Quality and Safety Aspects Associated with Organic Foods

Slides presented by Carlo Leifert

Complete slide set is also available

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Quality and Safety aspects associated with Organic Foods

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Contents

1. Nutrient composition
2. Heavy metals/Mycotoxins
3. Pesticides
4. Food-borne pathogens
5. Organic food vs. livestyle

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Nutritient composition

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Effects of production systems on food composition (K. Brandt 1993)

Organic	Conventional
Plant foods have more:	
– Dry weight %, minerals	– Nitrate
– Vitamin C	– Protein
– % essential amino acids	– β-carotene
– Natural pesticides	– Synthetic pesticides*
Animal foods have more:	
– Unsaturated fatty acids, CLA, carotenoids	– AB-resistant bacteria
Processed foods have more:	
	– Food additives*

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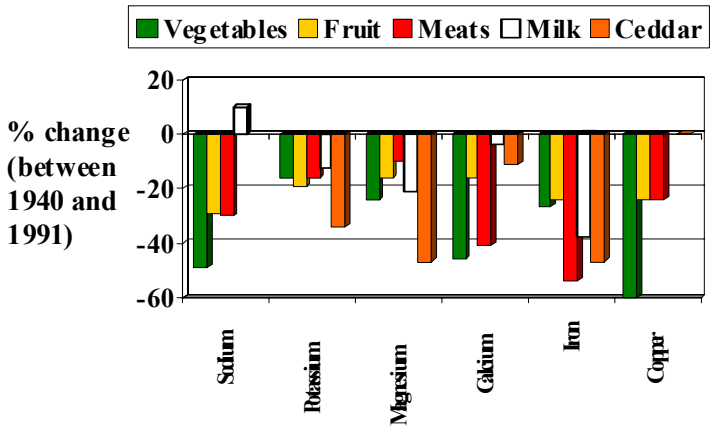
Figure 5. Change in the mineral content of UK foods between 1940and 1991



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References

- Thomas, D. (2000) A study on the mineral depletion of the foods available to us as a nation over the period 1940-1991. Report
- Mayer, A-M. (1997) Historical changes in the mineral content of fruits and vegetables. *British Food Journal* 99; 207-211.
- Berger, P (1997) *The Healing Power of Minerals*. Prima Health, New York.

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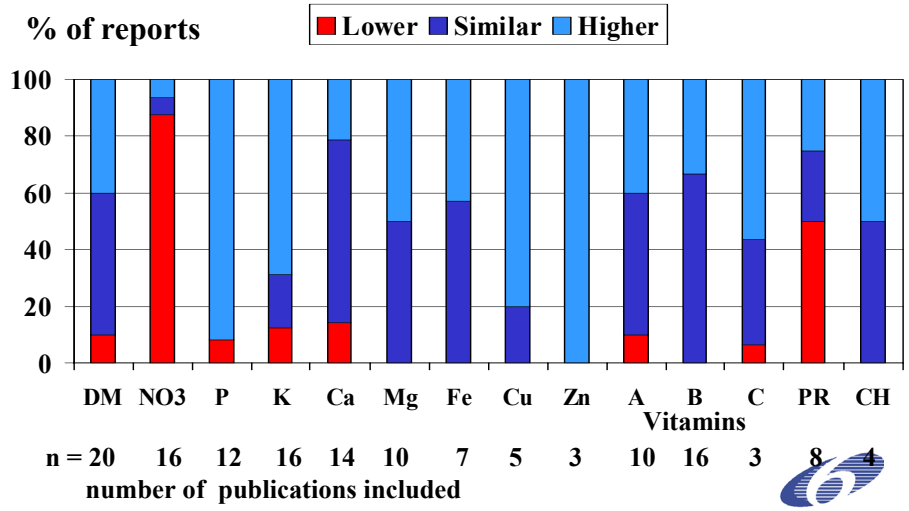
Differences in dry matter, mineral, vitamin, protein and sugar concentrations between organic and conventional foods reported in the literature



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Differences in dry matter, NO_3, K, Vit. C and storability between organic and conventional potato reported in the literature

