

# BOOK OF ABSTRACTS

Second International Conference on  
**ORGANIC FOOD QUALITY  
AND HEALTH RESEARCH**

**June 5–7, 2013**

**Warsaw, Poland**

Editors

Johannes Kahl, Ewa Rembiałkowska,  
Aneta Załęcka, Grzegorz Lesiński



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Second International Conference on  
**ORGANIC FOOD QUALITY  
AND  
HEALTH RESEARCH**

**June 5–7, 2013, Warsaw, Poland**

Sofitel Hotel

Organized by:

**Food Quality and Health Association**

(FQH, The Netherlands)

&

**Warsaw University of Life Sciences – SGGW**

(WULS, Poland)

&

**The International Society of Organic Agriculture Research**

(ISO FAR)

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# CONFERENCE PROGRAM



## WEDNESDAY, June 5, 2013

- 12:00–14:00**  
FOYER  
**Registration for the FQH 2013 conference**
- 14:00–14:50**  
BELWEDER  
**OPENING CEREMONY AND WELCOME**  
**Ministry of Agriculture and Rural Development**, Warsaw, Poland  
**Johannes Kahl**, chair of FQH 2013 conference, FQH, Driebergen, The Netherlands  
**Gerold Rahmann**, ISOFAR, Bonn, Germany  
**Ewa Rembialkowska**, co-chair of FQH 2013 conference, Warsaw University of Life Sciences – SGGW, Warsaw, Poland
- 14:50–17:30**  
BELWEDER  
**GENERAL SESSION**  
*chair Johannes Kahl*
- 14:50–15:30** L 1 **PERSPECTIVES OF ORGANIC AGRICULTURE AND SUSTAINABILITY IN 2050**  
*Noemi Nemes*, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy
- 15:30–16:10** L 2 **NUTRITION AND HEALTH – CHALLENGES AND GAPS IN RESEARCH METHODOLOGY**  
*Ben van Ommen*, TNO, Zeist, The Netherlands
- 16:10–16:50** L 3 **FOOD QUALITY, VERSATILITY, NEEDS AND EXPECTATIONS**  
*Wolfgang Kneifel*, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria
- 16:50–17:30** L 4 **HOW DO WE DETERMINE PLANT QUALITY OF ORGANIC CROPS?**  
*Sören Husted*, University of Copenhagen, Copenhagen, Denmark
- 17:30–18:00**  
**Break**
- 18:00–20:00**  
FOYER +  
TERRACE  
**Welcome Organic Cocktail**

## THURSDAY, June 6, 2013

- 9:00–11:00**  
609 A+B/  
BELWEDER  
A+B  
**PARALLEL SESSIONS A, B, C, D**
- 9:00–11:00**  
609 A  
**SESSION A: Future of Sustainable Agriculture**  
*moderator Ulrich Köpke*, Bonn University, Bonn, Germany
- 9:00–9:30** L 5 **OPPORTUNITIES FOR AGROECOLOGY WITHIN THE CAP AND HORIZON 2020**  
*Les Levidow*, Open University, Milton Keynes, United Kingdom

9:30–10:00 L 6 **RESEARCHING LINKS BETWEEN SUSTAINABLE AND HEALTHY ORGANIC SYSTEMS**  
*Niels Halberg, International Centre for Research in Organic Food Systems (ICROFS), Foulum, Denmark*

10:00–10:30 L 7 **BNN MONITORING ON SUSTAINABILITY**  
*Karin Wegner, Bundesverband Naturkost Naturwaren, Berlin, Germany*

10:30–11:00 **DISCUSSION**

9:00–11:00 **SESSION B: Quality of Food from Organic and Related Systems**  
**BELWEDER A**  
*moderator Franz Ulberth, Joint Research Centre – Institute for Reference Materials and Measurements (JRC-IRMM), Geel, Belgium*

9:00–9:30 L 8 **INFLUENCE OF PROCESSING ON FOOD QUALITY WITH FOCUS ON ORGANIC FOOD**  
*Flavio Paoletti, Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione (INRAN), Rome, Italy*

9:30–10:00 L 9 **INFLUENCE OF FARMING SYSTEMS ON PLANT FOOD QUALITY**  
*Kirsten Brandt, Newcastle University, Newcastle, United Kingdom*

10:00–10:30 L 10 **A SYNERGISTIC APPROACH TO CHARACTERIZE WHITE CABBAGE CULTIVARS FROM DIFFERENT CULTIVATION METHODS ON SYSTEMIC QUALITY, PHYTOCHEMICAL CONTENT AND BIOLOGICAL ACTIVITY**  
*Anne von Bergh, University of Applied Sciences Utrecht, Utrecht, The Netherlands*

10:30–11:00 **DISCUSSION**

9:00–11:00 **SESSION C: New Methods for Food Quality Determination**  
**609 B**  
*moderator Saskia van Ruth, Wageningen University (WUR), Wageningen, The Netherlands*

9:00–9:30 L 11 **FROM SINGLE CONSTITUTENTS TO METABOLOMICS IN FOOD QUALITY ANALYSIS**  
*Jana Hajšlová, Institute of Chemical Technology (ICT), Prague, Czech Republic*

9:30–10:00 L 12 **APPLICATION OF METABOLITE PROFILING TO DIFFERENTIATE ORGANIC VS CONVENTIONAL WHEAT**  
*Georg Langenkaemper, Max Rubner Institute, Detmold, Germany*

10:00–10:30 L 13 **USE OF MULTIVARIATE STATISTICAL ANALYSES OF THE LIPOSOLUBLE FRACTION OF DIFFERENT WHEAT IN ORDER TO PROVE AUTHENTICITY**  
*Marija Bodroža-Solarov, University of Novi Sad, Novi Sad, Serbia*

10:30–11:00 **DISCUSSION**

9:00–11:00 **SESSION D: Systemic View on Food and Health**  
**BELWEDER B**  
*moderator David Jacobs, Minnesota University, Minneapolis, US*

9:00–9:30 L 14 **FOOD SUPPLEMENTS AND EFFECT ON HUMAN HEALTH**  
*Barbara Pietruszka, Warsaw University of Life Sciences – SGGW, Warsaw, Poland*



9:30–10:00	L 15	<b>HEALTHY PROFILES OF ORGANIC PRODUCT CONSUMERS IN A LARGE SAMPLE OF FRENCH ADULTS: FIRST RESULTS FROM THE NUTRINET-SANTÉ COHORT STUDY</b> <i>Denis Lairon, Aix-Marseille Université, Marseille, France</i>
10:00–10:30	L 16	<b>THE IMPACT OF ORGANIC DIET ON NUTRITION AND ON FOOD PURCHASING COSTS: COMPARATIVE CASE STUDY WITHIN FINNISH MUNICIPAL DAY CARE</b> <i>Eija Muukka, University of Eastern Finland, Kuopio, Finland</i>
10:30–11:00		<b>DISCUSSION</b>
11:00–11:30		<b>Organic Coffee Break</b>
11:30–13:00 609 A+B/ BELWEDER A+B		<b>PARALLEL SESSIONS A, B, C, D</b>
11:30–12:30 609 A		<b>SESSION A: Future of Sustainable Agriculture</b> <i>moderator Ulrich Köpke, Bonn University, Bonn, Germany</i>
11:30–12:00	L 17	<b>PRODUCTION OF CARP STOCKING MATERIAL COMAPTIBLE WITH STANDARDS FOR ORGANIC AQUACULTURE</b> <i>Miroslaw Cieśła, Warsaw University of Life Sciences, Warsaw, Poland</i>
12:00–12:30	L 18	<b>ORGANIC FARMING IN UNITED ARAB EMIRATES: CHALLENGES AND OPPORTUNITIES</b> <i>Safdar Muhammad, College of Food and Agriculture, Al Ain, United Arab Emirates</i>
11:30–13:00 BELWEDER A		<b>SESSION B: Quality of Food from Organic and Related Systems</b> <i>moderator Franz Ulberth, Joint Research Centre – Institute for Reference Materials and Measurements (JRC-IRMM), Geel, Belgium</i>
11:30–12:00	L 19	<b>THE INFLUENCE OF ORGANIC AND CONVENTIONAL FARM MANAGEMENT ON THE NUTRITIVE VALUE OF WHITE CABBAGE (<i>BRASSICA OLERACEA</i> L. VAR. <i>CAPITATA</i>) AND NATURALLY FERMENTED CABBAGE JUICE</b> <i>Ewelina Hallmann, Warsaw University of Life Sciences – SGGW, Warsaw, Poland</i>
12:00–12:30	L 20	<b>ORGANIC SHEEP MILK PRODUCTION AND QUALITY BY USE OF LEGUME GRAINS AS DIETARY SUPPLEMENT</b> <i>Adriana Bonanno, Università degli Studi di Palermo, Palermo, Italy</i>
12:30–13:00	L 21	<b>EFFECT OF REARING SYSTEM ON FATTY ACID COMPOSITION OF MEAT AND FAT IN FATTENING PIGS</b> <i>Anne Dostálová, Institute of Animal Science, Prague, Czech Republic</i>
11:30–13:00 609 B		<b>SESSION C: New Methods for Food Quality Determination</b> <i>moderator Saskia van Ruth, Wageningen University (WUR), Wageningen, The Netherlands</i>
11:30–12:00	L 22	<b>FLUORESCENCE EXCITATION SPECTROSCOPY (FES): A SUITABLE METHOD TO DIFFERENTIATE BETWEEN ORGANIC AND CONVENTIONAL PRODUCTS</b> <i>Peter Stolz, KWALIS Quality Research GmbH, Dippertz, Germany</i>

12:00–12:30 L 23 DROPLET EVAPORATION METHOD AS AN APPROACH TO QUALITY ANALYSIS OF ORGANIC AND BIODYNAMIC WINE SAMPLES FROM A LONG-TERM ITALIAN FIELD TRIAL  
*Maria Kokornaczyk, University of Bologna, Bologna, Italy*

12:30–13:00 L 24 FROM CRYSTALS TO PATTERNS IN FOOD QUALITY DETERMINATION  
*Nicolaas Busscher, Kassel University, Witzenhausen, Germany*

11:30–13:00 BELWEDER B **SESSION D: Systemic View on Food and Health**  
*moderator David Jacobs, Minnesota University, Minneapolis, US*

11:30–12:00 L 25 FATTY ACID COMPOSITION OF BREAST MILK, AND CONSEQUENCES FOR ALLERGIC SENSITIZATION AND STRESS, IN A BIRTH COHORT WITH CA. 50% CONSUMERS OF PREDOMINANTLY ORGANIC FOOD  
*Axel Mie, Karolinska Institutet, Stockholm, Sweden*

12:00–12:30 L 26 WHAT'S IN MY WEE? REDUCING URINARY PESTICIDES USING AN ORGANIC DIET (INTRAPERSONAL VARIATION IN PESTICIDE RESIDUES IN RESPONSE TO AN ORGANIC DIET: A BIOMONITORING TRIAL)  
*Liza Oates, RMIT University, Melbourne, Australia*

12:30–13:00 L 27 RESILIENCE AS A CRITERION OF HEALTH IN AGRICULTURE  
*Thomas Döring, Humboldt University of Berlin, Berlin, Germany*

13:00–14:30 **Organic Lunch**

14:30–15:30 609 A+B/  
BELWEDER  
A+B **PARALLEL SESSIONS A, B, C, D: DISCUSSION**

15:30–16:00 **Organic Coffee Break**

16:00–18:00 SASKI/  
BELWEDER **POSTER SESSION**

19:00–22:00 **CONFERENCE DINNER**

## FRIDAY, June 7, 2013

9:00–11:00 BELWEDER **GENERAL SESSION**  
*chair Susanne Bügel, University of Copenhagen, Copenhagen, Denmark*

9:00–9:40 L 28 TOO SLOW MOTION OF NEW SCIENTIFIC RESULTS DEMANDS MORE EFFORTS TO DEFINE FOOD QUALITIES WITH NOVEL METHODOLOGIES  
*Gerold Rahmann, J.v. Thünen-Institute of Organic Farming, Trenthorst, Germany*

9:40–10:20 **L 29** **ORGANIC FOOD AUTHENTICATION – POTENTIAL AND LIMITATIONS**  
*Saskia van Ruth, Wageningen University (WUR), Wageningen, The Netherlands*

10:20–11:00 **L 30** **ORGANIC FOOD AND HEALTH – CONCEPTS AND PERSPECTIVES**  
*Machteld Huber, Louis Bolk Institute, Driebergen, The Netherlands*

11:00–11:30 **Organic Coffee Break**

11:30–12:50 **REPORT SESSION**  
BELWEDER *chair Gerold Rahmann, J.v. Thünen-Institute of Organic Farming, Trenthorst, Germany*

11:30–11:50 **REPORT SESSION A** *Rapporteur Ewa Rembiałkowska*

11:50–12:10 **REPORT SESSION B** *Rapporteur Susanne Bügel*

12:10–12:30 **REPORT SESSION C** *Rapporteur Johannes Kahl*

12:30–12:50 **REPORT SESSION D** *Rapporteur Machteld Huber*

12:50–13:00 **POSTER AWARD**  
BELWEDER

13:00–13:10 **CLOSING REMARKS**  
BELWEDER *Johannes Kahl, Ewa Rembiałkowska*

13:30 **Organic Lunch**



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# **ORAL SESSIONS**

## **(L1–L30)**



**L 1**  
**PERSPECTIVES OF ORGANIC AGRICULTURE AND**  
**SUSTAINABILITY IN 2050**

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## L 2 NUTRITION AND HEALTH – CHALLENGES AND GAPS IN RESEARCH METHODOLOGY

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Metabolic homeostasis (and thus health) is determined by the adaptability and reversibility of many processes and mechanisms, like insulin mediated glucose regulation, muscle metabolic flexibility, optimal inflammatory balance, triglyceride metabolic regulation, oxidative stress regulation, HPA mediated stress response etc. This concept of flexibility (or adaptation, robustness, elasticity, resilience, stress response) appears to be rather universally present as a basis for optimal performance, health, even survival. Interestingly, diet both plays the 'bad guy' (energy overload) and the 'good guy', providing essential factors for many of these processes.

Daily meals provide energy pulses which are efficiently absorbed by multiple processes and mechanisms, and likely negative side effects (like oxidative and inflammatory stress responses) are ideally quenched by counteracting mechanisms. Other external stressors, ranging from bacterial infections to mental stress, trigger comparable stress responses that adapt molecular physiological mechanisms to regain homeostasis. In general, chronic stressors may go beyond the limits of phenotypic flexibility and thereby induce inflexibility, which in turn promotes disease onset.

Interestingly, diet does act on both sides of the balance. On one hand certain nutrients, by excess or by defect, challenge phenotypic flexibility. On the other hand most nutrients, when consumed appropriately, play key roles in the mechanisms maintaining phenotypic flexibility. Understanding the role of nutrients in optimizing each link (organ, process) in the system of phenotypic flexibility may be the best strategy for (personalized) prevention of obesity-related and other nutritional disorders. A new generation of biomarkers will emerge from the application of this concept in a range of physiologically (and psychologically?) relevant processes. I will discuss the concept, mechanisms, consequences and relation with diet of phenotypic flexibility.



## L 3 FOOD QUALITY, VERSATILITY, NEEDS AND EXPECTATIONS

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Due to a multitude of factors and also owing to regional as well as global developments, food quality has increasingly become a topic of complexity and diversity. Furthermore, outbreaks of food- and feed-borne diseases and related crises, mass production, criminal fraud, nuclear incidents, but also, for example, changing trends in nutrition and consumer food habits, globalisation of food trade have stimulated public interest in food quality and safety issues in general.

According to above described reasons, consumers are getting more and more concerned about food quality although they, on average and compared to earlier times, spend steadily decreasing proportions of their regular budget for purchasing food products and daily nutrition. In terms of information about food, consumers can be regarded as both target and primary driving source, and every kind of information is being fed into a rather inscrutable communication network consisting of public and social media. Today, internationally linked surveillance and alert networks established based on official regulations aim at protecting national markets from contaminated or unhealthy food, and the transfer of messages via modern IT systems, in general, promotes elevated communication, also in terms of various issues of food quality. However, the so-called informed consumer is not always an educated consumer, as he often lacks sound information and specific knowledge. Hence consumer perception on food quality is rather based on relatively illogical issues and on individual gut feeling than on proven facts. Being aware that the area of food quality includes several important sub-categories such as health and nutrition aspects, pleasure, entertainment and also criteria of ethnic relevance, food safety and related risks are considered as the major issues. In this lecture, the diversity of criteria will be illuminated from different perspectives and illustrated according to historical and current trends. Special emphasis will be given on food safety criteria and related constraints and needs.

**Key words:** food quality and safety, developments, consumer perception, needs and gaps

## L 4 HOW DO WE DETERMINE PLANT QUALITY OF ORGANIC CROPS?

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Plants are photoautotrophic organisms being able to synthesize all metabolites and macro-molecules on the basis of light, CO<sub>2</sub>, H<sub>2</sub>O and 14 inorganic elements taken up from the soil. As plants are confined to the environment in which they germinate, this means that the plant ionome, metabolome and proteome are heavily influenced by soil mineralogy, climate and not least agricultural management.

Organic plant products within the European Union are produced according to a specific set of regulations, which e.g. implicate that organic plants are cultivated without pesticides and synthetically produced nitrogen (N) fertilizers. In addition, N fertilizers are often used in lower amounts relative to conventional agriculture. Over more than a decade it has been intensively studied whether these marked agronomical differences lead to systematic differences in the chemical composition of plant tissue and whether this has an impact on selected plant quality attributes. From a theoretical point of view the marked differences in fertilization strategies between organic and conventional agriculture will cause systematic differences in the chemical composition of plants. The differences are expected to be very large when comparing plants representing the extremes of organic and conventional agriculture. Thus, if synthetic fertilizers are used exclusively for conventional plant production and in high amounts relative to organic production based on animal manure, green manures, compost etc., the conventional plants are likely to differ from the organic ones. However, in most cases plants are not produced with such extreme fertilization strategies and differences are often masked by natural variation caused by e.g. geographical locations and growth season and thereby little difference in plant quality is usually observed.

Despite the fact that systematic differences in chemical composition between organic and conventional plants are usually overridden by natural variation it was recently found that the type of N fertilizers is reflected in the isotope ratios of plants and that the isotopic fingerprints are unbiased by geographical locations and growth season. However, the fundamental differences in isotope ratios are supposedly irrelevant regarding plant quality, but have shown to be a strong signature for authentication of organic plants products.

In this lecture we will further explain how the fertilization strategy can affect the underlying biochemical mechanisms controlling the chemical composition of plants and discuss how these are related to organic plant quality. Special attention will be given to N fertilizer forms and quantity, as fertilization generally appears to be the single-most parameter with the strongest impact on metabolism when comparing plants from organic and conventional agricultural systems.

