Assessing the risk from mycotoxins for the organic food chain: Results from Organic HACCP (5th EU-framework) and other research

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Outline

- Introduction
  - Danger of mycotoxins
  - Critical factors in the production and storage of feedstuff
- Results of Organic HACCP
- General Findings in the Literature

Mycotoxins in Organic Animal Feed

Susceptibility of domestic animals towards mycotoxicoses (Dänicke, 1999)

	Cattle	Swine	Swine	Poultry
Mycotoxin		Breeding	Consumption	
Zearalenon	-	+++	++	+
Desoxynivalenol	-	++	+++	+
Ochratoxin	-	++	+++	++

- slight; + fair; ++ moderate; +++ severe

Critical Factors in Production and Storage of Organic Food and Feed

Climate

Crop management
Soil treatments
Variety

Previous Crop

Production

Harvest/ Drying

Storage at Mill

Storage before Market

Storage at Farm

Organic

Plant Protection

Crop Rotation

Review of consumer criteria values and concerns

Description of current production and control methods

analysis of safety and quality aspects using HACCP procedures

Recommendations to actors on the chain of production, distribution and consumption:

Producers, Processors, Retailers, Consumers, Policy makers, Scientists etc.

Focus on 7 quality and safety criteria:

- Microbial toxins and abiotic contaminants
- Nutrient content* and food additives(*)
- Pathogens
- Freshness and taste*
- Natural plant toxicants
- Fraud*
- Social and ethical aspects*

* Criteria new to Critical Control Point Analysis

Critical Control Points (CCPs)

Critical Control Point (CCP)

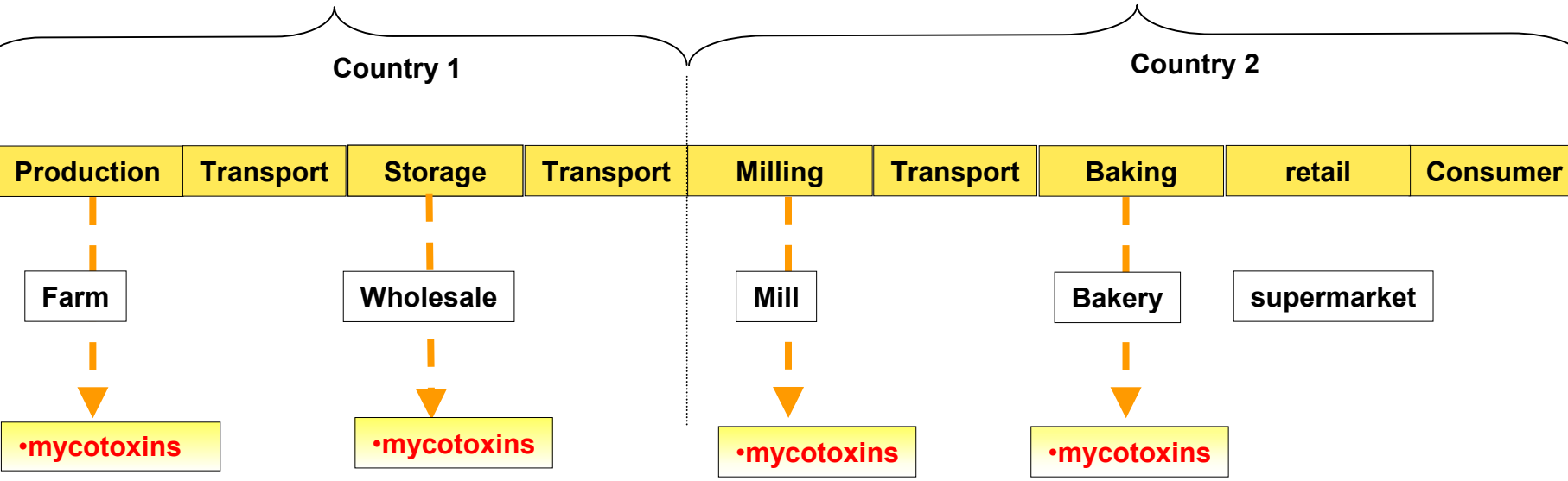
- A step at which control can be applied and is essential to prevent or eliminate a risk (instead of a food safety hazard) or reduce it to an acceptable level