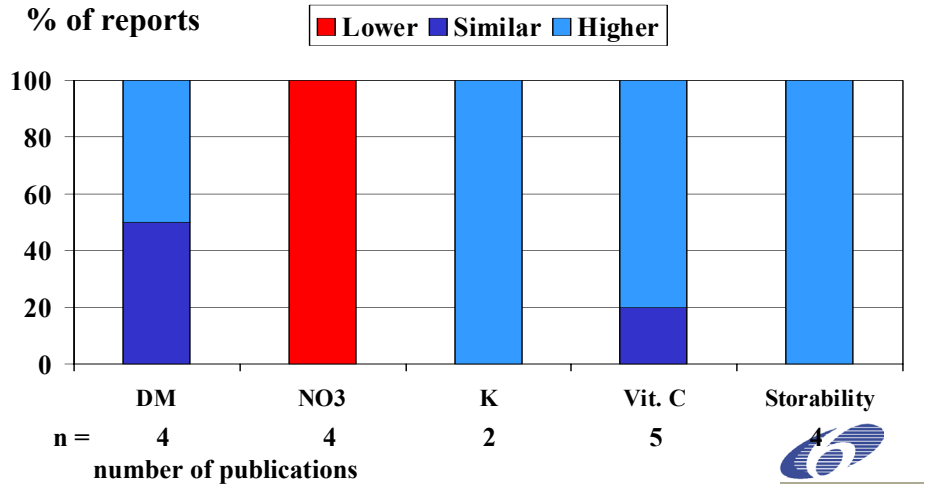

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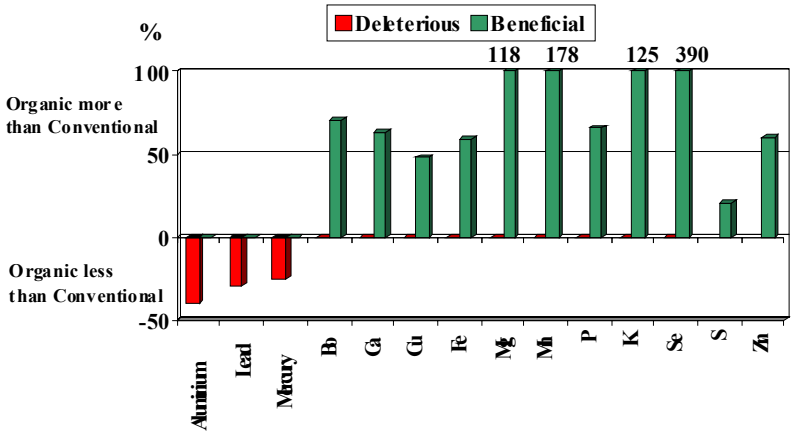
Figure 4. Differences mineral content between conventional and organic fruit/vegetables



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References

- Smith, B.L. (1993) Organic Foods vs Conventional Foods: Element Levels. *Journal of Applied Nutrition* 45; 35-39.
- Lairdon, D. *et al.* (1981) Analysis of vegetables produced by orthodox (=conventional) and biological (=organic) methods; some preliminary results. In: *Biological Husbandry, a Scientific Approach to Organic Farming.* (pp327-228), Billings & Sons Ltd., London.

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Mycotoxins

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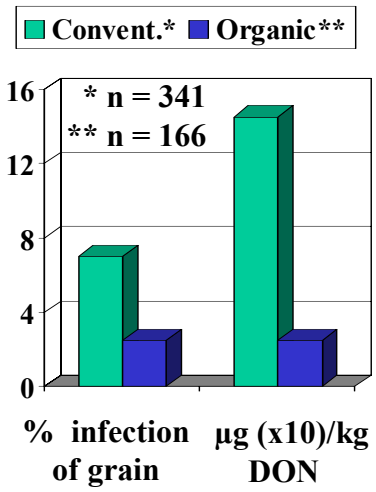
Fusarium infection and mycotoxin levels in conventional and organic grain samples



Stähle *et al.* (1998)

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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Potential reasons for differences between conventional and organic systems

CONVENTIONAL

- short straw varieties
- CCC (haulm shortening Hormones)
- strobilurins used
- excessive N-fertilisation
- minimum tillage
- frequent wheat & maize crops in rotation

ORGANIC

- long straw varieties
- Plant hormones not permitted
- fungicides not permitted
- moderate N-fertilisation
- MT-not used (weeds)
- long rotations (break crops between cereals)

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Pesticides

Neurotoxicity associated with organophosphorus (OP) and chlorinated hydrocarbon pesticide

Chlorinated hydrocarbon pesticides

- Diarrhoea, headaches, tremor, vomiting, lack on energy, depression, anxiety, dermatitis, convulsions **(Laseter & Rea 1983, *Clin. Ecol.* 2, 10**