**Key words:** chemical composition, isotopes, metabolites, organic agriculture, plant quality

**Acknowledgement:** *The Ministry for Agriculture, Food and Fisheries and CoreOrganic II are acknowledged for providing funding to the organic research projects "OrgTrace" and "AuthenticFood".*

## L 5 OPPORTUNITIES FOR AGROECOLOGY WITHIN THE CAP AND HORIZON 2020

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Agroecology has three main forms – agricultural practices, interdisciplinary knowledges and citizens' support networks. By linking those three forms, promotional efforts can better gain societal support, obtain state funds, expand agroecological practices and enhance farmers' livelihoods. Through short food-supply chains, supported by citizens, farmers can gain more of the value that they add to products and to the wider environment through agroecological practices. Such improvements have already gone beyond organic-certified agriculture and could be extended further, e.g. by organifying conventional agriculture. There are opportunities to promote agroecology within the Common Agricultural Policy (CAP) and Horizon 2020 – the two main components of the EU budget. Understanding tensions within the EU's policy frameworks can help to identify such opportunities.

As an obstacle to agroecology, both CAP and Horizon 2020 are dominated by an agro-industrial productivist model which degrades the natural resource base. This dominant model benefits mainly input suppliers and food processors, while subordinating farmers and cultivation methods accordingly. EU policy acknowledges the consequent environmental harms, while seeking remedies through resource-efficient techno-fixes which promise to increase both productivity and environmental sustainability. Central to this policy framework is the Life Sciences paradigm, redesigning crops (and trees) for higher-value products which can be more readily extracted, e.g. by more readily decomposing cell walls, processing biomass in biorefineries and recomposing substances into novel products. This paradigm has been reinforced by the Europe 2020 strategy, promoting greater resource efficiency through eco-innovation. Despite the dominant EU policy framework, it can accommodate an alternative paradigm exploring and realising the potential of agroecology. Agroecology combines several types of innovation (social, know-how, organisational and technological). This combination can appeal to EU eco-innovation policy and help build wider support networks. Likewise agroecology offers greater resource efficiency by reducing external inputs and recycling resources.

The CAP has profoundly shaped the European agro-food market and its production-distribution methods. Known as the CAP's first pillar, direct farm payments have been subsidising agro-industrial practices and thus environmental degradation. In preparing the post-2013 CAP, the European Commission proposed measures for 'greening' the criteria in the first pillar. But those criteria were significantly weakened by the European Parliament, thus siding with the agro-industrial farm lobby. For the European Agricultural Fund for Rural Development (EAFRD), known as the second pillar, the Commission proposed that member states must guarantee minimum funds for environmentally sustainable measures and organic conversion; these criteria could incentivise agroecological practices, at least implicitly. The second pillar already has been funding some measures favourable to agroecology – e.g. low-external input methods, organic conversion, high-quality food products, synergies between agricultural and energy production, short food-supply chains, etc. These measures could be expanded in response to farmer-citizen alliances at national or regional level, regardless of the EU-level legislative outcome on the EAFRD. The EU research agenda too has scope for developing agroecological knowledge. Framework Programme 7 has done so implicitly. Examples include research on: waste conversion into energy and biofertiliser; mixed farming methods; nutrient recycling techniques; and peri-urban food networks which can remunerate farmers for agroecological practices. Horizon 2020 includes 'ecological intensification'; this adapts a concept from Technology Platform Organics for enhancing productivity through agroecological methods, without increasing external inputs or conventionalising organic agriculture. This concept resonates with initiatives in some national research programmes; agroecological research will have opportunities at both levels.

**Key words:** agroecology, CAP, EAFRD, Horizon 2020, research

## L 6 RESEARCHING LINKS BETWEEN SUSTAINABLE AND HEALTHY ORGANIC SYSTEMS

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According to the organic principles and ideas of IFOAM agriculture should sustain and enhance the health of soil, plants and animals. Thus, healthy farming systems rely on preventive measures for securing crop and livestock health rather than use of external inputs e.g. for control of pests and diseases. Historically organic agriculture was motivated by an interest in improving soil health by use of compost and other organic matter as a prerequisite for achieving healthy crops, which again should support healthy animals and humans. The health principle is linked to the ecology principle because they both build on agro-ecological methods. The EU regulatory principles for organic agriculture include the importance of working with soil fertility, biodiversity, the environment, animal welfare and careful processing.

Sustainability is an additional criterion, which deals with the question of long term impact on the farming system's reproductive capacity and its use and reproduction of resources and ecosystems services it depends on, thus securing the system's functional integrity. In a broader societal perspective farming systems' sustainability is also considered a question of its wider long term environmental and social impact and of economic relations, thus aspects partly included in the fairness principle. Thus, following the organic principles should – in theory – lead to improved sustainability of organic farming systems.

However, there is a large variation in practice between how closely organic farming systems adhere to the health and ecology principles. There is a need to – one the one hand-developing a language to describe and benchmark the relation between principles and practices in order to make better use of the good examples and – on the other hand – improving the knowledge base for the further development of organic farming systems which are more in line with the health and ecology principles and are also on a sustainable pathway. From a research and innovation perspective this could be linked through focusing on developing more robust or resilient farming systems in both a biological and an economic sense. In other words, farms that through their organisation and adaptability have strong resilience to external pressures and changes in the form of e.g. attack by pests and diseases, climate change and market fluctuations. This resilience can be strengthened by technology and knowledge which enhances the preventative capacity and by improving soil health and improved understanding of its importance for crop and livestock health, including the use of molecular techniques.

Based on these initial definitions of the ideas of healthy systems and sustainability the paper will discuss how these aspects needs to – and can – be included in research programs in organic agriculture.

**Key words:** sustainability, functional integrity, indicators, benchmarking, organic principles

## L 7 BNN MONITORING ON SUSTAINABILITY

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Sustainability is a core value of organic farming and the whole organic sector. Being seen as a matter of course for the sectors protagonists, communication of sustainability performance has long been neglected in the organic sector – differently to the conventional sector. As sustainability is getting more and more important for consumers, it becomes crucial to present ones efforts in sustainable development for the organic sector as well. For these reasons it seemed important to better transport the sustainability performance of the organic sector and of organic companies. To communicate achievements in sustainability successfully, achievements need to be measured consequently and need to be made comparable. This led to the development and introduction of the BNN sustainability monitoring, a system comprising a set of indicators, aiming at analysis, communication and coordination of sustainability performance. Also legal requirements on measuring environmental performance which might come up show the importance of having a tool for its measurement on hand. The monitoring has been successfully implemented on the basis of a three columns model. Sustainability can be measured by a total of 122 questions (criteria) concerning ecological, social and economic issues. The criteria allow for measurement of a status quo and for showing potential for further development. A yearly report will transparently show the participants' achievements in sustainability, make them comparable and easy to communicate on both company and the organic sector level. The sustainability monitoring will also generate data for a more convincing communication also at the point of sale.

First data collection was conducted in the end of 2011 with about 40% of BNN members participating. Before second data collection in the end of 2012/beginning of 2013 some optimization in capturing the achievements in sustainability was carried out. Also linking to further systems was strengthened. Latest developments will be presented.

**Key words:** sustainability monitoring, processors and wholesalers of organic products, analysis, communication, coordination

**Acknowledgement:** *The development of the BNN monitoring on sustainability has been supported by Deutsche Bundesstiftung Umwelt.*

## L 8 INFLUENCE OF PROCESSING ON FOOD QUALITY WITH FOCUS ON ORGANIC FOOD

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Consumers' demand for fresh, natural products is increasing, yet most of the food products on the market nowadays are processed.

Food processing is the set of the practices used by food and beverage industries to transform raw plant and animal materials into products for consumers. The aims of food processing are to ensure microbiological and chemical safety of foods, adequate nutrient content and bioavailability, and acceptability to the consumer with regard to sensory properties and ease of preparation. Traditional techniques, such as heating, chilling, drying, salting, fermentation etc. have been used since centuries. For a long time they have been applied empirically; however, after the principles underlying most of these techniques were known and the knowledge about the mechanisms of food quality deterioration has increased, it became feasible to reduce/control the intensity of some treatments (e.g. heat) and/or modify the approach of their application ('hurdle technology' concept), thus making possible to obtain food products having high level of nutritional and organoleptic quality (fresh-like quality characteristics). The duration of storage of these products is achievable through the selection of raw materials with high microbiological and hygienic characteristics, and the control of the conditions these products undergo along the chain (processing, transport, distribution). The widespread of low temperature storage facilities and the use of packaging has made possible this result; however, the energy cost and environmental impact of this kind of processing represent critical points.

An important contribution has come from the technological development: optimization of the conditions of use of the traditional methods, individuation of technological solutions, and introduction of novel technologies. The public concern about the negative impact of the agro-food system on the environment has boosted the development of environmentally sound and resource efficient production methods and processing techniques. Among the former, organic agriculture is the best example. In the organic sector, the use of substances and processing methods that might be misleading regarding the 'true nature' of the product and negatively affect the 'vital qualities' and the 'organic integrity' of the product should be avoided (EC Reg. 834/2007). In the regulation, however, these terms and other such as 'careful processing' are not defined, as well as the concrete criteria to select the technologies that can be used in organic food processing are missing. Among the latter, novel technologies such as pulsed electric field, high hydrostatic pressure etc. seem promising. However, their industrial exploitation has not yet taken place due to their inherent technological limits, and/or high investment costs as well as cost-intensive maintenance, and/or the need of further research.

**Key words:** food processing, organic food, careful processing, food quality

## L 9 INFLUENCE OF FARMING SYSTEMS ON PLANT FOOD QUALITY

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The growth and development of a plant is strongly influenced by external factors including availability of nutrients, light, water etc., and this results in predictable differences in the composition of the plants and products harvested from them. Some effects are direct, for example the content of sulphur-containing bioactive compounds such as glucosinolates can depend on the availability of sulphur in the soil. More often effects are more subtle, where a range of different factors influence the growth rate, and the growth rate subsequently affects the allocation of plant resources to different functions in the plant. These effects are due to the plant's ability to adapt to changes in the environment, which have developed during billions of years of evolution, where only the fittest individuals succeeded to pass on their genes to the next generation. This means that understanding of the process of evolution often allows a prediction of how plant composition will be affected by external factors, for example when comparing the quality of crops produced in organic and conventional farming systems.

The principle is that the contents of those compounds that are most valuable for plants with a high growth rate will tend to be high in conventionally grown plants (e.g. chlorophylls, carotenoids), while other compounds (e.g. phenolic acids, tannins) are favoured by the lower maximal growth rates common in organic farming.

In relation to nutritional food quality, the composition of fast-growing plants tends to increase digestibility and high growth rates of the consumer, which is an advantage for consumers/farm animals at risk of malnutrition, and a disadvantage if the risk is obesity. So organically produced plants are particularly beneficial for populations where obesity is a major health risk. The even lower growth rates in subsistence farming (without any nutrient management) lead to yet another range of compositions, sometimes with very low digestibility.

However, the composition is also affected by other factors such as genotype and climate, usually more than the farming system, so to detect the effect of the farming system it is necessary to control for the other factors, for example to test the same genotypes grown in the same climate.

In general the effect of farming system will affect plants in the same way across different genotypes and climates. This means that on a larger scale this effect can be measured by comparing data from a range of different studies, as long as the data are comparable and the calculations appropriate for the types of experimental design that are used. To the extent that a farming system increases the content of a desirable compound, such meta-analyses can be used to estimate how much health benefit may be obtained by using this system.

Another way this knowledge can be used is to identify batches where the plant composition does not match the expectations. These batches are prime suspects for fraud, whether deliberate or inadvertent, and frequent use of plant analysis, in particular testing for certain secondary metabolites, could be a useful tool to support fraud prevention measures.

**Key words:** plant secondary metabolites, evolution, human health

## L 10

**A SYNERGISTIC APPROACH TO CHARACTERIZE WHITE CABBAGE CULTIVARS FROM DIFFERENT CULTIVATION METHODS ON SYSTEMIC QUALITY, PHYTOCHEMICAL CONTENT AND BIOLOGICAL ACTIVITY**

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Vegetable components are known to be essential for maintaining our health. In particular, cabbage provides a valuable source of phytochemical compounds, such as phenolic acids, flavonoids and glucosinolates that provide preventative protection against cancer, atherosclerosis, nephritis and diabetes mellitus. Different levels of phytochemical compounds exist among various genotypes of cabbage. However, the impact of cultivation methods on the systemic quality and phytochemical content is not clear.

Two cabbage cultivars from biodynamic, organic and conventional production systems were studied by different approaches. The first approach was based on a systemic quality assessment (e.g. evaluating crystallization patterns of copper chloride crystallized in the presence of cabbage juice). Patterns were evaluated and grouped based on visual morphological criteria, Gestalt representations of plant physiological processes and image analysis. For the second approach, homogenized cabbage segments were extracted with methanol. The phytochemical content of the extracts was analyzed by HPLC. By chemometric analysis classification models were developed for sample spectra at 280 nm and 320 nm (glucosinolates and phenolic acids) to assess the capability of the HPLC approach in predicting the cultivation source of cabbages. The third approach comprised several *in vitro* assays to analyze the biological activity of the cabbage extracts. A p53-luciferase reporter cell line was used to measure reduction in DNA damage induced p53 expression. Antioxidant activity was determined using an erythrocyte-based antioxidant protection assay (CAP-e).

Visual evaluation of the crystallization patterns correctly grouped the cabbages from the same cultivation system. Growth and ripening were reflected moderate to poor in the biodynamic samples, intermediate in organic samples and most abundant in conventional samples. However, both the organic and biodynamic samples reflected a better balance between growth and ripening. HPLC analysis revealed different phytochemical contents between cabbage cultivars. Antioxidant activity was abundant in all cabbage samples, whereas extracts from organic and biodynamic cultivated cabbages appeared to present more antioxidant activity in the CAP-e assay than extracts from conventional cabbages. Moreover, extracts from biodynamic and organic cultivated cabbages seemed to reduce p53 expression better than extracts from the conventional cultivation method.

Overall, this study indicates that the biodynamic and organically cultivated cabbages display specific systemic food quality, phytochemical content and biological activity. A new series of white cabbage samples is currently being analyzed.

**Key words:** white cabbage, copper chloride crystallization, antioxidant, HPLC, phytochemicals



## L 11 FROM SINGLE CONSTITUENTS TO METABOLOMICS IN FOOD QUALITY ANALYSIS

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Until now, a wide range of laboratory approaches has been employed for control of organic food quality and authenticity. In addition to widely used light isotope measurement based methods, various spectroscopic and/or chromatographic have been traditionally used for quantification of nutritionally important and biologically active single constituents typical for particular food crop. Recently, fingerprinting / profiling strategies have become promising tools for a more comprehensive characterisation of metabolome, a set of low molecular weight ( $\leq 1500$  Da) primary and secondary metabolites occurring in food commodities. It is assumed that not only phenotype of particular living organism but also external factors, including way of farming, may influence characteristic metabolome compositions. High resolution mass spectrometry either coupled with ultra performance liquid chromatography (UPLC) and/or gas chromatography (GC) represent challenging analytical options. To avoid discrimination of some matrix components, minimal or no sample preparation is required prior to instrumental measurement. These requirements are met for instance by solid phase micro extraction (SPME) sampling technique coupled to GC/MS: volatile metabolites fingerprint is collected in sample headspace. Similarly, in last decade introduced, ambient mass spectrometry (AMS) offers a very relevant solution in metabolomics studies. It should be noted, that instead of target analysis of individual 'quality markers', metabolomics is based on non-target analysis; identification of all compounds occurring in sample metabolome is not necessarily needed in the first phase, the entire data set consisting of instrumental sample 'signals' is classified by advanced chemometric techniques.

In our most recent research projects, we have implemented a novel approaches based both on SPME-GC/MS and AMS. In the latter case, a unique ionization source Direct Analysis in Real Time (DART) coupled with a high resolution time of flight mass spectrometer (HR-TOFMS) is employed for fast metabolomic fingerprinting / profiling. Several case studies will demonstrate the potential of these novel approaches to examine food origin.

**Key words:** food quality, DART-MS, metabolomic fingerprinting / profiling

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## L 12 APPLICATION OF METABOLITE PROFILING TO DIFFERENTIATE ORGANIC VS CONVENTIONAL WHEAT

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Profiling methods facilitate the analysis of a wide range of substances in biological samples. Data analysis using bioinformatic evaluation tools enables a fast and easy comparison of large data sets. In combination, these techniques are useful in the search for biomarkers, as in plant extracts.

A steadily increasing popularity of organic food, globalization of trade and price-premiums achieved with organic products are incentives for fraud in this market. Against this background, we set out to identify biomarkers capable of distinguishing organic and conventional wheat, employing a metabolite profiling approach. Organic and conventional wheat, up to 11 varieties from three years of harvest of the well-controlled long term DOK-field trial in Switzerland, as well as wheat samples from agricultural practice were chosen for analysis. Metabolite profiles were generated with GC-MS from derivatized methanol extracts of finely ground whole-wheat grains. Using these techniques we were able to identify on an average 50 metabolites and to detect approximately 250 unidentified metabolites (TAGs) per wheat sample. Monitoring of the variety 'Runal' revealed 5 metabolites that had significantly different concentrations in all three analysed harvest years. Across all 11 varieties of the 2007 harvest year, 5 metabolites and 11 TAGs showed significantly different concentrations between the cultivation forms. PCA performed on metabolite data for the individual varieties and for individual growing seasons revealed a clustering according to the cultivation forms. However, PCA of metabolites and TAGs of combined data of all 11 varieties and growing seasons did not result in such a clustering. Preselection of metabolites according to the variable importance estimation of the classification tool support vector machine was able to improve separation of organic and conventional wheat in PCA analyses. With view on differentiating samples from agricultural practice, results are suggesting that it is necessary to generate reference metabolite profiles from every new growing season comprising wheat samples from defined regions.

**Key words:** wheat, organic, metabolite profiling, GC-MS

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## L 13 USE OF MULTIVARIATE STATISTICAL ANALYSES OF THE LIPOSOLUBLE FRACTION OF DIFFERENT WHEAT IN ORDER TO PROVE AUTHENTICITY

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Spelt flour and spelt products are more expensive than those made from conventional wheat partially due to lower yields and an extra dehulling step is required prior to milling and partially owing to expected nutritional and/or health related benefits. Moreover, in majority of cases, spelt material comes from certified organic production which is an additional value-adding aspect. Since it is hard to distinguish between processed spelt and conventional wheat, a topic of spelt adulteration with conventional wheat has received a lot of attention.

Ten organically certified cultivars of *Triticum aestivum* and *Triticum aestivum* ssp. *spelta* were included in the study. The trans-esterification reaction of fatty acids from acilglycerol was done. All the testings were conducted on a gas-chromatography system. The GC-MS analyses were performed on an Agilent Technologies 7890 instrument coupled with MSD 5975 equipment operating in EI mode at 70 eV. A DP-5 MS column was used.

