QLIF Integrated Research Project

Advancing organic and low-input food

Photo: ICROFS and Organic Denmark

Improving quality and safety and reduction of costs in the European organic and low-input supply chains

The Integrated Project “Improving quality and safety and reduction of costs in the European organic and low input supply chains” (QLIF) was funded by the European Commission under the 6th Framework Programme for Research and Technological Development.

QLIF started in 2004 with 31 scientific and industry partners and supplemented the consortium with another five partners via open calls. The total budget was 18 million € of which the European Commission contributed 12.4 million €. The duration of the project was five years. The scope of QLIF was on quality and safety of organic and low-input foods in the context of cost efficiency and sound environments. Sixty-one work packages provided conclusive answers based on comprehensive analyses from scientific experiments, socio-economic data and complex modelling. The work was organized in 7 subprojects with interdependent aims. Here an outline is given on what the Integrated Project QLIF has achieved and what challenges remain. Individual subproject folders provide a further insight to the outcomes and a substantial amount of QLIF publications are available in the open access database Organic Eprints.

The major results of QLIF demonstrate the progress made by the approach of integrated research in organic and low-input food systems

1 The quality of organic foods is high and matches the expectations of European consumers

Experiments in different parts of Europe proved that the quality of crops and livestock products from organic and conventional farming systems differs considerably. In the case of dairy products, low-input systems like free-range grazing produced identical qualities as organic farming, but in most other cases, the low-input systems were more like conventional farming. The results showed that organic food production methods resulted in (a) higher levels of nutritionally desirable compounds (e.g., vitamins/antioxidants and poly-unsaturated fatty acids such as CLA and omega-3) and (b) lower levels of nutritionally undesirable compounds such as heavy metals, mycotoxins, pesticide residues and glyco-alkaloids in a range of crops and/or milk. In the case of milk, nutritionally desirable compounds were up to 70 pct higher in organic samples.

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The multi-factorial design of the QLIF experiments made it possible for the first time to correlate the higher quality of organic food to management practices. The nutritional composition in a range of crops was improved by the non-use of chemo-synthetic mineral fertilisers, and in some cases pesticides. Dairy milk gained in quality when the feeding regime was roughage-based and maize silage was low in the diet or during outdoor grazing periods.

The QLIF results increased our knowledge on how producers can further improve the quality of organic plant and animal foods. Some experiments targeted very specific quality improvements, for example (a) to increase protein contents and quality of wheat through soil fertility management and variety choice, (b) to improve the intra-muscular fat content which affects the sensory quality of pork through the feeding of grain legumes or (c) to improve milk and milk protein yields through the feeding of red clover silages. Specific HACCP (Hazard Analysis and Critical Control Points) protocols were developed to support producers to manage quality attributes specific to organic products.

2 Organic foods are safe

Consumers regard organic foods not only as better, but also as safer, more hygienic, and free of chemical residues and artificial ingredients. Organic foods were shown to deliver against these expectations – this is another major result of the QLIF project. Studies in Denmark proved that there is a lower risk of faecal *Salmonella* shedding in pigs from outdoor rearing systems. This was shown for both organic and non-organic outdoor systems. Intensive indoor systems had 2 to 3 times higher *Salmonella* levels and therefore pose a greater risk of enteric pathogen transfer into the human food chain. A study in Germany looked at the microbiological safety of lettuce fertilized with organic manure. Even for worst case scenarios, no additional safety risks could be detected with respect to *Salmonella* nor *E. coli* transfer risks However these studies concluded that it is essential to follow good agricultural practice with respect to manure use and processing to minimise safety risks. Many nutritionally undesirable compounds are found in lower levels in organic foods than in conventional ones. Again, protocols for specific organic Hazard Analysis with the relevant Critical Control Points were developed.

3 Processing of organic commodities is a challenging trend

Regular purchasers of organic food are suspicious of over-processed organic foods sold in supermarkets. Occasional buyers on the other hand are sensitive to convenience food, and this customer group represents the most dynamic potential for further market

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growth. Therefore, there is a high demand for processing methods that only sparingly use chemicals, additives and preservatives. The QLIF project proposed a code of practice, guiding processing standards which also include the aspect of maintaining the authenticity and naturalness of organic foods. In a case study with fresh-cut vegetables, alternative disinfectant strategies with ozone were successfully tested on both laboratory and industry level in order to avoid chlorine treatments. Furthermore, processing technologies were assessed that may improve the nutritional composition of dairy products.