Organophosphorus pesticides

- gastrointestinal and neurological complaints - OP's in fruit and vegetables **(Laseter & Rea 1983, *Israel J. Med. Sci.* 19, 810)**
- Neuropsychological effects, affective disorders, suicide - OP's in Sheep Dips **(Stephens *et al.* 1995; *Lancet* 345, 1135; Davies 1995, J. Nut. Environ. Med)**
- Developmental effects (altered learning, memory and motor skills) in children – prenatal pesticide exposure **(Guillette *et al.*, 1998, *Environ. Health Perspect.* 106, 347-)**

Endocrine system disruption (EC: 34 pesticides with oestrogenic properties)

- Round-up inhibits steroidogenesis by disrupting steroidogenic acute regulatory (StAR) protein expression **(Walsh *et* al., 2000, *Environ. Health Perspect.* 108, 767-)**
- Link between environmental oestrogens and decline in male reproductive health and sperm counts **(Jensen *et al.* 1995; *Clin. Chem.* 45, 1896-; Sharpe & Skakkebaek 1993, *Lancet* 341, 1392-)**
- IVF is less successful and semen quality lower in men with high occupational pesticide exposure such as greenhouse workers **(Tielemans *et al.* 1999, *Lancet*, 254, 484-; Abell *et al.* 2000, *Scand. .J. Work Environ. Health* 26, 492-)**

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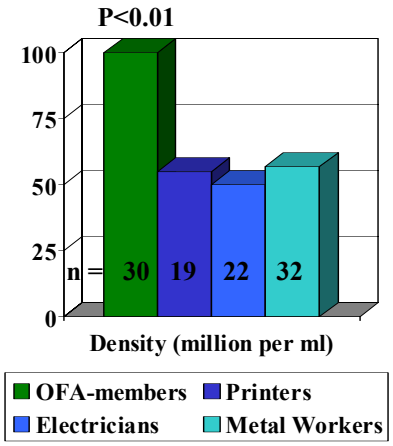
Sperm density in members of the Danish Organic Farmers association and workers from 3 other occupational groups



(Abell et al. 1994 The Lancet 343, 1498)

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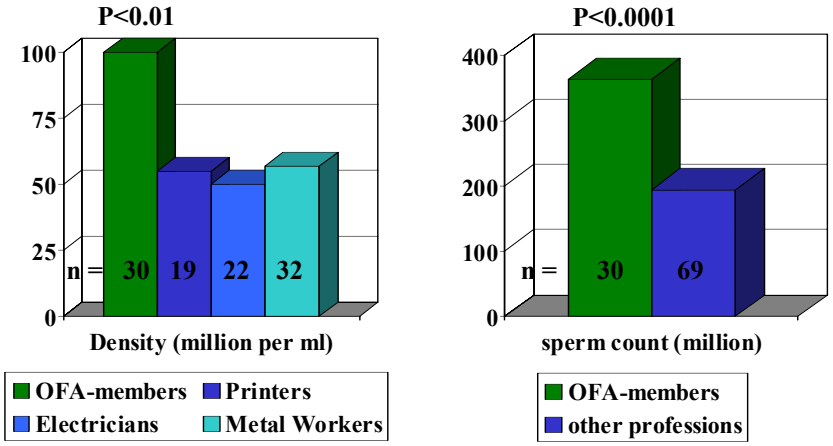
Sperm density and abstinence adjusted mean sperm count in members of the Danish Organic Farmers association and workers from 3 other occupational groups



(Abell et al. 1994 The Lancet 343, 1498)

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Carcinogenicity

- Farmers with high exposure to pesticides have higher incidences of cancers such as stomach, prostate, brain and skin cancer **(e.g. Wigle *et al.* 1990, *J. Nat. Cancer Inst.* 82, 575-582, Sterling & Arundel 1986 *Scan. J. Work Environ. Health* 12, 161-)**
- Link between higher cancer mortality rates\in four northern US states and a herbicide used in wheat **(Schreinemacher 2000, Environ. Health Perspectives 26, 436-).**

Immunotoxicity

- **Link between susceptibility to infection/low immune status and pesticide/herbicide exposure For example:**
  - Dewailly *et al.* 2000, Susceptibility to infections and immune status in Inuit infants exposed to organochlorines *Environ. Health Perspectives* 108, 205-
  - Faustini 1996, Immunosuppressive effects of chlorophenoxy herbicides. *Food and Chemical Toxicology* 34, 1190-1191