Multivariate statistical techniques (cluster and principal component analysis) were applied to modeling classes of different cultivars of common wheat and spelt grown in the same agricultural plot, on the basis of the GC-MS chromatography analytical data of liposoluble fraction for two peak areas: the first one ranging from 12<sup>th</sup> to 16<sup>th</sup> minute and the second one registered after the 16<sup>th</sup> minute (corresponding to non-saponifiable liposoluble substances). Obtained results revealed that better discrimination of samples could be achieved in the peak area after 16th minute, due to more distinctive positions of points in factor space. The Euclidian distances between points for peak area from 12th to 16th minute are much greater, as shown on dendograms, but in the peak area after 16th minute, these distances seem to be more distinctive. The same result has been obtained by PCA analysis. PCA for peak area after the 16<sup>th</sup> minute yielded two PCs explaining 79.53% of the total variance in the data. Projection of the variables on the factorial plane indicated that all wheat samples contributed mostly to the first PC (which accounts for 56.42% of variability), and thus to the total variability of the basic set. The second PC (which accounts for 25.42% of variability) was contributed mostly by the spelt cultivars.

Comparison of the samples based on the fraction of non-saponifiable lipids using multivariate statistical techniques seems more efficient for the discrimination between the cultivars than that based on the central part of chromatogram with the highest peaks representing fatty acids. Hence, the GC-MS analysis of non-saponifiable lipids showed the ability to differentiate between spelt and wheat and may have great potential as another method for authenticity control in practise.

**Key words:** GC-MS, liposoluble, spelt, common wheat, multivariate statistical analyses

**Acknowledgement:** *This work was supported by the national research project (Grant No: III 46005), financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.*

## L 14 FOOD SUPPLEMENTS AND EFFECT ON HUMAN HEALTH

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Food supplements are defined as foodstuff which purpose is to supplement the normal diet with deficient nutrients. They are relatively new products in comparison to traditional food which contain the balanced amount of constituents (as a consequence of evolution). Dietary supplements are concentrated sources of nutrients and usually one dosage can cover the daily human requirements. Epidemiological studies indicate that dietary supplement use is a very common practice all over the world, and depends on many factors (gender, life style, dietary habits etc.). However, despite the wide use of supplements, the effect of such a practice on human health has not been well defined.

The results of epidemiological studies indicate that the risk of the supplement usage is connected with several factors and among them consumer behavior and quality of such products. Consumers often combine dietary supplements and products fortified with the same nutrients, take more than one supplement at the same time, do not follow the manufacturer's instructions. Such behavior causes the risk of overdose of some nutrients with negative health consequences. Although the form of dietary supplements is like medicine (capsules, pastilles, tablets, pills etc.) the quality control is not as strict as for medicines. Some preparations contain contaminants, the amount of nutrients differ from those declared by producers etc. In spite of no demand to collect the information on side effects for dietary supplements there is some information in this area.

There is an agreement that some population groups can benefit from supplement usage. Among them are strict vegetarians, women of child-bearing age, elderly people. The special positive effects are noticed among people at great risk of malnutrition, especially in developing countries (Africa, Asia). There is a question if the supplement usage give the positive effect on human health in industrialized countries, where the reason for supplement usage is often to minimize the risk of chronic diseases such as cancer, cardiovascular diseases and dementia (Parkinson, Alzheimer diseases) etc.

The results of epidemiological studies are not consistent in opinion, whether the high nutrient doses with supplements taken for a long time are safe. Some studies reported that supplement usage can be beneficial for prevention of some diseases and decreases mortality, while the others indicated adverse effects of some nutrients or other related compounds (e.g.  $\beta$ -carotene) in preventing diseases. More and more attention is paid to the conditions of supplement usage (nutritional and health status of users, dosage, duration of the supplement use, number of constituents, lifestyle etc.) that can modify the health effect. Therefore vitamin and mineral supplementation are still under nutrition debate. What is emphasized by nutritionist is that the main source of nutrients should be a 'normal' diet.

**Key words:** dietary supplements, health

## L 15 HEALTHY PROFILES OF ORGANIC PRODUCT CONSUMERS IN A LARGE SAMPLE OF FRENCH ADULTS: FIRST RESULTS FROM THE NUTRINET-SANTÉ COHORT STUDY

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In the present context of world food insecurity and widespread unhealthy diets, the FAO raised in 2010 a definition of 'sustainable diet' to serve as a guideline for appropriate dietary patterns regarding environment, culture, food and nutrient needs, and health. Indeed, a diet based on organic products may better meet the definition of sustainability. While few hundreds studies have compared the nutrient and pesticide contents of organic foods vs conventional ones, very limited comparative studies have been performed in animals, and even less in humans. From a public health point of view, given the number of consumers of organic food is markedly rising, it is crucial to understand and analyze organic-product-related consumer profiles. Until now, only small-scale studies have described the profiles of organic consumers in few countries and very little information is available regarding their actual food and nutrient intakes or diet-related health indicators. Thus, in line with our previous epidemiological and clinical studies on nutrition and health, we aimed for the first time to describe the organic food consumer profiles in a very large cohort.

**Design and methods:** Consumer attitude and frequency of use of 18 organic (inc. 16 food group) products were assessed thanks to a dedicated questionnaire in 54,311 adult participants in the Nutrinet-Santé cohort ([www.etude-nutrinet-sante](http://www.etude-nutrinet-sante)), a nationwide, web-based survey, dedicated to nutrition and health status in adult volunteers since 2009 in France. Cluster analysis was performed to identify behaviors associated with organic product consumption. Socio-demographic characteristics, food consumption and nutrient intake across clusters were determined. Cross-sectional association with corpulence was estimated using multivariate polytomous logistic regression. Statistical analyses were performed using SAS software.

**Results:** Five clusters were identified: 3 clusters of non-consumers whose reasons differed (no interest, avoidance or too expensive cost), occasional (OCOP) and regular (RCOP) organic product consumers. RCOP were more highly educated and physically active than other clusters. Overall differences in incomes between the clusters of non-consumers and consumers were not striking. RCOP consumers also exhibited dietary patterns that included more plant foods and less sweet and alcoholic beverages, processed meat or milk. Their nutrient intake profiles (fatty acids, most minerals and vitamins, fibers) were healthier and they more closely adhered to dietary guidelines and fitted recommended nutrient intakes. In multivariate models (after accounting for confounders, including level of adherence to nutritional guidelines), compared to those not interested in organic products, RCOP participants showed a markedly lower probability of overweight (excluding obesity) ( $25 \leq \text{BMI} < 30$ ) and obesity ( $\text{BMI} \geq 30$ ): -36% and -62% in men and -42% and -48% in women, respectively ( $P < 0.0001$ ). OCOP participants generally showed intermediate figures for food consumptions, nutrient intakes and overweight/obesity rates.

**Conclusions:** Regular consumers of organic products exhibit specific socio-demographic characteristics, with a better dietary pattern fitting food-based recommendations. They are markedly less overweight and obese. The observed plant-food-based dietary pattern of organic food consumers, in addition to being closer to the recommended healthy dietary pattern, may also better comply with the sustainable diet concept to minimize the environmental impact. Finally, these findings provide important new insights into organic food consumer profiles, which will be useful for further testing the relationship between organic food intake and health in surveys based on a prospective design such as that of the Nutrinet-Santé Study.

## L 16 THE IMPACT OF ORGANIC DIET ON NUTRITION AND ON FOOD PURCHASING COSTS: COMPARATIVE CASE STUDY WITHIN FINNISH MUNICIPAL DAY CARE

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The aim of the research was to clarify the nutritional quality and the price of organic food served within the Finnish municipal public catering. The study deals with the total food intake with pre-school children as the target group. The approach, thus, differs from most of the health impact studies of organic food focussing on single food items. The presentation captures the results from a case study on two day care centres, one offering organic foods and the other relying on conventional foods in the daily meals. The studied compounds were vitamin D and selenium, which are critical because in organic diets there is a potential risk for their deficiency. In addition, the intake of two food additives, benzoic acid and nitrite, that are common in foods consumed by the Finnish children was studied.

The intakes of the micro nutrients and food additives were calculated from the total food intake data during two different six weeks periods. The information regarding food purchasing price was obtained from the municipal accountancy.

No significant difference was found between the two day care centres in the intake of nitrites and benzoic acid, because foods containing these additives are seldom used in both day care centres. The intake of vitamin D was less than recommended in both day care centres, but there was no significant difference between the two. Neither were there significant differences in the selenium intake. Using organic foods increased the food purchasing costs by about 30% and the total costs of the meals inclusive labour and facility costs by about 10%.

Adding vitamin D to organic milk does not guarantee sufficient supply, unless attention is paid also to the quantity of consumed milk and fish. Selenium appears not to present problems in Finnish circumstances, and for children, home meals are more of a risk for overdose of food additives than the meals of public catering. The higher price of organic food may present a serious bottleneck for the municipalities, unless there is unequivocal evidence for the benefits.

**Key words:** public catering, day care centre, organic food, intake of nutrients, price of food

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## L 17

**PRODUCTION OF CARP STOCKING MATERIAL COMPATIBLE WITH STANDARDS FOR ORGANIC AQUACULTURE****M. Cieśla<sup>1\*</sup>, R. Jończyk<sup>1</sup>, J. Śliwiński<sup>1</sup>, D. Gozdowski<sup>2</sup> & K. Kazuń<sup>3</sup>**<sup>1</sup>Department of Ichthyobiology and Fisheries, Warsaw University of Life Sciences – SGGW, Warsaw, Poland<sup>2</sup>Department of Experimental Statistics and Bioinformatics, Warsaw University of Life Sciences – SGGW, Warsaw, Poland<sup>3</sup>Inland Fisheries Institute in Olsztyn, Olsztyn, Poland

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Aquaculture is now the fastest developing sector of world agriculture, with 10% early growth rate since the '90. On the other hand, in case of carp aquaculture in Central and Eastern Europe, the opposite phenomenon is observed. Carp production has been stagnant or even decreasing. Such the process is alarming not only because of economic reasons, but social (increase of unemployment) and environmental as well. As traditional ponds play a very important role in environment enhancement, biodiversity protection (as refuges or habitats for many flora and fauna protected species), and many of carp ponds are implemented into Natura 2000 network.

One of the possible ways for reinforcement of the sector in upcoming future is diversification of the production, e.g. production of certified organic fish. The aim of the paper is to present results of certified organic carp fry production, compatible with EU standards. The studies were carried at the Fisheries Research Station Division of Ichthyobiology and Fisheries at Warsaw University of Life Sciences. Two stocking densities, 2500 ind per ha and 5000 ind per ha. Five feeding protocols were carried out for carp fingerlings cultivation: growing on natural ponds resources only (group I), feeding with ecological wheat (group II), wheat supplemented with effective microorganisms (EM) (group III), wheat supplemented with herbs (IV), wheat supplemented with effective microorganisms and herbs (group V) at. Following parameters were measured: survival rate, mean body mass, Fulton's condition coefficient, hematological parameters (number of erythrocytes, hematocrit, hemoglobin level), immunological parameters (lysozyme and gamma globulins level). Because of technical problems hematological and immunological parameters were not measured in group IV.

The significantly lower production results were obtained in group I. Survival rate was 45.6–55.6%, comparing to 75.0–92.5% in group II, 82.5–85.0% in group III, 95.0–97.5% in group IV, and 82.3–85.0% in group V. The average body mass of carp fry was 86–116 g in group I, while it was 209–323 g, 207–214 g, 216–325 g and 286–315 g in group II, III, IV and V, respectively. As a result, fish from group I were too small and total production in this group, 200 kg/ha, was too low to secure proper level of consumable carp production.

The lowest condition coefficient was obtained in group I (1.18–1.38), while in group II it was 1.56–1.62, in group III – 1.51–1.62, in group IV – 1.52–1.64 and 1.70–2.27 in group V, differences statistically significant.

No differences were found in hematological parameters between groups, but significant differences were recorded in case of immunological parameters. Significantly lower level of lysozyme ( $0.82 \text{ mg}\cdot\text{l}^{-1}$ ) was found in group I. In group II it was  $0.98 \text{ mg}\cdot\text{l}^{-1}$ , in group III –  $0.78 \text{ mg}\cdot\text{l}^{-1}$  and  $1.29 \text{ mg}\cdot\text{l}^{-1}$  in group V. The same phenomenon was observed in case of gamma globulins level, the lowest,  $6.60 \text{ g}\cdot\text{l}^{-1}$ , was observed in group I and was statistically lower than in group II, III and V, where it was  $10.64 \text{ g}\cdot\text{l}^{-1}$ ,  $16.6 \text{ g}\cdot\text{l}^{-1}$  and  $15.33 \text{ g}\cdot\text{l}^{-1}$ , respectively. It could be stated that feeding is indispensable in two-year organic carp fry production to obtain sufficient amount of good quality stocking material. Use of effective microorganism and herbs have positive effect on fish survival, growth and total production and diseases resistance as well.

**Key words:** carp ponds, organic aquaculture, sustainability, EM, herbs

## L 18 ORGANIC FARMING IN UNITED ARAB EMIRATES: CHALLENGES AND OPPORTUNITIES

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The global demand for organic food products is increasing rapidly in recent years. The consumers are willing to pay higher prices (price premium) for certified organic food products. Growing demand, high price premium, uniform standards, and increased production of organic food products indicate an opportunity for the farmers seeking high value alternative enterprises. Organic agriculture offers several opportunities for farmers, processors, traders and other agribusinesses in United Arab Emirates (UAE). The organic market is expected to grow globally and high growth rates are expected. The organic market expansion makes it possible for industry to reap the benefits of a trade with relatively high price premiums. However, this market is not well known to producers and consumers in UAE and information is not readily available. The absence of sufficient technical and market information and financial support also means that fewer producers will risk changing their method of production. In UAE, it is essential for the major players (e.g. government, farmers, traders, exporters etc.) that contribute in promoting organic farming to have up-to-date information on the available opportunities including market requirements and trends of the organic markets. The main goal of this paper is to assess impact, challenges and opportunities and identify strategies to promote certified organic farming in UAE. The availability of authentic certification will increase producers' competitiveness and ways for organic supply chain participants to sustain the trust of consumers. It is vital to promote organic farming by understanding stakeholders and designing programs in key areas of research, education and outreach.

**Key words:** organic farming, healthy food, price premium, organic certification



## L 19

**THE INFLUENCE OF ORGANIC AND CONVENTIONAL FARM MANAGEMENT ON THE NUTRITIVE VALUE OF WHITE CABBAGE (*BRASSICA OLERACEA* L. VAR. *CAPITATA*) AND NATURALLY FERMENTED CABBAGE JUICE****E. Hallmann<sup>1\*</sup>, J. Lipowski<sup>2</sup>, K. Marszałek<sup>2</sup> & E. Rembiałkowska<sup>1</sup>**<sup>1</sup>WULS-SGGW, Faculty of Human Nutrition and Consumer Sciences, Department of Functional and Organic Food and Commodities, Nowoursynowska 159c, 02-776 Warsaw, Poland<sup>2</sup>Department of Fruit and Vegetable Product Technology, Rakowiecka 36, Warsaw, Poland

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White cabbage (*Brassica oleracea* L. var. *capitata*) is one of the most important vegetables grown worldwide. It belongs to the family *Cruciferae*, which includes also red, savoy and Chinese cabbage, broccoli, cauliflower, Brussels sprouts, kale and kohlrabi. These vegetables contain a lot of antioxidative compounds as glucosinolates, polyphenols, carotenoids and vitamin C. Variation in the antioxidant composition of *Brassica* vegetables is caused by many factors: variety, stage of maturity at harvest, growing condition, soil state, and condition of post-harvest storage. A lot of experiments indicated that vegetables from organic production contained more bioactive compounds than from conventional production, however only few studies have been conducted on *Cruciferae* plants. The aim of the study was to prove the influence of farm management (organic and conventional) on the nutritive value of the white raw cabbage and naturally fermented cabbage juice. One cultivar of white cabbage (Sufama) have been used in the experiment, both in the organic and conventional cultivation. The cabbage was cultivated in the certified organic and conventional neighboring private farms located in Mazovia region in 2010 and 2011 years. The cabbage heads were collected in the autumn in the organic and conventional farms. The cabbage leaves were freeze-dried and chemically analyzed. Next the naturally fermented cabbage juice have been prepared and chemically analyzed. The content of dry matter, total and reducing sugars, titratable acidity, vitamin C, polyphenols, carotenoids as well as nitrates and nitrites have been determined in fresh leaves and cabbage juice. The obtained results showed that in 2010 organic raw white cabbage contained more dry matter, reducing sugars, vitamin C, some phenolic acids, zeaxanthin and beta-carotene compared to the conventional one. In 2011 organic raw white cabbage contained more dry matter, sucrose, organic acids, vitamin C, lutein, zeaxanthin and beta-carotene than conventional cabbage. In both experimental years raw cabbage from organic production contained less nitrates and nitrites than from conventional one. The naturally fermented juice from organically produced cabbage had different chemical composition than juice prepared from the conventional cabbage.

**Key words:** cabbage, naturally fermented cabbage juice, antioxidants, organic cultivation, conventional cultivation

## L 20 ORGANIC SHEEP MILK PRODUCTION AND QUALITY BY USE OF LEGUME GRAINS AS DIETARY SUPPLEMENT

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The aim of this study was to evaluate the sheep milk yield and quality as affecting by concentrate dietary supplements prepared on farm by mixing locally produced barley and legume grains, used as alternative to a commercial feed.

A total of twelve milking ewes, averaging 92 ±9 days in milking and 56 ±6 kg of live weight, were housed in individual pens and divided homogeneously into four groups. Each group was fed *ad libitum* with a grass-legume hay and received, according to a 4×4 Latin square design with periods comprised of 21 days, one of the following isonitrogenous concentrates: 500 g chickpea and 300 g barley (CP); 450 g faba bean and 350 g barley (FB); 550 g pea and 250 g barley (PE); commercial feed mixture containing maize and soybean meal (CF).

The ewes intake of concentrates based on legume grains was higher than that of commercial feed (702, 702, 678 vs. 587 g/d SS for CP, FB, PE and CF, respectively;  $P \leq 0.001$ ).

Comparing the different protein sources, the FB and PE increased milk yield in comparison with CP (710, 718 vs. 654 g/d for FB, PE and CP, respectively;  $P \leq 0.001$ ), whereas CF gave intermediate milk level (677 g/d). FB and PE diets improved also the efficiency of dietary protein utilization for milk casein synthesis in comparison with the other diets (96, 99 vs. 89, 88 g casein/kg crude protein intake for FB, PE, CP and CF, respectively;  $P \leq 0.001$ ). Being the same protein intake, these results from FB and PE seem to be attributable to their better amino acid composition, and also to their higher degradability favouring the balance between dietary energy and protein in the rumen for the microbial protein synthesis.

