the production rules and for the authenticity of organic products than sampling and analysis of final products.

Conclusions (II)

- It is questionable whether a representative sampling is the right approach to deal with compliance of organic production methods or whether targeted sampling is more appropriate.
- Risk-oriented planning and implementation of sampling and analysis as well as the correct evaluation of analytical results requires a high level of technical competence in this area.
- Pesticide residues might have different origins – not all indicate irregularities and fraud.

Conclusions (III)

- A proper follow-up of suspect cases is required in order to identify possible nonconformities.
  The approach applied by Competent Authorities (CA) and Certification Bodies (CB) needs to be defined on a case-to-case basis, but must lead to effective verification.

- A quality assurance tool to check for an appropriate follow-up of CA and CB needs to be established by Accreditation Bodies and the EC.