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Food Pathogens

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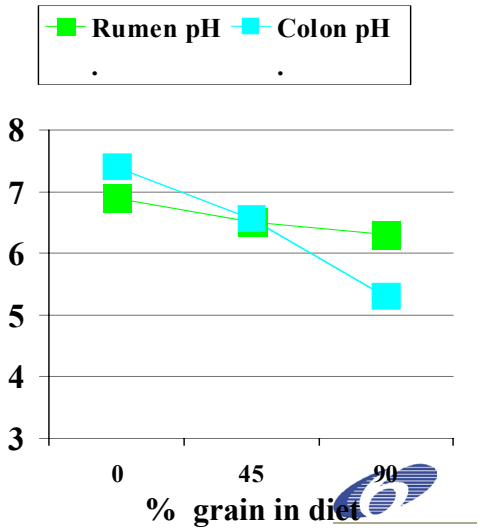
Effect of ruminant nutrition on rumen and colon pH

***E. coli* O157**

- asymptomatic in cattle
- faecal contamination of carcasses at slaughter
  - ➔ food chain (meat)
- infective dose: 10 cells!!!
  - **(other pathogens > 10.000)**
- highly pH-resistant



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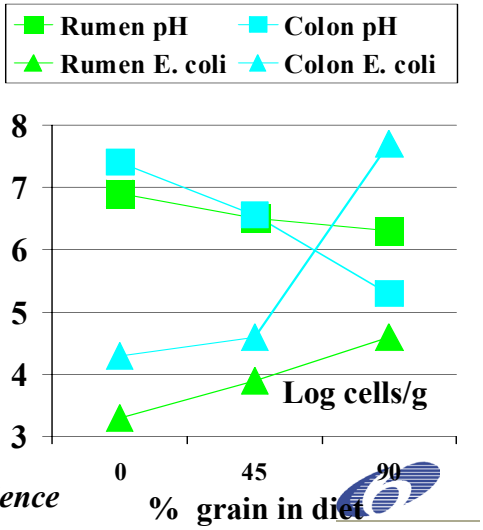
Effect of organic animal nutrition on rumen and colon pH and *E.coli* cfu

***E. coli* O147**

- asymptomatic in cattle
- faecal contamination of carcasses slaughter
  - ➔ food chain (meat)
- infective dose: 10 cells!!!
  - **(other pathogens > 10.000)**
- highly pH-resistent



Diez-Gonzalez *et al.* (1997) *Science*

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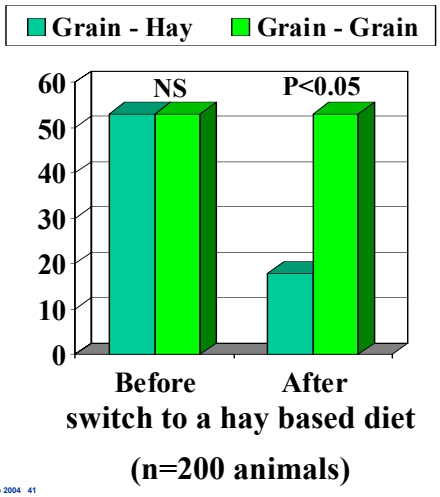
Effect of nutrition on *E. coli* shedding

% animals shedding *E. coli O157*



Conclusions

- **Grass based "organic" feeding regimes reduce the risk of *E. coli O157* contamination at CCP1**
- **Grain based "conventional" diets increase the risk**

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Organic Food vs livestyle

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Atopy (allergies) in children of families with an anthroposophic lifestyle

(J. Alm *et al.* 1999 *The Lancet* 353, 1485-1488)

Life style characteristic	anthroposophic schools children	State school children
Organic food	76%	6%
Antibiotics in the past	52%	90%
Antipyretics	39%	89%
MMR-vaccination	18%	93%
Measles*	1%	61%
Fermented vegetables*	63%	5%
Breast feeding	5.7 months	4.3 months
Symptoms/history of allergies	13% (p<0.001)	25%