Moreover, the diet induced variations in milk fatty acid (FA) profile, especially regarding some healthy polyunsaturated FA. Indeed, compared with FB and PE concentrates, CP increased, similarly to CF, milk contents in linoleic acid (C18:2 n-6 c9 c12) (2.24, 2.25 vs. 1.54, 1.42% FA for CF, CP, FB and PE, respectively;  $P \leq 0.001$ ), ruminic acid (CLA, C18:2 c9 t11) (0.63 vs. 0.32 vs. 0.25, 0.23% FA for CF, CP, FB and PE, respectively;  $P \leq 0.001$ ) and total unsaturated FA (24.87, 23.80 vs. 17.19, 16.81% FA for CF, CP, FB and PE, respectively;  $P \leq 0.001$ ), and improved the value of health promoting index (0.30, 0.28 vs. 0.17, 0.17 for CF, CP, FB and PE, respectively;  $P \leq 0.001$ ).

These results demonstrated how, in comparison with CF, the concentrates based on the legume grains were well palatable for the milking ewes and their use did not lead to a milk yield reduction or a worsening in milk composition and clotting ability.

**Key words:** chickpea, faba bean, pea, sheep milk, fatty acid composition

## L 21 EFFECT OF REARING SYSTEM ON FATTY ACID COMPOSITION OF MEAT AND FAT IN FATTENING PIGS

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The objective of this study was to estimate the effect of rearing system on the fatty acid composition of *Longissimus dorsi* muscle and subcutaneous fat in two pig genotypes – (Bu×L)×(H×Pn) commercial hybrid (H) and the Czech autochthonous Prestice Black-Pied (PB) breed.

The fatty acid composition of animal products is an important nutritional characteristic because of its influence on human health. A large effort is applied to modify the fatty acid profile with the aim to produce healthier meat according to WHO recommendations, i.e. with increased n-3 PUFA (polyunsaturated fatty acid) levels and decreased n-6:n-3 PUFA ratio.

During two years, three experiments were conducted in two different production systems: conventional indoor system (I) and organic free range with the pasture (O): 1: H (I) × H (O), 2: H (I) × H (O), 3: PB (I) × PB (O). The animals were slaughtered at the same live weight (ca. 110 kg) following the standard slaughtering procedures.

In the organic free range system, different pig genotypes were reared separately on the pasture with tarpaulin sheds. The animals were fed *ad libitum* with a complete mixture composed in accordance with the principles of organic farming. This mixture was characterized by lower protein, which is typical for organic feeding (with the crude protein content: 11% in experiment 1, 14% in experiments 2 and 3). The pigs had *ad libitum* access to water and pasture which was predominantly composed of lucerne and, to a lesser extent, of other plants in experiment 1, and of the mixture of barley, vetch and peas in experiments 2 and 3.

In the conventional system, the pig genotype groups were housed indoor in separate pens with concrete and partly slatted floors. They were fed with complete commercial feed mixtures with optimal nutritional values (the average crude protein content: 16% in experiments 1, 2 and 3).

In each experiment, the outdoor pigs had lower daily weight gains and slightly higher intramuscular fat contents. The fatty acid composition in outdoor pigs was characterized by significantly higher contents of PUFA n-3 and lower PUFA n-6:n-3 ratios in subcutaneous fat and lower contents of PUFA n-6 and lower PUFA n-6:n-3 ratios in muscle, compared with indoor pigs.

The free range pasture system may represent a profitable alternative pig fattening system applied with the aim to improve some nutritional characteristics of pork like intramuscular fat content or the fatty acid composition of muscle and subcutaneous fat. Thus, it gives the opportunity to produce pork with additional value which could satisfy consumers concerned with healthy food products.

**Key words:** pork, fatty acid composition, pasture

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## L 22 FLUORESCENCE EXCITATION SPECTROSCOPY (FES): A SUITABLE METHOD TO DIFFERENTIATE BETWEEN ORGANIC AND CONVENTIONAL PRODUCTS

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The investigation and development of FES was one part of the project 'Advancement and use recommendations of selected methods to differentiate between organic and conventional products', promoted by the federal Ministry of food, agriculture and consumer protection. FES as well as isotope-ratio mass spectrometry and profiling techniques were selected methods to be part of the project.

In contrast to well known NIR methods, the excitation and emission of FES-method use the visible range of the optical spectrum and a delay between excitation and emission (delayed luminescence). The method is based on the biophoton measurement as Ruth and Popp (1976) described.

The examinations concerning this project have been conducted on a device designed by J. Strube. The optical excitation is carried out at constant illumination intensity for a defined time made by a 150 W<sub>el</sub> (24 V) tungsten halogen bulb. Spectral sections are filtered out by standard coloured glass filters. The total light emitted by the sample is subsequently measured after the end of excitation using photomultipliers (EMI 9202 and Perkin Elmer CP1962). The practice of FES has already been described through Strube and Stolz (2010). The measurements have been applied to wheat and eggs.

The results concerning eggs are showing that it is possible to differentiate between organic and conventional egg samples. Relevant parameters were especially the different luminescence after excitation with yellow or white light and the yellow/blue ratio. With the parameters 90% of coded egg samples could be identified correctly.

Wheat with high luminescence values after excitation with yellow light and high percentage ratios yellow/blue could be identified as organically grown. The other wheat samples were differentiated with additional parameters of the emission curves. 80% of wheat coded samples were rated correctly according to organic or conventional cultivation.

In addition, wheat samples from the DOK trial of the Research Institute of Organic Agriculture FiBL, Frick (Switzerland), each with two samples and four field repetition and coded, were examined and identified 100% correctly.

With these results the potential of the FES method to differentiate between organic and conventional foodstuffs is proofed.

**Key words:** yolk luminescence, delayed luminescence, fluorescence excitation spectroscopy, biophotons

## L 23

**DROPLET EVAPORATION METHOD AS AN APPROACH TO QUALITY ANALYSIS OF ORGANIC AND BIODYNAMIC WINE SAMPLES FROM A LONG-TERM ITALIAN FIELD TRIAL****M.O. Kokornaczyk<sup>1\*</sup>, G.P. Parpinello<sup>2</sup>, A. Versari<sup>2</sup>, A.D. Rombolà<sup>1</sup> & L. Betti<sup>1</sup>**<sup>1</sup>Department of Agricultural Sciences, University of Bologna, Viale Fanin 42, 40127 Bologna, Italy<sup>2</sup>Department of Agricultural and Food Sciences, University of Bologna, Piazza Goidanich 60, 47521 Cesena, Italy

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Our previous experimentations have demonstrated that the droplet evaporation method (DEM) is suitable for the wheat quality analysis. The aim of the present study is to test whether DEM might represent an appropriate tool also for quality analysis of wines.

The analyzed wine samples were produced from grapes cv. Sangiovese obtained from organic and biodynamic management during harvest 2010 and 2011 in an experimental vineyard located in Tebano (Ravenna, Italy). The vinification of grapes from each trial was performed following an organic winemaking protocol.

The 8 samples (2 years, 2 managements, 2 field replicates), blinded and letter-coded, were analyzed by DEM in 4 replicates in different days. The experiment consisted in following steps: evaporation of whole-wine droplets placed on microscope slides; photographing of the droplet residues under an optical microscope; detailed description of the forms; measurements of chosen sizing-parameters by means of the software ImageJ. Furthermore, in order to compare the DEM results with chemical characteristics, the wines were analyzed for the following parameters: alcoholic strength, reducing substances, dry matter, and color intensity.

As concerns DEM results, the observed structures were of two different shapes: (i) long needles, and (ii) round, flower-like forms; since similar forms were already noted in our pilot-study conducted on other wine samples, we conclude they are typical for wine. In the present study many needles showed cracks perpendicular to their long axis, but only in the biodynamic samples. Out of the sizing-parameters the circularity and solidity significantly differentiated the both managements, although the year influence was also significant. We found strong correlations between the number and area of the flower-like forms and the alcoholic strength, dry matter, and color intensity. On the other hand, the perimeter and shape characteristics of the needles showed regressive correlations with the same chemical parameters, suggesting that the two kinds of forms depend on the wine chemical contents, but are antagonistic.

In conclusion, our analysis shows that the droplet evaporation method might be useful also for wine quality analysis.

**Key words:** droplet evaporation method, wine quality, patterns, structures

**Acknowledgement:** *The authors thank Demeter Italia and Dr Edda Sanesi for founding this research.*

## L 24 FROM CRYSTALS TO PATTERNS IN FOOD QUALITY DETERMINATION

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Food quality determination can either be performed by single compound analysis, fingerprinting profiles of marker compounds, or by analyzing food systemically. Here we present an approach, which uses a complex system as an indicator for systemic properties of food samples in a aqueous solution. The results are patterns, which can be evaluated by different methods. The concept behind the pattern formation is based on structure formation in physics, chemistry and biology.

Structure formation can be explained by different concepts: entropy export, dissipative structure and with some limitations self-organization.

Entropy export is the phenomenon in a thermodynamical 'open' system, that the entropy, which is created inside the system can be transported by the system to the outside (Benard Cells, earth, plants, animals and humans are 'open' systems with entropy export). A dissipative system is creating an ordered structure while emitting heat (e.g. Crystals, Benard Cells). The precondition for a dissipative structure is an entropy exporting system. In self organization processes e.g. in biology homeostasis and in physics e.g. the behavior of a nano-scale chaotic process which stabilizes on centimeter scale in structures (e.g. Benard cells, dendritic growth) one cannot point to defined factors that steer the system because all is connected, maintaining the form.

With our approach we use an aqueous  $\text{CuCl}_2$ -additive system, which consists of these three concepts. The applied crystallization is not a usual bulk crystallization, but a highly dynamic process called dendritic growth. It starts with a chaotic, self amplifying process, which is limited by the heat- and  $\text{CuCl}_2$  transport, and is building a tree like structure (the pattern). Crystallization is a dissipative process. The overall design is entropy exporting due to the evaporation of the water in the  $\text{CuCl}_2$  solution.

An additive (in this case a complex food sample in the form of a juice or an extract) is changing the branching and growth behavior of the dendritic process. We take this influence as the signal, whereas the dendritic  $\text{CuCl}_2$  crystallization is regarded as the basic process, enabling the signal to come forth.

The system reacts on several treatments on the food such as fertilization, storage, degradation, heating, fractionation and molecular weight. One of the major differences compared to compound analysis is, that the resulting pattern is a structure. This is of a higher complexity than comparing the geometric primitive of the Benard system to the weight of the used compound.

**Key words:** food quality,  $\text{CuCl}_2$  crystallization, self organization, open system

## L 25

**FATTY ACID COMPOSITION OF BREAST MILK, AND CONSEQUENCES FOR ALLERGIC SENSITISATION AND STRESS, IN A BIRTH COHORT WITH CA. 50% CONSUMERS OF PREDOMINANTLY ORGANIC FOOD****A. Mie<sup>1\*</sup>, L. Janssen Duijghuijsen<sup>1,2</sup>, H. Rosenlund<sup>1</sup>, J. Pickova<sup>3</sup> & J. Alm<sup>1</sup>**

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The ALADDIN birth cohort (Assessment of Lifestyle and Allergic Disease During Infancy) with in total approximately 500 participating families is aimed at investigating why children in families with anthroposophic lifestyle have less allergies than children in non-anthroposophic families. A large number of samples and questionnaire data have been collected. The ultimate goal of the ALADDIN birth cohort is the identification risk factors and protective factors for allergic diseases. One aspect of anthroposophic lifestyle is the preference of organic (biodynamic) food.

Within ALADDIN, infants (6 months) in families with anthroposophic lifestyle have fewer allergies and a lower salivary cortisol levels than children in non-anthroposophic families. High salivary cortisol was a risk factor for allergic sensitization independent of lifestyle. The mechanisms behind these findings are still unknown. Breast milk presents a large fraction of the cumulative food intake of 6-months-old infants and is therefore of potential interest for explaining the observed effects.

In this study, we investigate the influence of maternal lifestyle factors on the fatty acid (FA) composition of breast milk, and the impact of breast milk composition on the risk for allergic sensitization and on salivary cortisol levels in children. Among the lifestyle factors under investigation are anthroposophic vs. non-anthroposophic lifestyle, and conventional vs. organic food preference, as well as maternal consumption of milk products, as estimated from questionnaire data and as measured by milk fat specific odd-chain fatty acids in the breast milk.

The content of 37 fatty acids was determined in mature breast milk (2 months) of mothers with anthroposophic (n = 66), partly anthroposophic (n = 98) and non-anthroposophic (n = 80) lifestyle using gas chromatography and flame ionization detection. 122 of these participants prefer organic food and 122 prefer conventional food.

Initial principal component analysis (PCA) revealed a markedly different FA composition between breast milk from mothers with anthroposophic and non-anthroposophic lifestyles, and orthogonal projection to latent structures (OPLS) separates breast milk from these lifestyle groups with  $p = 2.2 \cdot 10^{-8}$ . An analysis of the impact of organic and conventional food preference (adjusted for lifestyle) on FA composition (single FAs, groups of FAs (e.g.  $\omega$ -6/ $\omega$ -3), and total composition) will be presented. Also, an analysis of the potential impact of FA composition on allergic sensitization and cortisol levels will be shown.

**Key words:** breast milk, anthroposophic lifestyle, organic food preference, fatty acid composition, allergic sensitisation

## L 26 WHAT'S IN MY WEE? REDUCING URINARY PESTICIDES USING AN ORGANIC DIET (INTRAPERSONAL VARIATION IN PESTICIDE RESIDUES IN RESPONSE TO AN ORGANIC DIET: A BIOMONITORING TRIAL)

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Organophosphate pesticides are widely used in conventional food production and have been associated with negative effects on human health. Sales of organic food are on the increase with consumers believing that organic food is healthier than conventionally grown food because it contains fewer pesticide residues. While studies have confirmed that organic diets reduce pesticide exposure in children, exposure in adults is likely to be different as children are more highly exposed to dietary pesticides because of their body weight and less efficient metabolism.

We conducted a prospective, crossover study to assess organophosphate exposure in a group of thirteen Australian adults following a seven day period on a largely organic diet compared to seven days on a largely conventional diet. Participants kept food diaries to ensure that a minimum of 80% of their food servings were organic or conventional during each phase. Urinary levels of six dialkylphosphate metabolites were analysed in first-morning voids collected on day 8 of each phase using GC-MS/MS. Limits of detection were 0.11–0.51 µg/L and results were creatinine corrected to account for the effects of urine dilution or concentration in spot samples. As the distributions of the metabolite levels were not normal, the non-parametric Wilcoxon matched pairs signed-ranks test was used for paired samples to determine whether there were significant differences between phases.

The mean total DAP results in the conventional phase were around nine times higher than in the organic phase ( $M = 0.294$  and  $0.032$  respectively,  $p = 0.013$ ). For total dimethyl DAPs there was more than a 23-fold difference ( $M = 0.252$  and  $0.011$  respectively,  $p = 0.005$ ). Although the mean total diethyl DAP levels were around double in the conventional compared to the organic phase ( $M = 0.042$  and  $0.021$  respectively), the difference was not statistically significant. The most frequently detected metabolites were DMTP and DEP in the conventional phase and DEP in the organic phase.

Overall the consumption of organic food resulted in a statistically significant reduction in dimethyl DAPs and thus a reduced exposure to organophosphate pesticides. However, future large scale studies are required to confirm these results and determine their clinical relevance.

**Key words:** organic diets, pesticide exposure, organophosphate insecticides, biomonitoring, urinary metabolites

**Acknowledgement:** *This biomonitoring trial was supported in part by a research restricted donation from Bharat Mitra, co-founder of Organic India Pty Ltd to RMIT University. The organisation had no input into the design of the study, or the interpretation and reporting of the results.*



## L 27 RESILIENCE AS A CRITERION OF HEALTH IN AGRICULTURE

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Nearly seven decades ago, Lady Eve Balfour captured one of the central tenets of organic agriculture in a programmatic sentence: 'The health of soil, plant, animal and man is one and indivisible'. It highlights the connections between wholeness and health, and between soils, plants, animals and humans. However, if this is to be filled with meaning, it needs to be clear what is meant by health. Contrary to the Balfourian spirit of interconnected health, current debates about the meaning and measurement of health are largely disconnected among the various agricultural disciplines. Soil science, plant pathology, veterinary science and human medicine have pursued separate paths in the quest to define and measure health.

Here we show that the concept of resilience can serve as one important criterion of health that is applicable to various subjects, such as soils, plants, animals, humans, and ecosystems. Originally coming from material science, resilience is defined as the power or ability to return to the original form or position after being bent, compressed, or stretched. More directly related to living organisms it is defined as the ability to recover readily from illness, depression, or adversity. However, resilience can also be applied to systems which are not organisms, such as soils and entire ecosystems. Here, resilience means the ability of a system to return to its original state after being disturbed.

It is clear that resilience is itself a term with many facets, but the understanding of it among different disciplines is surprisingly similar – a kind of bounce-back effect – and much clearer than the fuzzy term of health. While health is certainly more than just resilience, the focus on resilience as a key component of health opens up several interesting avenues, e.g. by looking for common causes of resilience such as increased diversity. We can then move on to ask if and how diversity also influences resilience in soils, animals, or humans.

Also, we can evaluate and compare the health of agricultural systems with a measureable concept. Finally, focusing on resilience as a universal criterion of health, we have a method at hand to return to Eve Balfour's idea and test whether the health of soil, plant, animal and man are indeed linked up through their individual resilience properties.

**Key words:** connectedness, health, principle, resilience

**Acknowledgement:** *Support of this project by the Ekhaga foundation is gratefully acknowledged.*

## L 28 TOO SLOW MOTION OF NEW SCIENTIFIC RESULTS DEMANDS MORE EFFORTS TO DEFINE FOOD QUALITIES WITH NOVEL METHODOLOGIES

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In the last decade several projects (e.g. QLIF) have shown interest in a comparison of organic and conventional food quality assessments and meta analyses. These studies came to the conclusions that there are advantages or no advantages in consuming organic products. Both studies suffer in the assessment of only English papers and ignore novel methodologies in food quality analysis. Therefore both studies are biases and did not help to answer the question of the 'real' food qualities to have healthy diets for humans. FQH has tried to fill these gaps to discuss food qualities with novel methodologies.

The main concern of consumers are the absence of chemical products like pesticides. There is no doubt that the risk of pesticide contamination is less (but not always zero) in organic than in conventional products which, for example, has been shown for 10 years in studies by the public food monitoring agency in Baden Württemberg. On the other hand, organic standards can be a risk for food quality, e.g. dioxins and heavy metals in eggs from free range chicken, meat (e.g. liver from grazing cattle and sheep) or germs in organic fertilized vegetable (e.g. EHEC contamination in organic sprouts in Germany 2011 with 50 deaths). Zoonoses and antibiotic resistant germs can occur in organic animal products. The level seems to be less in organic products due to low antibiotic treatments of poultry, pigs and dairy cattle.