Data Collection from Farm to Fork 1

- **Crop production**
  - Tomatoes
  - Cabbage
  - Wheat
  - Apples
  - Grapes
- **Animal production**
  - Eggs
  - Milk
- **Processors**
  - Mills
  - Bakeries
  - Dairies
  - Wineries
- **Wholesalers**
- **Transport**
- **Retailers**

Data Analysis

Wheat bread food chain

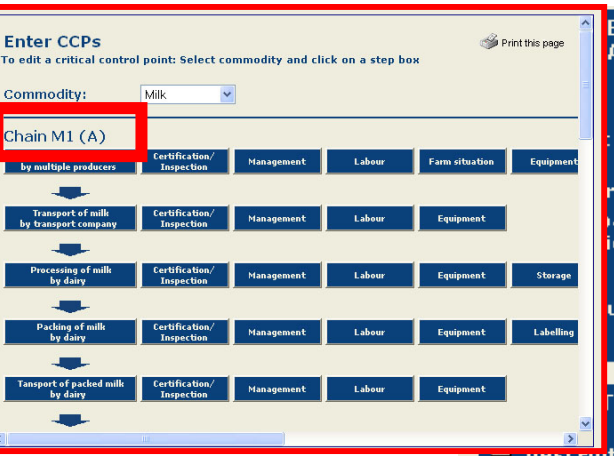


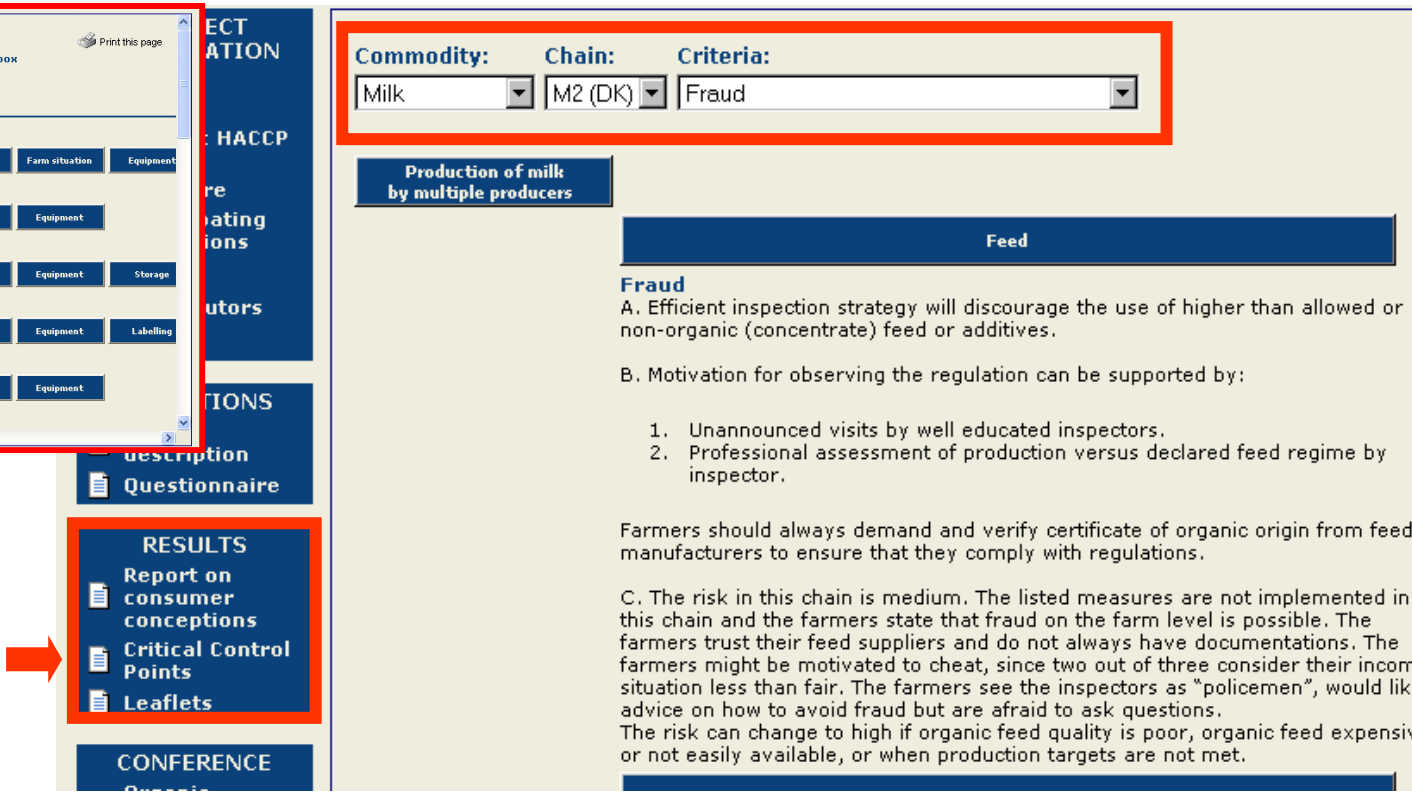

ORGANIC HACC
TOMATOES CABBAGE EGGS BREAD MILK APPLES WINE
QUALITY MONITORING AND TRACEBILITY THROUGHOUT THE CH

Results

Results

Database and CCPs





A. Explanation why there is a Critical Control Point at a this step
B. Measures to control the hazard
C. Evaluation of how well the risk is controlled in the chain
D. Methods to control the risk at a later step

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Critical Control Points – Milk Chains

Feed	M1 (A)	M2 (DK)	M4 (N)	M5 (DK)
Mould infested feed - subsequent forming of mycotoxins	risk variable; own feed production (3), dry and fresh roughage but also buy concentrate; QA concept (1); trust their feed supplier (2)	risk variable; own food production (3), dry/ fresh roughage, silage, grain, grass pellets and corn. Concentrate (2), trust their supplier and accompanied certificate; no QA concept (3).	medium risk; farmer buys feed from a neighbour, no awareness for feed checking; no QA concept (1).	medium to high risk; own food production (3), dry/fresh roughage, silage and grains, buys concentrate; farmer checks the feed upon delivery by visual control (1); none of the farmers is aware of the risk or uses a QA system.

Production of milk

certification / inspection | management | labour | farm situation | equipment | housing | feed | fodder storage | animal health care | storage of milk | customer contact

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Critical Control Points – Milk Chains

Fodder Storage	M1 (A)	M2 (DK)	M4 (N)	M5 (DK)
Inappropriate storage condition	low to medium risk; awareness of risk available; temperature control (1); no temperature control (2) but keep different types of fodder separate/in special containers, have established drying facility/cold air ventilation. No use of QA concept (3).	medium to high risk; awareness for risk not available (3); storage under simple conditions (2); storage in gastight silo (1); no QA concept for feed (3). Taking samples for analysis (1), trusts feedstuff supplier (1).	low risk; storage under simple condition for some feed; major portion contains fresh and dry roughage/silage. No QA concept (1).	low to high risk; partially awareness for risk Simple storage (3) Checking concentrate upon delivery (1), stores grain in gastight silos (1); observation of mould growth > better storage facilities necessary. No QA concept.