* Factors linked to reduced atopy rates in other epidemiological studies

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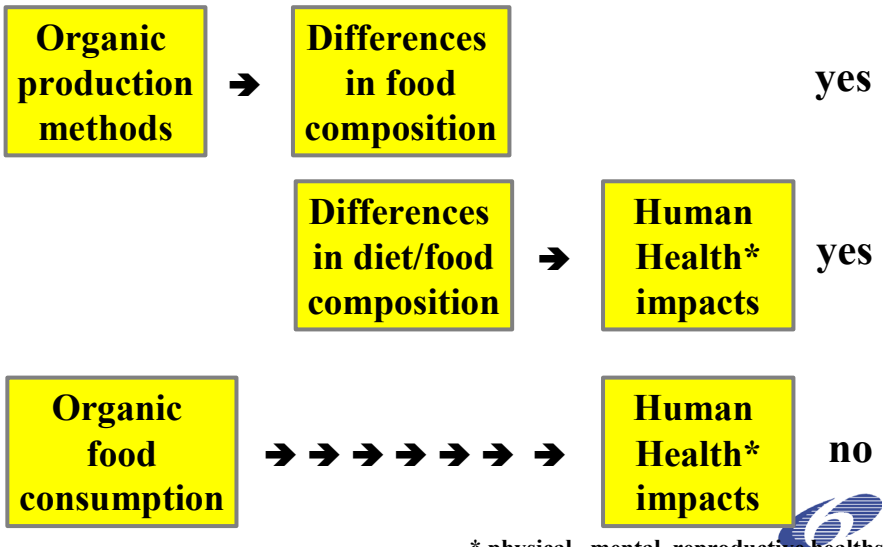
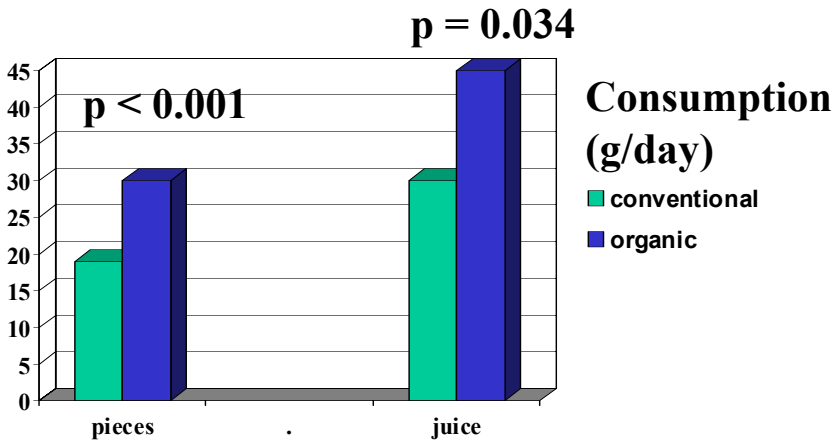
What do we have evidence for and what not?



Swiss rats prefer organic beetroot



Sources: Mäder et al. 1993
Acta Horticulturae 339, 11-31

Acknowledgements

European Union (EU):

- project QLK5-CT99-01065 BLIGHT-MOP

UK Dept for Environment, Food & Rural Affairs:

- projects CSA 1710 (biological control of diseases)
- project OF0167 (copper replacement strategies)

Greenpeace Environmental Trust

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Environmental benefits?

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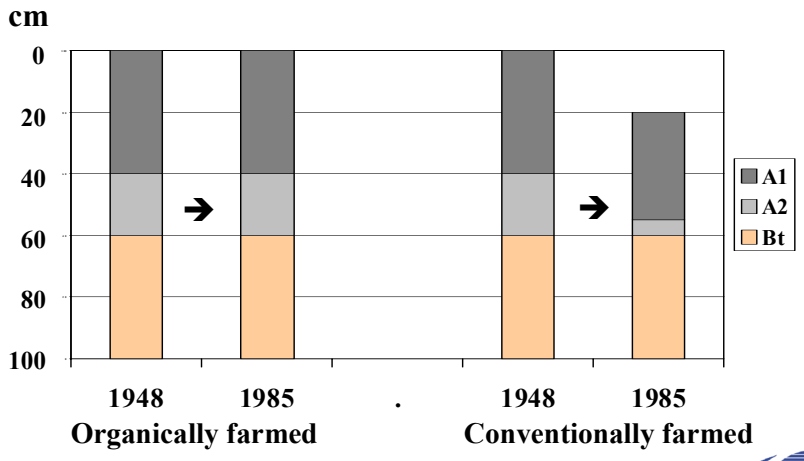
Organically and conventionally farmed soil (Naff silt loam) losses due to water erosion 1948 to 1985



(Reganold *et al.* 1987 Nature 330; 370-372)

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Nitrate leaching in matched farm comparisons studies