The positive ingredients are difficult to access. Expensive analytical technology and sophisticated methodologies hinder the broad discussion between scientists and stakeholders. Are nutrients and secondary plant ingredients are significantly good for food quality if they are more or less in food products? Omega 3 is proven as positive and does occur more in roughage based diets of ruminants (plus 20 to 50%) compared to concentrate feeding regimes but fish and flax seed oil has much more omega 3 than dairy products. Stress related ingredients like antioxidants are positive but not clear if they are significant always more in organic products. Phenols and flavonoids are usually more in organic products but the trend decrease with improved 'conventional' organic systems (e.g. apple juice from orchards have less phenols compared to apples from old varieties, not treated with copper on extensive orchard meadows).

Novel methodologies are crucial for the scientific support of such a food quality development. It has until now not been proven doubtless that organic foods are healthier, or rather that they can be differentiated from conventional products. The main reason are lack of studies and – mainly – lack of clear and proven samples of organic and conventional products. Major food quality research centres are rare in the area of organic food quality research. They have good technologies and methodologies beside good funds (public and private) to development standards without the scope of organic (e.g. profiling techniques). On the other hand the organic food quality centres are developing novel methodologies (e.g. picture making methods) without the discussion with conventional food researchers. The gap of knowledge between organic and conventional is broadening.

There are big differences in production pattern and production qualities between organic and conventional but even more between organic farms and regions. There can be a big overlapping of results between organic and conventional. Average figures are not suitable for assessments and development. The high standard deviations are excellent for system development in organic and conventional.

**Key words:** food quality, healthiness, quality parameters, knowledge transfer, organic, conventional

## L 29 ORGANIC FOOD AUTHENTICATION – POTENTIAL AND LIMITATIONS

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In the last decade public interest in the production of foods increased. This aspect was added to the sensory properties of foods, nutritional value and safety which have been on the agenda for a long time. This in turn boosted organic production. Due to higher production costs, organic produce tends to retail at a higher price than their conventional counterparts. As a consequence of the premium price, organic produce is susceptible to fraud. Fair competition between producers and sustained consumer confidence favour organic production. Analytical verification based on intrinsic markers would complement and underpin the certification process. However, this requires more than a simple analytical test.

Traditional analytical strategies for guaranteeing quality and uncovering adulteration have relied on the determination of the amount of a marker compound or compounds in a material and a subsequent comparison of the value(s) obtained with those established for equivalent material. Authentication of organic produce is complex, and depends very much on the product examined. Therefore, although individual isotopes may provide some information, generally it is unlikely that a single marker allows discrimination between organic and conventional produce. More and more fingerprinting approaches have been developed, which take into account a range of intrinsic (naturally present) components in combination with advanced chemometrics. In the presentation an overview of targeted single marker approaches will be provided, e.g. based on isotope ratio analysis, in addition to information on fingerprint techniques. The various techniques will be illustrated with example studies and are discussed in view of their potential and limitations.

**Key words:** authentication, food, fraud, organic, production system

**L 30**  
**ORGANIC FOOD AND HEALTH – CONCEPTS AND PERSPECTIVES****M. Huber**

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When asking the public if organic food is healthier, the regular consumers will say they think it is, whereas non-consumers will answer that again and again science found organic not to be healthier. The contribution will be evaluate several recent views and publications, presentations that were made during the Conference, and give an integrated perspective towards the future.

**Key words:** organic food, health, food quality, sustainability

# **POSTER SESSIONS**



**SESSION A:  
Future of  
Sustainable  
Agriculture  
(A 1–A 5)**





## A 1 COMPARATIVE EVALUATION OF WEED SPECIES COMPOSITION IN ORGANIC AND CONVENTIONAL CROPPING SYSTEMS

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The composition and abundance of weed species in a crop field depends on many factors which include weed infestation, history of previous crops, cropping systems, cultural practices and climate. The weed species composition of some plantation crops under different land use in south-west ecological zone of Nigeria was assessed for identification as well as evaluated for their abundance in the Federal University of Agriculture Abeokuta, in late 2010 to early 2011 cropping seasons. The three locations used were organic farm, pawpaw/maize intercrop and yam farms which were under conventional farming. In both seasons, weed samples were collected from 0.5×0.5 m quadrats and were sorted into weed types, identified, counted and recorded. Results showed that the three locations were infested majorly with broadleaf weeds compared with grasses and sedges. Organic farm had the highest flora diversity in the late cropping season with 20 species while pawpaw plantation showed low species diversity but higher relative density. Rare weed species such as *Aspilia latifolia*, *Asystasia gangetica*, *Calopogonium mucunoides*, *Hyparrhenia involucreta*, *Oldenladia corymbosa*, *Passiflora foetida*, and *Sorghum arundinaceum* were found only in the organic farm while *Commelina benghalensis* and *Cyperus esculentus* occurred in all the farms in both seasons except yam farm in the rainy season. *Leptochloa caeruleascens* occurred only in the late cropping season in the three locations while *Tridax procumbens* was the most dominant weed in organic farm in both seasons and *Cyperus esculentus* followed the same trend in pawpaw plantation. Whereas *Spigelia anthelmia* dominated the yam farm in the late cropping season, *Tridax procumbens* followed the same trend in the early cropping season. Our results show the comparative advantage of biodiversity in organic farming, however, the problem of weed interference associated with organic farming needs appropriate management strategy.

**Key words:** relative frequency, relative density, *Tridax procumbens*, *Cyperus esculentus*, pawpaw, yam

## A 2 PRODUCTION OF ROSELLE *HIBISCUS SABDARIFFA* L. USING GREEN MANURE AND AFRICAN BUSH TEA *HYPTIS SAUVEOLENS* (POIT): A TECHNIQUE FOR LOW TECHNOLOGY FARMERS

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Most food crops are produced by low technology farmers that are handicapped to improve soil fertility and protect their crops because of lack of means to invest in chemicals, though where feasible chemicals are employed. On account of their production systems, vegetables sold in markets originate mostly from such farms and thus their production techniques are important to both healthy living and the preservation of our environment. Often chemical used to protect crops are sprayed without regards to when such crops are harvested for sale or eaten. Roselle, one of such crops, is used both as a vegetable and for the production of sorrel drinks and in industries for the coloration of foods. Its production package is therefore important, as it can affect such products as well as impart the health of consumers. Through clipping/thinning management of legumes, between seven and fifteen tons per ha of green fodder can be added to the soil at 6–7 weeks after sowing, which translates to about 140 kg N per ha of total nitrogen, or about six bags of urea fertilizer, added to the soil in four seasons. In 2012 fodder cowpea planted on May 25, was incorporated into the soil in mid-July and a roselle/soyabean mixture was planted on August 9, in both replacement and additive mixtures. The roselle crop was sprayed from mid-September using the African bush tea and harvested in January 2013. Yields were low (due to late planting), though the replacement mixtures were higher in both calyx (more than 500 kg per ha) and seed (more than 50 kg per ha) yields than the additive mixtures. The advantage of such production techniques is that they are friendly to the environment, are within the reach of the average farmers and could enhance or promote healthy living. Organic manures improve carbon sequestration and encourage balanced release of nutrients to plants as well as soil moisture retention, is less damaging to the environment and is within the farmer's control. *H. sauveolens* (Poit) on its own contains anthraquinones, glycosides, phytosterols, cardiac glycosides, tannins, flavonoids, and saponins; as well as appreciable amounts of basic food nutrients, proteins, fats, carbohydrates and fibres; it can also control both gram positive and gram negative bacteria. Thus unlike chemical pesticides, its presence in foods and vegetables could actually enhance the quality of such products.

**Key words:** green manure, African bush tea, pest/diseases control, healthy environment and foods

### A 3

## AFRICAN BUSH TEA *HYPTIS SAUVEOLENS* (POIT) – PANACEA FOR IMPROVED AND SUSTAINABLE CROP PRODUCTION IN LOW TECHNOLOGY FARMING

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Major constraints to improved and sustained crop production among low technology farmers include soil fertility improvement, pest and diseases, as well as weed control. Farmers resort to the use of chemicals to overcome these bottlenecks with the attendant consequences on our environment and health; where chemicals are not used, the drudgery to produce crops has discouraged youths from farming. While soil fertility can be improved upon through the use of organic manures, green manure and crop rotation practices, the management of pests and diseases as well as weed control still remain serious problems for the farmer. The African bush tea *Hyptis suaveolens* (Poit); a common weed found growing wildly in the tropics and used by the natives both for repelling mosquitoes and the treatment of various ailments has been used successfully in the production of crops as well as in their storage. Leaves of the plant have shown allelopathic properties at high concentrations, while lower concentrations seemed to encourage weed growth, all with negligible effects on the test crop. The plant can thus be used both for weed control at the beginning of the season, for the control of pests and diseases of crops during growth, as well as in the storage of harvested produce, all with perhaps no serious environmental effects. Phytochemical screening of the aqueous extract shows that leaves of the plant contain carbohydrates, anthraquinones, glycosides, phytosterols, cardiac glycosides, tannins, flavonoids, and saponins. Also, antimicrobial screening revealed zones of inhibition indicating activity of the extract against screened micro-organisms viz, *Pseudomonas aeruginosa* and *Staphylococcus aureus* (gram positive and gram negative bacteria). Medicinal plants contain appreciable amounts of basic food nutrients, proteins, fats, carbohydrates and fibres; the leaves also have moisture contents that qualify them to be vegetables. Thus they can provide dietary supplements while some may promote bowel regularity and enhance frequent waste elimination like bile acid. Unlike chemicals therefore that require protective clothing and other precautionary measures because they are harmful to humans, leaves and leaves extract of this plant has the potential to control weeds, serve for pests and diseases control in crops as well as in storage and perhaps the treatment of some ailments affecting humans, thus promoting health. This will cut the cost of production as well as improve the health both of the soil and farming population as well sustain crop production among low technology farmers.

**Key words:** allelopathy, phytochemical/antimicrobial screening, aqueous extract

## A 4 ENVIRONMENT FRIENDLY METHODS OF CROP PROTECTION

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In the last decade the safety requirements for chemical plant protection products significantly increased. However, the fact that their effect on the organisms which are controlled may be, and frequently is, accompanied by the effect on organisms which are not the object of control is still a matter of concern. Reduction of dependency on chemical protection is one of European Union policy objectives.

We shall therefore not forget numerous methods of crop protection which do not involve chemical control. Many of them are very effective, and some of them cheap. Environment friendly methods of crop protection can be divided into prevention methods and intervention methods.

There are numerous prevention methods of pest control, many of them well-established in traditional agriculture. They include among others crop rotation, selection of resistant varieties, creation of proper conditions for beneficial organisms development and a number of agrotechnical treatments. A very popular in Poland prevention method of disease control in cereals, both cheap and efficient is cultivation of crop mixtures (mixture of species can be used as well as mixture of varieties). The huge scale of application should be stressed: In Poland this method is used on the area of over 1.2 million hectares, only in cereals produced for grain. On a smaller scale it is used also in cereals produced for green forage and other crops, like intra-species cereal-leguminous mixtures.

Environment friendly intervention methods are more scarce and usually more expensive but they also do exist. We can mention among others mechanical weeding, but also plant protection products containing microorganisms and active substances of natural origin. Good intervention effect in some cases can be obtained by introduction of beneficial organisms. In Poland this method is used mainly in glasshouses. Biological methods are not cheap, but used in proper way are efficient and long-lasting.

Sustainable agriculture must include numerous plant protection methods, because they complement each other. In authors' opinion, however, plant breeding is the area with the most valuable potential. Availability of resistant varieties with the desirable quality characteristics is crucial for environment-friendly agriculture.

**Key words:** crop protection, prevention, intervention, environment friendly

## A 5 VARIABILITY OF SOUTHERN SWEET-GRASS IN RESPECT OF DEVELOPMENTAL TRAITS AND COUMARIN COMPOUNDS ACCUMULATION

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Southern sweet-grass *Hierochloë australis* (Schrad.) Roem. et Schult. is a tuft grass growing wild in coniferous and mixed forest in Europe, mostly in Finland, Belarus and Poland. In Poland leaves of this plant are collected exclusively from natural sites as a coumarin raw material used for extracts production, utilized in food industry for aromatization of alcoholic beverages. The species is seriously endangered because of excessive and uncontrolled harvesting in natural sites. Introduction into cultivation of southern sweet-grass seems to be the most effective way to protect this plant in the wild. Taking into consideration relatively high natural resistance of this plant to biotic and abiotic stress factors such as diseases, pests or drought, cultivation of southern sweet-grass in organic farms seems to be promising.

The aim of work was to compare 12 populations of southern sweet-grass in the first year of plant vegetation. The seeds used to establish the field experiment were collected from natural sites from Podlasie district, in eastern Poland. The seedlings were produced in greenhouse and planted out at the experimental, organic field of Department of Vegetable and Medicinal Plants WULS-SGGW at the beginning of September (the experiments were carried out in 2010 and 2011). The observation of morphological traits and harvesting of raw materials were done two times during vegetation period, first time at the beginning of July and the second one after two month, at the beginning of September (regrowth – second cut).

The populations differed significantly in morphological traits i.e. the number of leaves per plant (from 14.3 to 65.8 in the first time of cutting and from 40.0 to 161.8 in the second one), their length (from 23.39 to 34.86 cm in the first time of cutting and from 21.27 to 35.20 cm in the second one), width (from 0.71 to 1.19 cm in the first time of cutting and from 0.61 to 0.92 cm in the second one) and air dry mass per plant (from 0.75 to 3.48 g in the first time of cutting and from 3.67 to 17.89 g in the second one).

The populations differed also distinctly in the content of coumarin compounds which are the most important quality discriminant of this raw material. The content of these compounds in investigated populations in first cut ranged from 0.19 to 1.62% and in second cut – from 0.60 to 2.66%.

The obtained results indicate the possibility to get relatively high yield and good quality raw material of selected southern sweet-grass populations in organic cultivation.

**Key words:** southern sweet-grass, organic cultivation, yield and quality of raw material, coumarin accumulation

**Acknowledgement:** This work was supported by Polish Ministry of Science and Higher Education.



**SESSION B:  
Quality of Food  
from Organic and  
Related Systems  
(B 1–B 22)**





## B 1 IMPACT OF HULLS AS BARRIERS AGAINST *ALTERNARIA* MYCOTOXINS CONTAMINATION OF SPELT WHEAT

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Nowadays, there is a focus on having food security which implicates health-promoting lifestyle and consumption of organic products. The occurrence of *Alternaria* mycotoxins in cereal-based foods and feeds is a global issue of high concern, due to their potential health risks for humans and animals. Spelt wheat (*Triticum spelta* L.), is a high quality grain which has been proved to be tolerant to biotic and abiotic stresses. Moreover, it is a hulled grain suitable for growing in less favourable conditions or in low-input and organic farming systems. The aim of our study was to assess if hulls of spelt wheat act as barriers protecting kernels from *Alternaria* toxins. Artificial inoculation of spelt wheat was performed in a full flowering stage with *A. alternata* and *A. tenuissima*. The content of alternariol (AOH) and alternariol monomethyl ether (AME) was determined in hulls and dehulled kernels separately by HPLC-DAD. Results showed that four times higher levels of *Alternaria* toxins were found in hulls compared to dehulled kernels. AOH was detected at levels in the range of 227–331  $\mu\text{g}\cdot\text{kg}^{-1}$  in dehulled kernels and 433–1647  $\mu\text{g}\cdot\text{kg}^{-1}$  in hulls. The level of AME was in the range of 227 to 398  $\mu\text{g}\cdot\text{kg}^{-1}$  in dehulled kernels and from 1844 to 2183  $\mu\text{g}\cdot\text{kg}^{-1}$  in hulls. These findings demonstrate significantly higher concentrations of both *Alternaria* toxins in hulls in comparison to dehulled kernels, which indicate that hulls might act as protective barriers against mycotoxin contamination of spelt wheat kernels. Since the knowledge of the differences between organic and conventional produce is extremely limited with respect to occurrence of mycotoxins, there is a need for additional study in this area of research.

**Key words:** *Alternaria* mycotoxins, spelt, hulls, HPLC

**Acknowledgement:** This work was supported by the research project 'New products based on cereals and pseudo cereals from organic production', financed by the Ministry of Education and Science of the Republic of Serbia.

## B 2 INFLUENCE OF FARMING SYSTEM AND ENVIRONMENTAL CONDITION ON POTATO TUBERS CHEMICAL COMPOSITION

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**Introduction:** Potato is still one of the most important crop in Poland although in the last years the area of this plant continuously decreases. Most of potato production comes from conventional system. There is still shortage of potatoes growing in organic and integrated systems and demands of people for this kind of potatoes getting increase. Potato is difficult crop specially for organic system because of high menace of agrofages. Most experiments connected with potato organic aim to assess its quality with conventional one. The aim of this study was comparison of chemical components a few potato cultivars growing under two environmentally friendly farming systems i.e. organic and integrated but in different soil-climatic conditions.

**Materials and methods:** Material for the study came from field experiments conducted in the years 2008–2010 at two experimental stations: south-eastern Poland on the heavier soil and central Poland on lighter soil. Eight potato table cultivars from very early to late were tested. Directly after harvest following chemical components content were assessed: dry matter, starch, vitamin C, nitrates and glycoalkaloids.

**Results:** The chemical composition of tubers depended on most tested factors. Crop production system significantly influenced on dry matter, starch and vitamin C content. In organic system quantity of these components was higher. Place of grown (soil conditions) effected dry matter, starch, vitamin C and nitrates content. Higher value of dry matter, starch and nitrates was noticed for lighter soil contrary to vitamin C. The years of investigation as well as cultivars features had the highest influence. They effected all components. Most of dry matter and starch were recorded in 2008, and the least in 2010. The year 2010, however, favored the accumulation of vitamin C and nitrates. The highest content of glycoalkaloids were recorded in 2009. Cultivar differences were mostly related to their earliness, especially in relation to nitrate. The earlier variety the higher content of nitrates. In conclusion it should be noted that both systems provide the desired chemical composition of potatoes and greater impact have environmental and genotypic conditions.

**Key words:** potato, organic system, integrated system, chemical composition, environmental condition

### B 3

## FREE PHENOLS AND FREE FLAVONOID CONTENT IN INTEGRATED AND ORGANICALLY GROWN WINTER WHEAT

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Background: Biological active components and antioxidants in whole grains have not received as much attention as the phytochemicals in fruits and vegetables although the increased consumption of whole grain products has been associated with reduced risk of developing chronic diseases such as cardiovascular disease, type 2 diabetes, some cancers and all-cause mortality. These bioactive components include among others: carotenoids, tocopherols, tocotrienols, phenolic acids, phytic acid, phytosterols and flavonoids. The content of biologically active components are influenced by various environmental factors and management practices.

