An overall view on the first results of the IP « QualityLowInput Food »

Urs Niggli & Carlo Leifert
FiBL & University of Newcastle
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Objectives

- To improve the **quality & nutritional value** of organic and other "low input" foods in line with **consumer demands** and expectations.

- To **increase the cost-efficiency** all along the organic and other "low input" food chain, while improving or maintaining its quality.

- To contribute to **minimising food safety risks** all along the food chain (including the stages of production, processing, distribution and consumer food handling).

- To contribute to **reducing environmental impact** and fossil energy use in organic and "low input" farming.
Approach

Determination of consumer attitude

Assessment of socio-economic impact

Assessment of ecological impact (LCA)

Primary production
Economic factors
Processing
HACCP

Animal supply chain

Quality and Safety of Organic Food

Human Health

? animal model
Approach

Assessment of socio-economic impact

Quality and Safety of Organic Food

Assessment of ecological impact (LCA)

Human Health
Production systems ...

Conventional  Low Input  Organic
Production systems ...

Conventional    Low Input    Organic
Production systems ...

Low Input

- Integrated pest management with action threshold (economic, health or aesthetic).
- Low external input arable crop production (reduced or no herbicides and pesticides, reduced nitrogen).
- Pasture-based, extensive beef rearing.
- Low input dairy systems (pasture-based, minimum concentrates).
- Free range egg production.
... and their components

<table>
<thead>
<tr>
<th>Crop production</th>
<th>Animal production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.  Fertility management</td>
<td>1.  Feeding system</td>
</tr>
<tr>
<td>2.  Crop protection</td>
<td>2.  Health management</td>
</tr>
<tr>
<td>3.  Rotational position</td>
<td>3.  Husbandry</td>
</tr>
<tr>
<td>4.  Variety/Genotype</td>
<td>4.  Genotype</td>
</tr>
</tbody>
</table>
Experimental design at Nafferton farm (Newcastle, UK)

Fertility management
- **Manure**
  - organic
- **Mineral NPK**
  - low input 1
  - low input 2
  - conventional

Crop protection
- no pesticides
- no CCC
- pesticides and CCC

Community Research
Mycotoxin loads in winter wheat
Adding both mineral fertilisers and pesticides/CCC increased *Fusarium* mycotoxin loads in wheat.
Winter Wheat - Protein Content
(2004)

Protein (%)

<table>
<thead>
<tr>
<th>Method</th>
<th>Protein</th>
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<tbody>
<tr>
<td>Organic</td>
<td>b</td>
</tr>
<tr>
<td>Manure (CCC pesticides)</td>
<td>b</td>
</tr>
<tr>
<td>Mineral fertilizer</td>
<td>a</td>
</tr>
<tr>
<td>Conventional</td>
<td>a</td>
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</table>
Wheat - Protein content (2005)
Effect of using varieties adapted to organic systems

<table>
<thead>
<tr>
<th>Variety</th>
<th>Protein (%)</th>
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<tbody>
<tr>
<td>Malacca</td>
<td>9</td>
</tr>
<tr>
<td>Pollux</td>
<td>12</td>
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<tr>
<td>Wenga</td>
<td>12</td>
</tr>
<tr>
<td>Greina</td>
<td>12</td>
</tr>
<tr>
<td>Paragon</td>
<td>13</td>
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<tr>
<td>Monsun</td>
<td>13</td>
</tr>
<tr>
<td>Fasan</td>
<td>12</td>
</tr>
<tr>
<td>Zebra</td>
<td>12</td>
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GO Gilchesthesia Organics, Stamfordham, UK
Vegetables: Enteric bacteria transfer risks associated with manures?

Lettuce
(*Lactuca sativa var. capitata*)

University of Bonn, IOL, Wiesengut farm
Vegetables: Enteric bacteria transfer risks associated with manures?

Parameters analysed:
- Total aerobic bacterial count
- Enterobacteriaceae
- Coliform bacteria
  - *E. coli*
  - *Salmonella enteritidis*
Practices compared:
- Fresh FYM, composted FYM, fermented plant extract of stinging nettle (Urtica dioica), mineral N-fertiliser.
- With/without post-harvest washing.
- Manure incorporated versus manure applied on soil surface.

Vegetables: Enteric bacteria transfer risks associated with manures?
What is a good apple? And how to produce it organically?