Production of milk

certification / inspection | management | labour | farm situation | equipment | housing | feed | fodder storage | animal health care | storage of milk | customer contact

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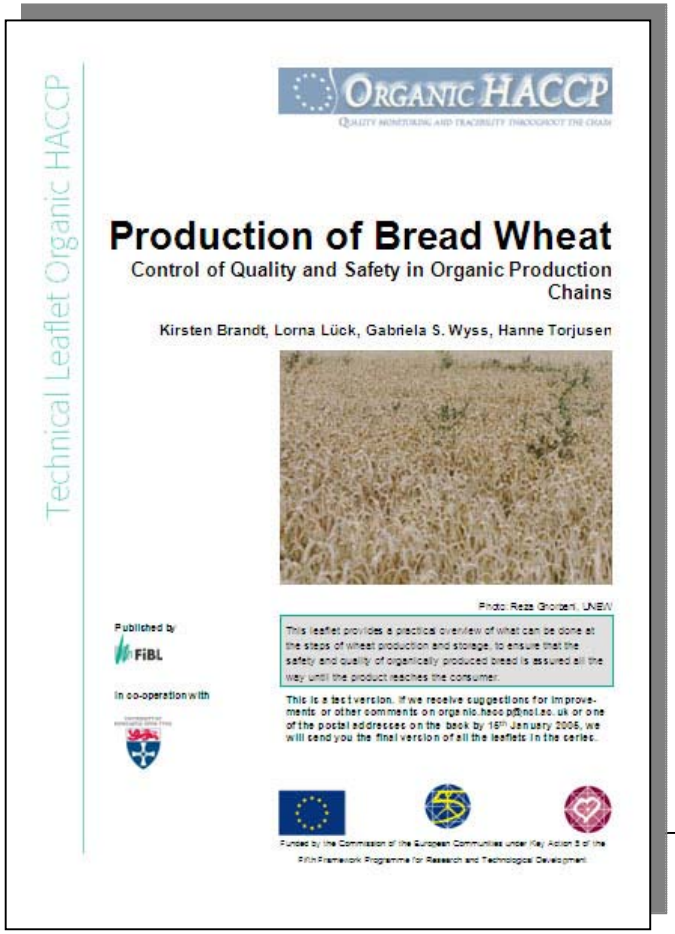
Critical Control Points – Egg Chains

CCPs	E1 (NL)	E3 (N)	E4 (UK)
Feed	Similar results as in the milk chains ➢no quality assurance concept in place		
Fodder Storage			

Results Wheat Production and Storage



TOMATOES CABBAGE EGGS BREAD MILK APPLES WINE

ORGANIC HACCP

QUALITY MONITORING AND TRACEBILITY THROUGHOUT THE CH

Technical Leaflet

Production of Wheat

Seed and variety selection

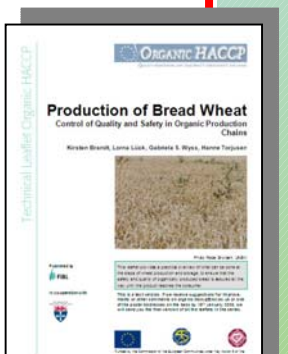
- **Baking quality**

Growing of wheat

- **Soil fertility**
- **Leaching of nutrients**

Drying and storage

- **Introduction of mould infested feed>mycotoxin formation**



- Harvest with good control of humidity and temperature, even in a year with bad weather conditions.
- Ensure swift drying to correct water content, normally 14-15%.
- Establish a quality control routine, where the appearance (smell, colour) of the grain and signs of insects are checked and humidity and temperature measured.