Objectives: Our aim was to investigate the effect of organic (OS) and integrated (IS) farming systems on the concentrations of the free phenols (FP) and free flavonoids (FF) in winter wheat (*Triticum aestivum* L.), white flour, whole grain flour and bran.

Methods: Field experiments were conducted at the Research Experimental Station Dolná Malanta, Western Slovakia. Grains of winter wheat grown in OS and IS were milled to obtain white flour, whole grain flour and bran. After sample extraction in 80% methanol, FP were determined using by Folin-Ciocalteu's method measured at 765 nm, expressed as micrograms of Gallic acid equivalent per gram of sample. FF content was evaluated by using the aluminum chloride colorimetric method, measured at 415 nm, expressed as micrograms of Rutin equivalent per gram of sample.

Results: The FP and FF content of whole grain flour was 51% higher than in the white flour. White flour contain 97.04  $\mu\text{g}\cdot\text{g}^{-1}$  of FP and 240.53  $\mu\text{g}\cdot\text{g}^{-1}$  of FF while whole grain flour contain 185.57  $\mu\text{g}\cdot\text{g}^{-1}$  of FP and 490.81  $\mu\text{g}\cdot\text{g}^{-1}$  of FF. Bran contain the highest concentrations of FP (493.93  $\mu\text{g}\cdot\text{g}^{-1}$ ) and FF (661.00  $\mu\text{g}\cdot\text{g}^{-1}$ ). Whole grain flour in the OS (210.64  $\mu\text{g}\cdot\text{g}^{-1}$ ) contain almost 18% more of FP than whole grain flour in the IS (173.03  $\mu\text{g}\cdot\text{g}^{-1}$ ). Similar result was in case of bran which contain 13% more of FP in OS (541.51  $\mu\text{g}\cdot\text{g}^{-1}$ ). Farming system had no effect on concentration of FP in white flour and FF in white flour, whole grain flour and bran. Wheat grown after spring barley (*Hordeum vulgare* L.) contained the lowest concentrations of FP and FF than after *Fabaceae* forecrop, in ES or IS.

Conclusions: In presented work, the content of free phenols and free flavonoids was double in whole grain flour compared to white flour. The highest concentrations contain the bran. Organic farming system lead to higher content of the free phenols only in whole grain flour and bran. Farming system had no effect on concentration of free flavonoids. Spring barley was worse forecrop for concentration of these substances than *Fabaceae* forecrop.

**Key words:** free phenols, free flavonoids, winter wheat, organic system

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## B 4

**EFFECT OF SOIL NUTRITION ON THE ORGANOLEPTIC QUALITY OF ORGANICALLY GROWN APPLES (cv. GOLDEN DELICIOUS)**

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In organic apple production only organic fertilizers can be used to supply the soil with nitrogen. In organic fertilizers the mineralization process, needed to provide the plants with the required amount of available nitrogen, tends to be slower than in the synthetic counterparts. This in turn may adversely affect flavour formation in the fruit, even though little is known about the effect of nitrogen soil nutrition on biogenesis of sensory related compounds. Different organic fertilizers are presently used for organic apples production in the Region of Trentino Alto Adige, which is particularly well-suited to the growing of high-quality fruit and currently provides more than 60% of organic apple production in Italy.

The aim of the present study was to assess the influence of the use of different commercial organic fertilizers on the organoleptic quality of cv. Golden Delicious apples and to compare it with the use of a common synthetic fertilizer.

Fruits grown in experimental fields by using three distinct organic fertilizers were considered: Azocor 105 (both animal and vegetable origin), Agrobiosol (fungal biomass) and compost + biogas slurry. In addition fruits from a plot without the use of fertilizer ('control') and a plot where a mineral fertilizer ('ammonium sulphate') was used, were examined for comparison. The rate of N application was normalized for all fertilizers. In addition, only for Azocor 105, two different N rates were tested.

On all fruit samples volatile aroma compounds were determined by a SBSE-GC-MS method, whereas organic acids and sugars were quantified by HPLC methods. A sensory profile, including 14 descriptors, was evaluated by a panel of 10 assessors, all with high expertise in fresh fruit sensory analysis.

The effects of fertilization on the sensory and chemical profiles were evaluated by multivariate analysis techniques. The relationships between sensory attributes and chemical profiles were also investigated.

Small differences were observed in the volatile compounds concentration of apple fruits in relation to the fertilizer used and N application rate. Moreover, these differences were often overshadowed by differences observed between apples from different field replicates within the same fertilization treatment.

Notwithstanding, PCA gave some important indications. The apples from the organic plot with the highest rate of N application and those from the plot with mineral fertilization showed higher concentration of apple key odorants, hexyl acetate and butyl acetate. The level of these compounds was low in the apples from not fertilized trees, although they showed a high concentration of 2-methyl-butyl acetate, another main aroma compound of apple.

No significant correlation was found between sensory odor and flavor attributes and volatile compounds.

**Key words:** fertilization, apple, organic, organoleptic quality

**Acknowledgment:** *This study was carried out within the project 'BIOQUALIA' funded by the Italian Ministry of Agriculture, Food and Forestry Policy.*

## B 5 EFFECT OF CODLING MOTH (*CYDIA POMONELLA* L.) EXCLUSION NETS ON THE ORGANOLEPTIC QUALITY OF APPLES (cv. BRAEBURN)

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Control of the codling moth, *Cydia pomonella* (L.) (Lepidoptera, Tortricidae), the major pest in apple fruit orchards, relies largely on insecticide application. In organic farming the use of these insecticides is forbidden, thus raising the need for alternative control strategies. Different products and technical tools for the control of codling moth in organic farming are available (mating disruption, granulosis virus (CpGV), Spinosad, entomopathogenic nematodes). However, their efficacy is not always satisfactory, especially when codling moth numbers are high or the treated area is small; in the case of Spinosad use a limited number of treatments is recommended in order to avoid resistance development.

An interesting approach for the codling moth control that could be adopted in organic farming is the enclosing of single rows of apple trees in hail net. The results of trials conducted using this method indicated a highly significant reduction of codling moth fruit damage, also under conditions of high pest pressure. However, little is known about the effect of netting on the quality of apple fruit.

The aim of this study was to evaluate the effect of codling moth exclusion nets on the organoleptic quality of apple fruits (cv. Braeburn).

The trials were conducted in 2011 and 2012 in an experimental apple cv. Braeburn orchard. Two different netting structures were tested. The first structure consisted in enclosing single rows in black net: trees along one single row were covered with net from top to ground, and the net was then closed by pegging it to the ground. The second structure consisted in entirely enclosing a plot in black net. Not netted trees acted as control.

On the apple fruit samples organic acids and sugars were quantified by HPLC methods, total phenol content was determined by Folin-Ciocalteu method, volatile aroma compounds were determined by a SBSE-GC-MS method. A sensory profile, including 18 descriptors, was evaluated by a panel of 10 assessors.

The effects of netting and harvest year factors and their interactions on sensory and chemical profiles were evaluated by multivariate analysis techniques. Relationships between sensory attributes and chemical compounds were also investigated.

A significant effect of the harvest year factor on chemical and sensory parameters was observed. However, in both the years the total phenol content measured on the fruit with the skin was higher in the apples from the control than in the fruits from the plot entirely enclosed in the net and, in decreasing order, in those from the plot in which the single rows were covered with the black net. This result was probably due to the incident solar radiation that was lower under the net and further reduced when the single rows were covered. No relationship was observed between the total phenol content and related sensory attributes such as bitterness and astringency.

**Key words:** apple, codling moth, net, organoleptic quality

**Acknowledgment:** This study was carried out within the project 'BIOQUALIA' funded by the Italian Ministry of Agriculture, Food and Forestry Policy.

## B 6 ACQUISITION OF HIGH VALUE DEER FARMING PRODUCTS IN ORGANIC FARMING SYSTEM

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In deer farms, haylage is one of the main feed ration ingredients. Apple pulp as an agri-industry by-product could replace a certain amount of haylage in deer diet. In comparison with haylage, apple pulp contains less dry matter, crude protein, crude fiber, crude fat, crude ash and less Ca. The advantage of the apple pulp is its high carotenoid (17.86 mg/kg higher) and high phosphorous (1.64% higher) in comparison with haylage. The winter feed ration for deer contains insufficient level of carotenoids and P therefore their deficit could be compensated by the apple pulp. In winter period, the consumption of carotenoids (for stabilizing the anti-oxidation processes) and phosphorous (for formation of the antler structure) is of special importance for red deer. RI Sigra performed a feeding trial making use of the apple juice production by-product (apple pulp) in feeding of red deer (*Cervus elaphus*).

Apple pulp is less fibrous than haylage. The NDF content of the apple pulp applied was 36.97, i.e. by 32.92% lower than in haylage (69.89%). According to the test results, apple pulp contained 26.84% ADF fraction which is by 18.23% less than in haylage. Consequently, the use of apple pulp in deer diet ensures by 1.49% higher energy level (NEL MJ/kg) in animal system. The use of apple pulp in the winter feed ration of deer provides the required natural, biologically active ingredients to animal system especially vitamins C and PP, as well as Na, Mg and P and pectins.

High quality meat or mass of the muscle tissue should be high in crude protein, amino acids, poly-unsaturated fatty acids and low in crude fat, cholesterol and saturated fatty acid content. The cholesterol content preferably as low as possible in the mass of muscle tissue is one of the most crucial meat quality parameters. The cholesterol content in muscle tissue of the control group was 79.50 mg% on the average, while in muscle tissue of the trial group deer it was 60.0 mg%, which is by 19.5 mg% improvement. It indicates that due to lower cholesterol level the muscle tissue of the trial group red deer is of higher quality and more favorable to consumer health. As showed by the latest scientific data, carotenoids hinder the settling of cholesterol in the muscle tissue of animals. It certifies that the content of carotenoids and other biologically active substances contained in apple pulp has a favorable impact of cholesterol metabolism enhancing its reduction in muscle tissue.

The muscle tissue of red deer contained 0.09–0.14% of phosphorous on the average; the muscle tissue of the trial group was slightly higher in phosphorous (by 0.05%). That logically happened because the feed containing apple pulp was 2.9 times richer in phosphorous than feed of the control group causing a higher phosphorous transit from feed to muscle tissue and resulting in its higher content there. A higher quality and more wholesome meat is characterized by low level of saturated fatty acids and higher level of mono-unsaturated fatty acids, poly-unsaturated fatty acids as well as higher level of omega-6 and omega-3 fatty acid sum proportion. The muscle tissue of the trial group red deer contained by 17.31% less saturated fatty acids and by 15.82% more poly-unsaturated fatty acids than the control group. Consequently, inclusion of the apple pulp in red deer feed rations improved the fatty acid quality of the acquired venison.

On the whole, we can conclude that apple pulp as a red deer winter feed ration ingredient is a valuable source of vitamins, anti-oxidants (carotenoids), phosphorous, non-nitrogen extractives and pectins improving the quality of the acquired products.

**Key words:** apple pulp, venison quality

## B 7 ORGANIC MEAT QUALITY – A META-ANALYSIS

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Meat quality can be defined by different meat quality characteristics. Those characteristics are influenced by various factors during all stages in the production chain. Although some of the factors are regulated by organic regulations and standards, little is known to what degree organic meat quality has some authentic characteristics or levels of these characteristics, compared to meat from non-organic production. In the last years, several meta-analysis reviews on organic food were published, with focus on plant products and milk but the meat quality was not analyzed. Since the different regulations on organic farming came into force, several studies were carried out, comparing meat from organic to non-organic production. In order to summarize a quantitative status quo on this topic, a meta analysis was used to evaluate peer-reviewed literature on the quantitative comparison of different meat product related criteria with focus on the nutritional and technological quality of the meat. There was no time frame of publication date, but all studies had to document the organic regulation or standard, under which the research was carried out or the samples were certified. For the evaluation of the meta-analysis, Hedges' d effect size method was applied. For the literature search, the following databases were used in the period from March 2008 to April 2011: ISI Web of Knowledge and Science Direct, with the following key words: 'comparison', 'conventional', 'organic', 'meat', 'compare', 'label', 'claims', 'farm\*management', 'production\*management', 'nutrition' and 'quality'. Added to that, authors, known from conferences, books or research projects were asked for publications in this area until February 2012. For further processing, all publications had to be available as a full version in the English language and contain the comparison of at least two production methods. In addition to organic regime, we included in-door/out-door regimes as a separate data set, because it is part of most of the organic regulations and standards. Also, only such studies have been considered, where the comparison was made based on nutrition and technological parameters. From 660 articles, 16 studies comparing organic versus non-organic and 13 studies comparing out-door versus in-door housing were analysed.

The meta-analysis shows that organically produced meat is characterised by desirable nutritional properties: significantly higher content of PUFA and higher content of n-3 fatty acids (lower ratio of n-6 fatty acids to n-3 fatty acids) compared to meat from non-organic production. Furthermore organic meat samples have significantly less fat than meat from other production systems. Carcass yield is significantly lower in organic meat production.

**Key words:** organic meat, quality, meta-analysis



## B 8 VARIABILITY OF PHYTOCHEMICAL PROFILES IN ORGANIC PRODUCTION: KHORASAN WHEAT CASE STUDY

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It raises a great deal of recent interest that organic wheat constitutes valuable nutraceutical raw material for healthy food production and special dietary uses. In particular, khorasan wheat (*T. turgidum* ssp. *turanicum*) has attracted great attention because of its specific nutritional and functional properties (antioxidant, antitumoral and prebiotic activities). Currently, few data about fibre and antioxidant composition of organically grown Kamut<sup>®</sup> brand grains is available in literature and, as far as we know, the changes of their amounts as a function of cropping year and growing location have never been investigated. Moreover, this is the first study in which an organically grown crop is investigated in a region of such broad expanse, including several different environments, covering an area of approximately 180,000 km<sup>2</sup>. The aim of the research was to provide an overview of the health-promoting properties of Kamut<sup>®</sup> brand grains produced at different locations (Canada and USA) and to contribute to the understanding of the environmental dynamics affecting the phytochemical profile. A collection consisting of 109 samples of organic Kamut<sup>®</sup> brand grains harvested in different farms of North America in 2010, was characterized for agronomic traits, antioxidant compounds (polyphenols, flavonoids) and fibre components (soluble and insoluble dietary fibres, resistant starch). As regards the agronomic performance, the results demonstrated a high heterogeneity among samples. Yield, test weight and protein content varied within the intervals 0.30–1.69 t/ha, 49.2–61.1 kg/hl and 12.6–16.6 g/100 g, respectively. As previously reported in literature, the content of health-promoting compounds is strongly influenced by environmental conditions. In fact, the investigated wheat grains showed great variability for the total polyphenol and flavonoid contents (133.6–223.4 and 28.6–63.6 mg/100g, respectively). The insoluble fibre content varied between 12.55 and 20.25 g/100 g, while the soluble dietary fraction showed less heterogeneity (2.70–4.31 g/100 g). Concerning starch, statistically significant differences were observed between farms for the amounts of both the resistant and the total starch (0.22–1.5 and 57.7–66.4 g/100 g, respectively). The results of the research were computed using Geographic Information System (GIS) to develop quality maps that showed the variability of the phytochemical amounts among the North American farms and allowed the identification of areas in which bioactive compounds had accumulated at a higher level in the wheat grains. According to the present results, the choice of a growing location in which the accumulation of health-promoting compounds (i.e. polyphenols, fibres) is stimulated by specific climatic conditions may be a key factor for the production of organic wheat foodstuff as a functional food.

**Key words:** khorasan wheat, antioxidants, fibre, bioactive compounds, organic



## B 9 THE EFFECT OF ORGANIC PRODUCTION ON TOMATO FRUIT QUALITY

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Organic farming methods are considered by many to be more environmentally friendly than conventional methods. Fundamental differences between organic and conventional production systems, particularly in soil fertility management, may affect the nutritive composition of plants, including secondary plant metabolites. This study compared organic and conventional farming systems for their effects on tomato fruit quality. Ripe tomato fruit samples were chemically analyzed at the end of cultivation. Tomato fruit quality was characterized on the basis of fruit fresh weight by measuring total soluble solids (TSS), titrable acidity (TA), lycopene content and antioxidant activity (AA). Comparisons of analyses of archived samples from conventional and organic production systems demonstrated statistically higher levels ( $P < 0.05$ ) of TSS, TA, lycopene content and AA in organic tomatoes (6.27°Brix, 157.31 citric acid  $\mu\text{mol}\cdot\text{g}^{-1}$  FW, 17.19  $\text{mg}\cdot\text{kg}^{-1}$  FW, 1870.23  $\mu\text{mol TEAC}\cdot 100\text{ g}^{-1}$  FW) then those in conventional tomatoes (3.96°Brix, 70.25 citric acid  $\mu\text{mol}\cdot\text{g}^{-1}$  FW, 14.22  $\text{mg}\cdot\text{kg}^{-1}$  FW, 935.71  $\mu\text{mol TEAC}\cdot 100\text{ g}^{-1}$  FW). These data provide evidence that improvement in the antioxidant defense system of the tomato plant occurred as a consequence of the organic cultivar practice. The increase of the antioxidant activity under organic production is very desirable characteristic that could be beneficial from the aspects of health-promoting value of tomato fruits.

**Key words:** tomato, organic production, conventional production, fruit quality

**B 10****THE QUALITY OF POTATO TUBERS WHEN USING A SURFACE MULCHING****P. Dvořák<sup>1\*</sup>, V. Schulzová<sup>2</sup>, V. Krtková<sup>2</sup>, J. Tomášek<sup>1</sup>, J. Hajšlová<sup>2</sup> & K. Hamouz<sup>1</sup>**<sup>1</sup>Department of Crop Production, Czech University of Life Science, Prague, Czech Republic<sup>2</sup>Department of Food Analysis and Nutrition, Institute of Chemical Technology, Prague, Czech Republic

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The application of new cultivation techniques in organic farming can bring a change in the inner quality of harvested products. It is urgent to assess the safety of these procedures on the final product quality. In this study, the quality characteristics of potato tubers grown under four different organic cropping systems over five-year period were analyzed in order to investigate their influence on the nutritional value. As a control variant (C) for comparison was used in the cultivation of tubers by using full mechanical cultivation per vegetation without any subsequent regulation of Colorado potato beetles (CPB) and Late blight. With this were compared to tubers grown under black mulch textile (BTM) and grass mulch (an applied in two terms: GM1 – immediately after planting and GM2 – before emergence). The incidence of CPB and the Late blight were regulated only mulch without further treatment. The monitored parameters were positive biologically active compounds as vitamin C, chlorogenic acid, amino acids, sugars and also dry matter content (DMC). High performance liquid chromatography coupled with conventional detectors was used for their determination. The results of the experiment did not prove any significantly decreasing of DMC and vitamin C in treatments with mulch (BTM or GM1, GM2) in comparison with C variant without mulch. On average years 2008–2012, two varieties and two localities the tendency of lower DMC and content of vitamin C of tubers in variant with GM and BTM in comparison with C variant (by 0.26% BTM, 0.74% GM1 and 0.65% GM2 respectively 7.0 mg/kg, 20.7 mg/kg and 19.3 mg/kg) was found. A probable reason of DMC reduction in variant with GM1 and GM2 is higher content of nitrogen in plants and their luxuriant vegetation. The DMC was most influenced by locality and variety. We believe that the trend of a lower content of the vitamin C in GM1 and GM2 may be caused by overall lower soil temperatures with grass mulch. Also, another antioxidant chlorogenic acid was not affected significantly by using of mulch. The trend of higher content of chlorogenic acid (about 1.9%) was detected only in tubers grown under BTM. The contents of sugars and amino acids in tubers were least variable monitored characteristic from the viewpoint of the mulching. Despite the use of GM we found trend higher contents of sugars and amino acids in potato tubers. Sugars content were the most influenced by variety and content of amino acids by locality. The use of plastic mulch or grass mulch was not adversely affected content of monitored parameters in potato tubers.