Apple research at DARCOF, Aarslev, Denmark.
To get to the bottom of things …

- Impact of fertility managements, planting densities and weed management (soil cover) on:
  - soil and yield parameters.
  - apple quality, e.g. disease incidence, mineral contents, technical and sensory quality, aroma analysis (volatiles), mycotoxins (patulin), carotenoids, phenolic compounds.
Big potential, but also big variation: e.g. secondary plant metabolites

- **Polyphenols**
  - Organic has higher content than conventional
  - No differences
  - Organic has lower content than conventional

- **Carotenoids**
- **Glycoalkaloids**
- **Glucosinolates**

Effect of organic and conventional production systems

% higher in organic milk

RRR-alpha tocopherol
beta carotene
lutein
zeaxanthine
CLA
omega-3

Vitamin E
Fat-soluble Vitamins
poly-unsaturated fatty acids

North East England
Wales

p<0.01

DARCOF (DK), IGER (Wales), University Newcastle, Granolo (I)
Low input (pasture-based) strategy is equivalent!

Slots et al (2006) DIAS & University of Newcastle
Assessment of processing technologies which may improve the nutritional composition of dairy products

- Conjugated linoleic acids (CLA) in dairy products: positive effects on human health (such as anti-mutagenic, anti-carcinogenic, anti-diabetic and anti-atherosclerotic).
- Organic milk higher CLA content (13% to 50%).
- Preserving or enhancing specific bio-active or functional components during processing.
First results:

Novel processing procedures

- CLA content in processed dairy products (e.g. butter) stable.
- Physical separation processes were successful (CLA enrichment up to 32%)
- Microbiological techniques: *still in investigation*

Agroscope ALP (CH), FiBL (D and CH), University of Kassel (D)
Innovation: non-antibiotic teat sealer (bismuth)
Innovation: probiotics, nutribiotics to reduce risk of gastro-intestinal infections

- Specific strains of Lactic Acid Bacteria (RA 18 *Bifidobacterium animalis* subsp. *Lactis*).
- Addition of oligosaccharides or lactose.
- Better formulation by micro-crystals of cellulose.

University of Bologna, B. Biavatti
Induced resistance with naturally occurring elicitors

- **BABA (β-Amino-Butyric Acid)**: Bar-Ilan University, Ramat-Gan, Israel.
- **Milsana (extract of giant knotweed)**: Technical Education Institute, Heraklio, Crete.
- **Pen (Penicillium chrysogenum)**: Research Institute of Organic Agriculture, FiBL, Switzerland.
Downy Mildew
(*Plasmopara viticola*)
on vine leaves.
Subproject 1: Determining consumer expectations and attitudes towards organic and low input food quality and safety

- Analysis of consumer expectations and attitudes.
- Analysis of actual buying behaviour and its evolution.

- University of Newcastle (UK), University of Wales (UK), University of Kassel (D), FiBL (CH), INRA (F), DARCOF (DK), Polytechnical University of Ancona (I), Group de recherche et d’échanges technologiques, Paris (F)
Market research:
Target group are occasional buyers

Shift in a mature market (e.g. CH):
2000 - 2004

- Regularly: 36%
- Occasionally: 27%
- Seldom: 29%
- Never: 25%

2000
2004
Economic analysis of structures, conduct and performance of supply chains for organic foods in Europe.

Case studies:

<table>
<thead>
<tr>
<th></th>
<th>UK</th>
<th>CH</th>
<th>IT</th>
<th>FR</th>
<th>DK</th>
<th>DE</th>
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<td>Eggs</td>
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<td></td>
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<td>X</td>
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<tr>
<td>Wheat</td>
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<tr>
<td>Pork</td>
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</tr>
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## Additional costs of organic milk

<table>
<thead>
<tr>
<th></th>
<th>Farm</th>
<th>Transport</th>
<th>Processing</th>
<th>Transport</th>
<th>Logistics</th>
<th>Transport</th>
<th>shop</th>
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<tr>
<td><strong>DK</strong></td>
<td>20%</td>
<td>20%</td>
<td>0-5%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>CH</strong></td>
<td>10-20%</td>
<td>30-50%</td>
<td>10%</td>
<td>10%</td>
<td>0</td>
<td>0</td>
<td>5-10%</td>
</tr>
</tbody>
</table>

*Note: The table shows additional costs in percentage for farm, transport, processing, logistics, and shop for organic milk in Denmark (DK) and Switzerland (CH).*
Conclusions

- Many experimental designs help to explain factors affecting quality, safety and agronomic performance of organic production ➔ a clear and scientific basis for better management on all levels!

- Many extensive surveys of production, consumers, food chains give excellent practical data for a very innovative food sector.

➔ A multifunctional food and farming sector gets more competitive and better manageable!
Outlook

- Organic farming still ‘virginal’ with regard to research innovation.
  ➜ input/output ratio of research excellent.

- Potential of genotype improvements in the context of low input systems not yet exploited (both crops and livestock).

- Organic, local or traditional foods against uniform food: a novel strategiy for private and public health care?