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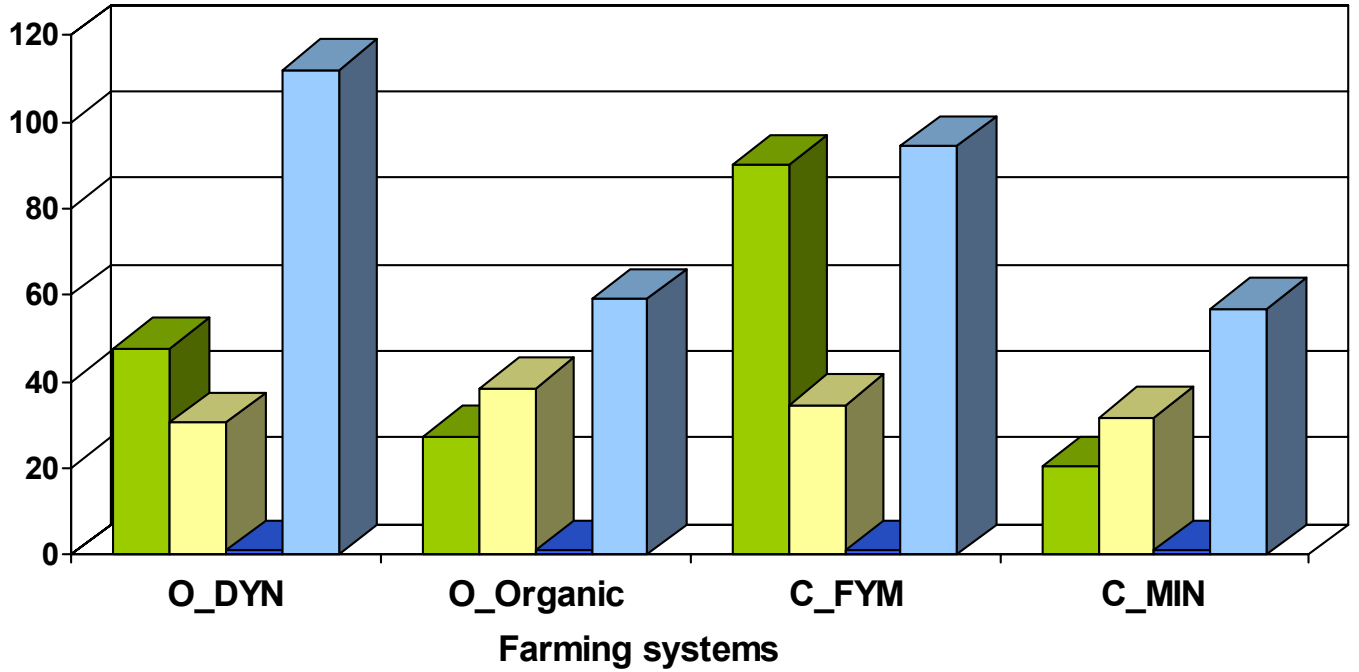
Other Research

- **Higher risk of exposure to mycotoxins with organic food?**

DON and NIV levels in conventional and organic grain samples

Hahn *et al.* (2004). **Wheat quality in organic and conventional farming as assessed by analytical and holistic methods, in review**



Other studies reporting higher infection and/or mycotoxin levels in conventional samples:

Lepschy & Beck (1997)/ Dornbush *et al.* (1993)/Piorr (1990)

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Food Standards Agency Survey on Milk 2001, UK

- 100 milk samples, 50 retail and 50 farm gate conventionally and organic produced
- Analysis for aflatoxin and ochratoxin A
- Results:

Samples	Aflatoxin M_1 n.n.	Aflatoxin M_1 ≤0.05 µg/kg (MRL, EU)
Organic	100%	-
Conventional	97%	3%

- Ochratoxin A was not detected in any of the samples
- Conclusion: Survey results do not raise any food safety concerns.

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FAO

- **…From studies carried out from 1995-1999 it cannot be concluded that organic farming leaads to an increased risk of mycotoxin contamination. It is important to emphasise that good agricultural, handling and storage practices are required in organic as in conventional agriculture to minimise the risk of mould growth and mycotoxin contamination….**
- **As organically raised livestock are fed greater proportions of hay, grass and silage, there is a reduced opportunity for mycotoxin contaminated feed to lead to mycotoxin contaminated milk…..**

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FAO. 2000. Food Safety and Quality as affected by Organic Farming. 22nd FAO Regional Conference for Europe, Porto, PL, 24-28 JULY 2000; http://www.fao.org/docrep/meeting/X4983e.htm

General Conclusions

- No relevant differences between farming systems from the literature or experimental studies
- Major contamination sources in all farming systems > must be taken seriously
- A well maintained quality assurance system has to be set up based on occurrence, detection, and prevention
- Good agricultural, handling and storage practices are required in both organic and conventional agriculture to minimize the risk of mould growth and mycotoxic contamination.