**Key words:** potato, mulching, antioxidant, organic farming**Acknowledgement:** *This study was carried out within the project NAZV QH82149 supported by Ministry of Agriculture of the Czech Republic and by 'S' grant of MSMT CR.*

**B 11****THREE-YEAR COMPARISON OF ANTIOXIDANT COMPOUNDS IN ORGANICALLY AND CONVENTIONALLY GROWN TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) CULTIVARS****D. Anton<sup>1\*</sup>, D. Matt<sup>1</sup>, I. Bender<sup>2</sup>, R. Kazimierczak<sup>3</sup>, A. Luik<sup>4</sup> & T. Püssa<sup>1</sup>**

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The development of organic agriculture has been rapid in the last decade and content of bioactive compounds of organic vegetables is of great interest. Tomato is an important worldwide crop and year-round consumed fruit containing numerous bioactive compounds. The aim of the present study was to evaluate the influence of organic and conventional cultivation system on the content of polyphenols and antioxidativity in the fruits of four tomato cultivars grown in Estonia. Plants of four tomato cultivars (Maike, Malle F1, Garten Freude and Valve) were grown under organic and conventional conditions in separate unheated greenhouses in 2008–2010. Fruits were harvested on the same day and analyzed at the optimal maturity stage. The content of lycopene was estimated in fresh tomatoes and polyphenols were determined in air-dried tomatoes. All the analyses were performed in three replicates. Polyphenols were identified and quantified by high performance liquid chromatography-mass spectrometry (LC-DAD-MS/MS) at Agilent 1100 Series instrument equipped with photodiode array and ion-trap mass spectrometric detectors. UV-Vis spectrophotometer was used for the determination of total phenolics by Folin-Ciocalteu and antioxidativity analysis with DPPH as a stable free radical. Data was statistically analysed using 2-way and 3-way ANOVA analysis.

Fruits of all varieties grown in the conventional conditions had slightly higher lycopene contents. The highest values had Maike cultivar and the lowest Garten Freude.

Antioxidativity analyses showed that organically grown cherry-type cultivar Garten Freude was the best in all three sequential years.

The content of polyphenols was more dependent on the year and cultivar than on the growing system. Significantly ( $P = 0.02$ ) higher amounts of phloretin dihexoside were established in fruits of all organically grown cultivars in all three years.

It can be concluded that the content of antioxidant compounds was first of all dependent on the growing year and cultivar and only content of a single polyphenol was significantly influenced by the cultivation system.

**Key words:** tomato, polyphenols, organic, conventional, HPLC-MS/MS

## B 12 COMPARISON OF FATTY ACID COMPOSITION OF EWE'S ORGANIC AND CONVENTIONAL MILK AND ITS EVOLUTION THROUGHOUT THE YEAR

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Previous work has suggested that the fatty acid profiles of cow's milk are the parameters most affected on comparing organic and conventional management. Higher contents of polyunsaturated, CLA, linolenic and vaccenic fatty acids have been reported although the results are sometimes ambiguous. Regarding ewe's milk, the results are very scarce but in a previous case study the organic milk showed significantly higher values of mono- and polyunsaturated fatty acids. Taking it into account the aim of the present work was to perform a farm-based study to compare the milk fatty acid profile depending on the production system (organic vs conventional) and on the intensification.

During a 12-month longitudinal study, bull-tank milk from organic (n = 2) and conventional (n = 18) dairy farms in Spain were analysed. The conventional farms were classified as intensive (n = 8) or semi-extensive (n = 10). The sheep under the intensive system remained on a feedlot and were allowed *ad libitum* access to the commercial concentrate. The sheep under semi-extensive system remained on the feedlot during the first month of lamb lactation. During this period they were allowed *ad libitum* access to the commercial concentrate. After weaning, the sheep were put out to pasture constituting a maximum of 50% of DM, completed with concentrate on the feedlot. The organic ewes had the most extensive production system, they had free access to pasture and were put out to feed every day for at least eight hours and their diet was supplemented (maximum 30% of the ration, approximately 700 grams) during lactation and when necessary with a certified organic mixture. For fatty acid analysis of milk samples, milk lipids were extracted (ISO 14156:2001) and the fatty acids were methylated and analysed by gas chromatography according with the method proposed by Lurueña et al. (2010). The statistical significance of each factor (production system, intensification, sampling month) and their interactions on total saturated (SFA), mono- and polyunsaturated fatty acids (MUFA, PUFA) and on total conjugated linoleic acid (CLA) was calculated using GLM.

The results did not show a statistically significant effect of production system (organic vs conventional) for any of the fatty acid groups studied, however a significant interaction with time was observed. Then, organic milk showed higher values of SFA and lower amounts of MUFA and PUFA in winter months but during the spring the results were the opposite. CLA showed more or less constant values through the year and the organic milk showed the highest levels. However, the intensification showed a statistically significant effect on all the fatty acid groups. Milk from semi-extensive farms showed the highest mean levels of MUFA, PUFA and CLA. Moreover, a significant interaction with time was also observed and during spring organic dairy farms showed the lowest values of SFA and the highest of MUFA, PUFA and CLA.

**Key words:** organic farming, SFA, MUFA, PUFA, CLA

**Acknowledgement:** *The work has been made possible by funding from the Ministry of Science and Innovation for the project number RTA-2010-00064-C04-03.*

## B 13 DEVELOPMENT OF BAKING METHODS OF ORGANIC SPELT BREAD WITH A REDUCED MYCOTOXINS CONTENT

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The aim of this study was development of technological methods to improve organic bread quality in aspect of mycotoxin reduction by working out of sourdough composition on the base of starter cultures.

Elisa test was used to analysis of flours contaminated by mycotoxins. Flours were collected in bakery every two weeks and analyzed for the presence of deoxynivalenol, T-2 toxin, zearalenone, ochratoxin A and aflatoxins. Isolation and identification of lactic acid fermentation bacteria from sourdough and spelt flours were done in Institute of Agricultural and Food Biotechnology in Warsaw. Composition of starter cultures was worked out from isolated LAB strains. Sourdoughs were done by using of equal weight amounts of flour and water and inoculated by 1 weight per cent fermentation starter proliferated from isolated LAB strain in MRS medium. Fermentation were conducted for 24 h in 30 Celsius degrees. Laboratory baking test were done using equal amounts of rye sourdough and spelt flour, 10% w/w of water, 2% w/w of salt and for each combination additional sample with 2% w/w of bakery yeast were done. Dough fermentation was for 1.5 h in 30 Celsius degrees. Baking was in 210 Celsius degrees conditions. The physical and sensory evaluation of laboratory baking on the base of different starter cultures and vary storage times was conducted. After sensory analysis bread was desiccated and milled and evaluation of mycotoxins contamination in them was carried out on the ground of HPLC/MS/MS analysis. Two strains, *Lactobacillus plantarum* and *L. brevis*, were isolated from sourdough. From spelt flours EKO 1850, EKO TLG – 185 and wholegrain EKO 2000 type 3 strains, *Pediococcus pentosaceus*, *L. plantarum* and *L. lactis* ssp. *lactis* were isolated. Flours for mycotoxin analysis were of good quality, met all the quality parameters set out appropriate standards. Mycotoxins contamination in them was low. DON and OTA occurred in all flour samples. ZEA in 2, T-2 toxin in 5 and AFLA in 3 flour samples were found. For 5 samples ochratoxin A tolerated level defined by the UE on 3 µg/kg in cereal products were gone beyond. For other mycotoxins tolerated levels were not exceeded.

Flour used in laboratory baking test contained insignificant amounts of OTA and DON and spelt flour additional was contaminated by ZEA and T-2 toxin up to respectively circa 20 µg/kg and 10 µg/kg. The best abilities for storage had bread on the base of fermentation starters without bakery yeast. Most quickly, after 3 days, moulds appeared on bread with singular starter cultures and yeasts. The longest bread storage time was 6 days without symptoms of moulds infestation. Critical quality distinguishing feature in sensory evaluation was taste. For bread with flavoring additions like pumpkin, sunflower or linen seed etc. better notes had breads on bakery original sourdough then fermentation starters with isolated LAB strains. Yeast significantly improved sensory bread features.

**Key words:** organic, bread, mycotoxins, sourdough, LAB, spelt

## B 14 BIOACTIVE SUBSTANCES IN ORGANIC HOPS

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Hop (*Humulus lupulus* L.) is one of the basic raw materials employed in brewing. Practically all hops secondary metabolites exhibit more or less pronounced bioactive effects. Therefore beer is the most important source of hop bioactive compounds in the human diet.

The contents of alpha and beta acids, tannins, xanthohumol, total phenolic, flavan-3-ols were investigated in Polish organic hop cultivars during the period 2010–2012.

The alpha and beta acids and tannins were analysed by spectrophotometric methods and the results were expressed as % of dry weight. The xanthohumol content was determined by high-performance liquid chromatography with diode array detection and the results were described as % of dry weight. The total phenolic content was measured using modified Folin-Ciocalteu method and the results were expressed as mg of gallic acid equivalent (GAE) per gram of dry weight. The flavan-3-ols and proanthocyanidins content was analysed with vanilin reagent and the results are expressed as mg of catechin equivalent (CE) per gram of dry weight.

It was found that cultivar differed in content of bioactive compounds. The highest content of tannin, total phenolic and flavan-3-ols were found in Marynka cultivar and they amounted 18.52% dry wt, 7.25 mg GAE/g dry wt and 39.83 mg CE/g dry wt, respectively. The concentrations of xanthohumol in hop cultivars amounted in the ranges of 0.06 to 0.51% (w/w). The highest amount of the xanthohumol was found in Sybilla cultivar, but on the other hand the lowest content of tannin and flavan-3-ols (9.66% dry wt and 0.96 mg CE/g dry wt, respectively) were found in that cultivar.

In the organic hops cones, in comparison to the conventional hop, a decrease in alpha and beta acids content was observed. However, organic hop contained a higher content of xanthohumol in almost any combination. Organic hop variety Marynka contained a similar amount of tannins compared to conventional crops, and organic variety Magnum was characterized by significantly higher its content in comparison to the conventional cropping system. Regardless of the variety, fertilization with basalt meal resulted in a higher content of biologically active substances in cones in comparison to other organic fertilizing methods, although these differences have not always been statistically significant. The use of the probiotic microorganisms composition with the addition of plant extracts resulted in an increase in the xanthohumol content in the cones in comparison to other methods of organic methods of plant protection.

**Key words:** hop, organic farming, bioactive compounds

## B 15 QUALITY ASSESMENT OF GREENLEG PARTRIDGE EGGS KEPT IN ORGANIC CONDITIONS

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The aim of the study was to analyze the eggs collected from Polish breed hens – Greenleg Partridge adapted to the production in organic farming conditions in Lower Silesia. As a reference material (control group) eggs from Lohmann Brown hens (LO) kept on litter in the intensive system of breeding were used. The native breed hens were kept in free-range system conditions and eggs were collected from two farms. The first farm was certified as an organic production with the accreditation no RE-02/2002/PL (ZK) and the other one was in the second year of conversion to ecological production (ZH).

The evaluation of the experimental material included the basic parameters of eggs of the consumer relevance: egg weight, shell color, indicators of freshness, weight and color of egg yolk, sensory characteristics of eggs. Chemical composition of egg mass was also determined (dry matter, lipid and protein content).

The biological value of the protein was analyzed as an activity of egg proteinase inhibitors (cystatin, ovomucoid) and enzymatic activity of lysozyme influencing the immune system of newly created chicks.

The nutritional value of eggs was specified by determination of fatty acids composition, cholesterol and vitamin A content in lipids extracted from egg yolk.

The results of the study showed that the quality of eggs from organic production was high, confirmed by higher yolk proportion and the calculated values of Haugh units (over 70). Sensory evaluation marks of cooked eggs were comparable within all groups.

Activity of the biologically active components in egg white was significantly higher in eggs from ecological production ( $p \leq 0.05$ ) compared with conventional conditions. The activity of lysozyme was higher about 50–100% in organic eggs (811–1252 units).

No difference in cholesterol content was observed between groups (12.7–13.2 mg). Lower content of vitamin A was analyzed in eggs from organic conditions (1.36–1.62  $\mu\text{g}$ ) than in LO eggs (2.46  $\mu\text{g}$ ). The ratio between n-6/n-3 fatty acids was two-three times lower in ecological eggs (7–10 : 1) comparing to control (19 : 1), as a result of 2-fold higher levels of ALA and DHA acids. In this regard, the eggs from organic production is a product that meets the requirements of functional foods.

Statistical analysis of variance was performed using Statistica software.

Two groups of the collected results were analyzed also with the use of 'cluster analysis' (CA) and 'multidimensional scaling' (MS) statistical methods. The first group of investigated parameters was 'biology-chemistry-sensory' group (with 11 variables – each with 18 individual results) and the second was 'technology' group (with 14 variables – each with 60 individual results). Different clusters for both groups at CA and MS statistical analysis were found, what confirmed high usage of such methods in finding of similarities among different egg raw material as compared to indicated groups also including organic or non-organic eggs.

**Key words:** Greenleg Partridge, organic eggs, egg quality, cluster analysis



**B 16****BEETROOT (*BETA VULGARIS*) AND NATURALLY FERMENTED BEETROOT JUICES FROM ORGANIC AND CONVENTIONAL PRODUCTION: METABOLOMICS, ANTIOXIDANT LEVELS AND ANTI-CANCER ACTIVITY**

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Organic food is getting more and more interest from the consumers. There are already many studies showing that organic vegetables are generally richer in valuable bioactive compounds for healthcare than conventional vegetables, but only few studies have been conducted on the anti-cancer values of the organically grown plants. Consumers are looking for scientific evidence of health promoting qualities of the organic products, and there are very scarce evidences in this respect. The aim of the work was to determine the level of antioxidants and metabolomic fingerprinting in both raw beetroots and naturally fermented juice made of beetroots grown in the organic vs. conventional farms. In the addition the anti-cancer properties of the fermented beetroot juices from organic and conventional production have been evaluated.

The study was conducted in 2 consecutive years (2010–2011) using Libero beetroot variety. Beetroots were grown in the neighboring organic vs. conventional farms in Poland. The effects of the extracts of naturally fermented beetroot juices from two production systems on the induction of apoptosis and necrosis in vitro of stomach cancer cells AGS have been investigated, and possible correlations with the level of several antioxidants in the juices were analyzed. Additionally the influence of organic and conventional cultivation system on the metabolic profiles of beetroots and beetroot juices was compared.

The results showed that organic beetroot juice contained more ascorbic acid than conventional juice both in 2010 and 2011, and also had higher level of betanin-3-O-glucoside in 2010. Conventional juice was richer in flavonoids, chlorogenic acid and quercetin-3-O-glucoside than organic juice in 2010, and richer in the ferulic acid, myricetin and sum of phenolic acids in 2011 as well. Significantly bigger effect of the extracts from organic beetroot juices compared to the conventional ones have been found only in 2011 and it induced only the late apoptosis in AGS cells; there was no impact on early apoptosis. Some correlations have been found between the level of antioxidants in beetroot juice and the impact on apoptosis in AGS cells. The metabolomic analysis showed that beetroots and fermented juices from both years of the experiment had significantly different profile of the compounds depending on the growing system, but at the same time the significant influence of different vegetation seasons on chemical composition of the products was observed.

The results indicate that beetroots and naturally fermented beetroot juices may be considered as a good source of phenolic compounds and betacyanins. Because of the significant cohibitive activity on the stomach cancer cells, the fermented beetroot juices from organic production could be used as a component of healthy diet.

**Key words:** beetroot juice, metabolomic fingerprinting, anti-cancer properties, organic, conventional



**B 17**  
**IS THERE EVIDENCE FOR A NEGATIVE CORRELATION BETWEEN YIELD AND NUTRITIONAL VALUE IN HIGH YIELDING PLANT VARIETIES, IS THERE AN ALTERNATIVE APPROACH?****L. Trenchard, T. Eyden-Wood & J. Wright\***

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Fast growing, high yielding varieties have increased productivity and yield in intensive agricultural systems. The impacts of intensive agriculture on the environment are well documented and accepted, but the effect of these intensive methods on the nutrient content of food is less clear. Whilst some studies which compare organic and conventionally produced foods have identified greater nutrient contents in organic foods compared to the conventional equivalent for individual foods and individual nutrients, other studies have not been able to find a significant difference or have found that the opposite is true. Similarly, systematic reviews carried out have produced contradictory or unclear results. There is some limited evidence that organic growers choose more resistant varieties and that these highly resistant varieties may provide greater nutritional value in the final food product. This study reviews the evidence available for the link between farming method, yield and nutritional value to determine whether there is sufficient evidence to suggest that choice of variety can influence the nutritional value of produce. Intensive agriculture in the EU currently relies upon commercially available high yielding seed varieties and seed production is highly regulated. High yielding varieties have been bred to increase the productivity and profit of intensive farming operations and much of the world now relies upon restricted number of varieties of only a few species to provide them with their daily energy requirements. More than 50% of the world relies upon three plant species, rice, wheat and maize for most of their daily calories. This study considers whether traditional varieties have the potential to provide greater nutritional value than conventional varieties. It also explores the availability of alternatives to the intensive agricultural approach of using highly bred, high yielding varieties and examines the potential for their greater use, the current EU policy and highlights constraints which limit their potential. The study found that whilst there is evidence available for some crop species to show that there are differences in nutritional value between conventional and traditional varieties, there are a number of issues which make scientifically rigorous comparisons between studies difficult. These are discussed. Whilst differences in nutritional value are apparent, it was not possible from the evidence reviewed to conclude that there is a negative correlation between yield and nutritional value for modern varieties and further work is necessary. What is clear, it that this trend towards a reduction in agrobiodiversity has led to fewer varieties available for research and development and what some are calling 'genetic erosion'. An alternative agroecological approach is to use traditional regional varieties, adapted to their location and resistant to local conditions.