4 Health claims for organic foods are not yet substantiated

The positive findings on the quality and safety of organic foods might be the reason why a majority of European baby food producers already shifted to processing organic raw materials. In contrast, studies investigating the effect of organic food consumption on the health of experimental animals only produced preliminary, but not yet conclusive results. Interestingly, organic and conventional feed from the field trials affected the hormonal balances and immune status of rats differently and significant correlations with fertilisation and crop protection techniques occurred. However, further and more detailed studies are required to provide proof for positive health impacts of organic diets on human and animal health.

5 Factors identified that impede an increased consumption of organic and low-input foods

The main barriers hindering the increase of demand for organic food are (a) insufficient availability, (b) limited range and assortment, and (c) high prices or an insufficient perceived price-performance ratio. The perception may possibly change with the information gained by QLIF research on the actual qualities of organic food. In countries where availability and assortment is very good (e.g., Denmark, Austria, Switzerland), the share of organic added up to 5 to 6 pct of all food purchases, but the relatively high premiums on consumer prices continue to obstruct large scale organic production.

6 Bottlenecks addressed and some solved along the organic food chains

A number of QLIF experiments addressed bottlenecks of organic crop and livestock production, which reduce yields, increase economic risks and therefore push up prices:

> In line with the organic concept, soil fertility management was a major focus in order to deploy the potential of soils to release nitrogen and to increase the suppressiveness to economically important diseases. The consequent application of good organic practices over decades was more effective than short-term interventions. Therefore, excellently managed organic farms become significantly more productive in the long run.

> Yield stability and increase was achieved by novel indirect and direct control of pests and diseases, e.g., by sowing companion plants in *Brassica* crops, attracting beneficial insects, by applying β-amino-butyric acid against mildew in lettuce, by treating seeds, e.g., with compost extracts and acidified nitrite solutions.

> Livestock performance was successfully improved, e.g., by preventive management strategies in the case of mastitis of dairy cows and in the case of two helminth species of poultry on outdoor runs.

> In other cases, alternative treatments such as diatomaceous earth and liquid formulation of silicas were successful against the red mite of poultry. Dried chicory roots included in the diet of sows and boars abolished egg excretion of parasitic round-worms. Some of these new techniques have been taken up by practitioners recently.

> Case studies of organic food supply chains revealed economically important weaknesses, especially in the high logistic and transport cost, high input costs and low spending on

research and product development. Good co-operation among the supply chain actors was identified as improving the non-financial and financial performance.

7 The scientific output from QLIF is big and the outreach for consumers and producers is highly relevant

Within five years of targeted research, the Integrated Project QLIF produced a solid scientific basis for organic food chains. The number of peer reviewed publications on organic food and farming grew considerably. Many findings were already disseminated to consumers and farmers by the end of the project. Further, the QLIF website now serves as entry to the open access database Organic Eprints, where an increasing number (more than 100) of publications from the QLIF project are available.

8 Major challenges ahead

Productivity remains a weakness of organic food chains, affecting the costs and the ecological footprint. The QLIF project showed, e.g., that the higher energy efficiency and lower greenhouse gas emissions per land area partly melted away when calculated on per ton basis. These challenges have to be addressed by future research.

In addition to soil fertility management, intensified breeding under low-input conditions could probably better exploit effects of genotype x environment interactions on genetic gain in breeding programs, both in organic and low-input crop and livestock systems. To some extent, novel and innovative non-chemical direct treatments, especially for diseases, might also help. Novel farm, food chain and landscape strategies based on diversification by co-operation could increase system productivity and might reduce trade-offs between economic, ecological and social goals. Sustainable production and consumption will require transparent information and active participation of stakeholders – uncommon for most scientists. Developing markets and changing consumption patterns call for a stronger research focus on processing, packaging, transportation and storage.

These are some of the future challenges to be addresses by researchers for organic and sustainable food chains.

Further about QLIF

QualityLowInputFood

QLIF comprises seven subprojects on:

1) Consumer expectations and attitudes
2) Effects of production methods
3) Crop production systems
4) Livestock production systems
5) Processing strategies
6) Transport, trading and retailing
7) Horizontal activities

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Information on partners and subprojects is found at the project website **www.qlif.org**. The website also holds the library for project newsletters and serves as entry to Organic Eprints, where more than 100 publications from the QLIF project are available: http://orgprints.org/view/projects/eu_qlif.html

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