**Key words:** yield, nutrition, traditional variety, agrobiodiversity, agroecology

## B 18

**ORGANIC FOOD PROCESSING IN THE CONTEXT OF SUSTAINABLE AND HIGH QUALITY FOOD PRODUCTION**

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The goal of the paper is to describe and discuss the topic of organic food processing and in particular the processing methods to make it operational. This is done by transferring the underlying paradigms and principles from organic agriculture and food to processing as one important step in the food chain. The focus is on concept development, definitions and examples for verification. Because the concept of organic processing is developed in the context of related approaches such as careful, minimal and sustainable processing, the results presented here are of general interest for agriculture and food scientist as well as stakeholders.

FQH experts elaborated a framework for concept development, definition and evaluation of organic food processing. The work was carried out within FQH with 10–12 experts at different expert workshops. This paper summarizes the outcome of these meetings. In addition a qualitative survey was performed among organic stakeholders on their understanding of organic processing related to concepts and criteria.

The descriptions and discussions are based on relevant scientific literature, including primary research and reviews, reports, books, dealing with organic food quality issues, IFOAM-Principles and Standards, the EC-Regulation 834/2007 and EC-Regulation 889/2008, as well as personal consultancy with different stakeholders in the organic sector.

The conceptual framework is based on underlying paradigms in organic agriculture and food as extracted from literature; the history of organic processing from various sources as well as the clustering of processing methods according to literature and organic standards. Agro-ecology and integral product identity are identified as underlying paradigms. Principles of care, health, fairness were transferred from IFOAM as well as models described by Kahl et al. 2012. Moreover, a system approach, related to understanding of organisms is a central part of the concept. A literature survey among stakeholders at Biofach 2012 shows, that terms like 'organic integrity' and 'vital qualities' are valuable for the practice. Stakeholders agree to regulate technologies in organic processing more strictly.

Three different products including different methods applied on these products are used in order to verify the proposed definition and evaluation. Fresh apple is related to the concept of minimal processing in connection with the organic standards (regulation). Different heating technologies are compared according to their impact on milk product and process quality. From literature the impact of different temperatures (pasteurization, direct and indirect UHT) on milk quality parameters such as proteins can be estimated for potential limits in regulation. Hence, data from LCA measurements on milk processing are still missing. Organic bakery products produced with traditional technology were compared to such organic products produced by exploiting fully the possibilities of organic regulation. Here the wide range of possibilities to select technologies within the organic regulation is visible.

**Key words:** food processing, organic, quality, sustainability

## B 19 SENSORY PROPERTIES OF BEETROOT AND CABBAGE DERIVED FROM DIFFERENT FARMING SYSTEMS

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Consumers are becoming increasingly concerned about food quality, especially regarding how, when, and where food is produced and what impact the production has on the environment. This is reflected in the demand for organic certified products. Furthermore, consumers of organically grown vegetables tend to believe, and expect, that these products taste better than conventional produce. Results of comparative studies of organic versus conventional products indicate differences, however, often show no consistent pattern for sensory quality.

In the present study, sensory properties have been investigated in beetroot (*Beta vulgaris* L. cv. 'Rote Kugel') and white cabbage (*Brassica oleracea* L. var. *capitata* f. *alba* cv. 'Kranjsko okroglo') derived from long-term field experiment, which was established to study the impact of different production systems. Plant samples were obtained from adjacent plots managed according to organic (EKO), integrated (INT), biodynamic (BD), and conventional (KON) production systems, and control - without protection means and fertilisers (K) applied. To assess the likeability of the samples, sensory evaluation was conducted in year 2009 by 78 untrained panellists and was based on 9-point hedonic scale. Five pooled samples of each vegetable crop were freshly served randomly and monadically on open white plastic trays marked with three-digit random numbers. Each serving weighed around 17 g. Evaluated attributes were colour, odour, taste, overall acceptability, and willingness to purchase.

Regarding beetroot, there were statistically significant differences shown for colour. Colours of control (6.56) and biodynamic beetroot (6.38) were significantly better assessed than the colour of integrated grown beetroot (5.82). In the case of cabbage, there were statistically significant differences in all evaluated attributes, except in the willingness to buy. In terms of taste, the cabbage from biodynamic cultivation was significantly higher scored (6.00) than samples derived from the control (5.27) and organic production (5.26). The age and education level of panellists affected scores obtained in beetroot, and the education level and gender of panellists affected scores obtained in cabbage evaluation.

**Key words:** production systems, beetroot, white cabbage, sensory characteristics

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**B 20****CONSUMERS' ACCEPTANCE OF THE USE OF ORGANIC RAW MATERIALS TO IMPROVE HEALTH VALUE OF SWEETS****M. Jeżewska-Zychowicz\*, M. Jeznach & M. Kosicka-Gębska**

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The use of organic raw materials in production of non-organic food gives the opportunity to achieve product with improved health value. However, the controversy can be aroused by sweets with increased health value, mostly because of many negative consequences of sweets consumption.

The aim of the paper was to assess consumers' acceptance of the sweets containing organic materials used in order to increase health value of sweets, and their willingness to eat such products.

Questionnaire survey was performed in 2010 among 1,000 Polish consumers aged over 18 years. The questions concerned the acceptance of using organic ingredients in sweets in order to improve health value, opinions on benefits from organic chocolate products, their impact on health, health risk, and the willingness to eat them. Participants indicated their opinions on the 5-point scales (from 1 – very negative, to 5 – very positive). Data were analyzed using SPSS software version 14. Chi-square test was used to determine the relationships between consumers' socio-demographic characteristics and their opinions. Bivariate correlation coefficients ( $r$ ) were used to determine the predictors for willingness to eat chocolate products with organic ingredients.

Majority of participants (74.2%) did not accept the use of organic ingredients as a way to improve the health value of sweets. More women (26.0%) than men (20.0%) expressed their acceptance. Nevertheless, positive opinions on benefits from sweets with organic ingredients available on market declared 37.0%, on their impact on health – 47.7%, lack of health risk – 39.7%, and finally willingness to eat these products declared 45.4% of participants. Women represented more positive opinions than men ( $p \leq 0.05$ ). Consumers' willingness to eat sweets with organic ingredients showed significant correlation with opinions on benefits ( $r = 0.560$ ;  $p < 0.001$ ), impact on health ( $r = 0.615$ ;  $p < 0.001$ ), and there was no significant correlation with opinions on health risk ( $r = -0.057$ ;  $p = 0.073$ ).

It can be stated that Polish consumers did not accept the use of organic ingredients as a way to improve the health value of sweets. The consumers' acceptance of sweets with organic ingredients was determined by their beliefs on benefits, and impact on health.

**Key words:** consumer acceptance, organic materials, health value, sweets

**Acknowledgement:** *The research was carried out within the project EUREKA EI4449 AKTINIDIA.*

## B 21

**THE INFLUENCE OF LINSEED CAKE SUPPLEMENTATION ON THE ANTIOXIDANT CAPACITY OF MILK OBTAINED FROM ORGANIC DAIRY COWS DURING WINTER SEASON OF FEEDING****K. Puppel<sup>2</sup>, T. Sakowski<sup>1\*</sup>, B. Kuczyńska<sup>2</sup>, E. Metera<sup>1</sup> & M. Gołębiewski<sup>2</sup>**

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The aim of this study was to improve quality of cow's milk during winter season on organic farm, aimed to increase its antioxidant capacity.

Organic farm produce milk according to the regulations concerning methods applied to organic farming issued by the EC (No. 834/2007). Thirty Polish Holstein Friesian cows at 90 ±30 day of lactation and averaging 14.71 ±2.26 kg·d<sup>-1</sup> of milk yield were divided into two groups: Control (CTL) and Experimental (LC). The treatments were: (1) the Control group, which was the grass-clover and maize silage, concentrates and mineral additives with no linseed cake and (2) the Experimental group, which was additionally fed with 1.5 kg·d<sup>-1</sup> linseed cake. The study was conducted over a continuous seven-week-period, starting with a one-week-diet adaptation period, followed by a six-week-full diet period. Milk samples were taken six times during the investigation period and analyzed for basic chemical composition with infrared spectroscopy, cytological quality, total antioxidant status (TAS), and fat soluble vitamins using liquid chromatography.

Based on the obtained results, there were no statistically significant differences between control and experimental groups in the basic chemical composition of milk. Both groups had also similar urea, calcium, magnesium and phosphorus concentration. Besides the addition of linseed cake had highly positive influence on the antioxidant capacity of cow's milk. The study show almost 2-fold increase of vitamin A (1.75 vs. 0.74 mg·L<sup>-1</sup> in control group), β-carotene (0.54 vs. 0.22 mg·L<sup>-1</sup> in control group), vitamin E (1.96 vs. 0.84 mg·L<sup>-1</sup> in control group), vitamin K<sub>2</sub> (3.75 vs. 2.32 μg·L<sup>-1</sup> in control group), vitamin D<sub>3</sub> (10.81 vs. 4.83 μg·L<sup>-1</sup> in control group) and TAS (2.09 vs. 1.06 mmol·L<sup>-1</sup> in control group). The results showed that the use of linseed cake positively improved the nutritional quality of cow's milk during winter season of feeding. Adding of linseed cake during winter season of feeding will help to keep the high nutritional value of milk on organic farms throughout the year. Consumers may benefit from higher vitamins content in milk during winter, thanks to linseed cake supplementation.

**Key words:** ECM, BCS, TAS, fat soluble vitamins, organic milk

**Acknowledgement:** *Research realized within the project BIOFOOD – innovative, functional products of animal origin no. POIG.01.01.02-014-090/09 co-financed by the European Union from the European Regional Development Fund within the Innovative Economy Operational Programme 2007–2013.*

**B 22****THE TWO-YEAR-STUDY ON BIOACTIVE PROPERTIES OF ORGANIC MILK IN POLAND**

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The aims of this study are: 1) to determine nutritional value of organic milk in Poland; 2) to investigate which herd and nutritional factors affect antioxidant capacity on organic farms; 3) to investigate the seasonal effects on the bioactive properties of milk from organic farms.

Selected organic farms produce milk according to the regulations concerning methods applied to organic farming issued by the EC (No. 834/2007). From 2011 to 2012 820 milk samples were taken from six investigated farms, during summer and winter feeding seasons.

The obtained results show that supplementation with corn grain to the basic fodder ration improved average milk yield. In 2012 on the farm, where cows were fed with corn grain, a slight increase of protein content was observed (3.18 vs. 3.39% in grazing period), as well as improvement of fat/protein ratio (1.44 vs. 1.25 in grazing period). This result was also achieved thanks to the systematic undersowing of meadows and pastures with legumes and noble species of grass.

The summary results from the all the investigated farms indicate significant increase of average milk yield in 2012 vs. 2011. The average protein content in milk also increased in 2012 vs. 2011 which pointed to the feeding quality improvement on the observed farms. In 2011 higher antioxidant level of the fodder had positive influence on lower FFA content in milk during winter, as well as in summer feeding season compared to 2012.

During the grazing period a significant decrease of lactose content in milk was noticed, compared to winter feeding season. This may be associated with simultaneous increase of fat and protein content in milk. Higher level of the antioxidants and protein content in fodder for cows during the grazing period was easily recognizable by higher level of urea and lower level of FFA in milk.

Milk antioxidant capacity was affected by farming system. Seasonal, farm management, and cow nutrition factors affected milk nutritional value. The obtained results show that additional supplementation with corn grain to the basic fodder ration improved average milk yield. The improvement of fat/protein ratio is resulted in the systematic undersowing of meadows and pastures with legumes and noble species of grass.

**Key words:** antioxidants, milk fat, milk protein, organic milk

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**SESSION C:  
New Methods for  
Food Quality  
Determination  
(C 1–C 3)**





## C 1 DETECTION OF COW MILK IN GOAT MILK BY DNA MICROARRAY

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Goat milk is more nutritious than cow milk. Goat milk is very close to the human breast milk. Detection of cow milk in goat milk is important by two aspects. First of all, transparency of a company matters because customers do value the products by their ingredients. Secondly and most importantly skipping to write the right ingredients may lead to allergic problems. Unfortunately, some companies take the path to mislead the customers by mixing the cheaper cow milk to the more expensive goat milk and not declaring the presence of cow milk in the package of the product. This is by far the most common practice followed for those companies.

Pure goat milk has a high economic value. To detect the missing information on the packages and clarifying the right ingredients protein based immunologic, electrophoretic and chromatographic methods are used.

Recently, DNA based methodologies are also started to be used. These types of techniques have an advantage of high sensitivity and specificity: they can detect low concentrated solutions (0.1–0.5%).

DNA Microarray technique enables us to conduct DNA extraction for every type (cow, goat, sheep, buffalo) with only one extract instead of multiple extracts to observe whether the mentioned types exist on the chip or not.

During this study, after the goat and cow milks were pasteurized in the lab conditions, independent solutions were prepared. The existence of cow milk that was mixed to the pure goat and pure cow milks at pre-specified amounts was studied with DNA Microarray technique.

**Key words:** goat milk, DNA Microarray, detection

## C 2 A GEOMETRIC APPROACH TO QUALITY: BILATERAL SYMMETRY AND FRACTAL COMPLEXITY OF DROPLET EVAPORATION PATTERNS REFLECT VITALITY OF WHEAT SAMPLES

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Methods based on the evaporation-induced creation of polycrystalline structures (PCS) are especially suitable for quality analysis of organic and biodynamic products, since the crystallization processes involved in the creation of patterns have been proved sensitive to quality differences in terms of vitality. According to this view food quality depends on the organism's health, from which the food derives. In living nature an organism's health expresses itself inter alia through geometry: symmetry of the body and fractal complexity of the physiological functions. The exactness of bilateral symmetry in a living organism's body (in plants, animals, and humans), measured by means of the fluctuating asymmetry (FA), reflects the organism's growth conditions, its health, and its success in sexual selection. Equally, the organism's physiological functions, expressed by means of fractal dimensions, depict the health conditions and aging processes: it has been found that higher fractal dimensions correspond to health, whereas lower fractal dimensions indicate a disturbance.

Here we report on an observation that PCS from evaporating droplets of wheat seed leakages show different FA and local connected fractal dimension (LCFD) values. PCS obtained from chemical stressed wheat seeds exhibit significant higher FA (are less symmetric) and lower LCFD (are less complex) with respect to non-stressed control. Significantly different FA and LCFD values were also detected when different wheat cultivars were tested, proving that these two parameters are sensitive to both stress- and cultivar-related changes. In order to support these results with a traditional method for seed quality analysis, we applied the germination test, known to indicate the seed vitality: the germination rate corresponded with the geometric parameters of PCS.

In the light of our findings, FA and LCFD of PCS might be proposed as quality indicators for wheat. Furthermore, we suggest that similar measurements might find their utility also as underpinning of the visual evaluation of biocrystallization patterns.

**Key words:** bilateral symmetry, fluctuating asymmetry, fractal dimension, crystallization, food quality

**Acknowledgement:** *The authors thank Demeter Italia and Dr Edda Sanesi for financing this research.*

### C 3

## AUTHENTICATION OF ORGANIC TOMATOES, WHEAT, AND RELATED PRODUCTS

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There is an increasing consumer demand for food cultivated by organic farming practices. Because of higher price of these products, there is a need for development and validation of analytical methods, which allow discrimination between organic and conventional food products. This contribution concerns with one of the novel methods of food analysis, the metabolomic fingerprinting/profiling by the ambient mass spectrometry employing Direct Analysis in Real Time (DART) ion source coupled with Orbitrap mass spectrometer.

The method based on metabolomics for organic food authenticity was evaluated. In this study, a wide set of wheat and wheat products samples from both organic and conventional production was analyzed (whole wheat, flour and pasta from four different localities in Italy, including eight varieties of wheat). For extraction, aqueous methanol and cyclohexane were chosen as the best solvents to obtain a broad spectrum of polar and nonpolar metabolites, respectively. Tomatoes and respective tomato sauces was also analyzed in this study. Tomatoes were grown under both organic and conventional conditions (two Italian localities, three varieties). Instrumental analysis was performed using DART-Orbitrap-MS. In addition to metabolomic fingerprinting, identification of some markers has been conducted. In an organic fraction, triacylglycerols were the main group of identified analytes, while in an aqueous fraction, predominantly organic acids, amino acids and sugars were identified. Samples were classified using sophisticated chemometric tools like Principal component analysis (PCA) and Partial least squares-Discriminant analysis (PLS-DA). This research was carried out within the AuthenticFood project (FP7 ERA-Net project no. 249667, CORE Organic II).

**Key words:** tomatoes, wheat, organic and conventional production, DART-MS, metabolomic fingerprinting

**Acknowledgement:** *This study was partially supported by Ministry of Agriculture of the Czech Republic.*



**SESSION D:**  
**Systemic View on**  
**Food and Health**  
**(D 1–D 4)**



## D 1 HEALTH, WELLNESS AND ORGANIC DIETS

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The 1948 WHO definition of health suggests that health is more than the absence of disease and encompasses complete physical, mental and social well-being. While the concept of wellness is still evolving, it is generally agreed that wellness is holistic and multidimensional and involves a balance between all aspects of life that includes individuals, communities, organisations and the environment. Similarly, organic agriculture is a holistic practice that recognises the inter-relatedness of systems and works with natural cycles to restore and maintain balance in a precautionary rather than reactionary or suppressive way.

While medical science often takes a narrower view of health, as simply the absence of disease, and scientific nutritionists view poor diets as a lack of nutrients, these views discount important social and psychological aspects. Well publicised reviews of the health benefits of organic food that focus on nutritional content and claim inconclusive evidence for the health benefits of organic food are therefore missing the point and this is evident from the results of the Australian Organic Health and Wellness Survey.

Respondents from this survey reported numerous perceived benefits from consuming organic food, only a few of which involve the absence of disease. These indicators; including improved disease resistance, energy, cognition and mood as well as rating higher on the Personal Wellbeing Index than the general population; especially with regard to community connectedness, sense of safety and future security. Respondents also commonly reiterated the psychological benefits that are derived from purchasing products that they believe reflect their values.

These results suggest that the benefits of organic food consumption go far beyond any direct benefits from additional nutrients or even the benefits associated with a reduced intake of pesticides, genetically modified organisms, artificial hormones antibiotic resistant bacteria or food additives. When assessing the benefits to consumers from purchasing organic food the full spectrum of social, environmental and psychological benefits should be considered and thus it is imperative that researchers adopt a 'wellness paradigm' rather than perpetuating the current model where the benefits of organics are largely confined to the narrow microscope of reductionist 'nutritionism'.

**Key words:** organic diets, wellness, health

**Acknowledgement:** *Lucy van de Vijver, for her assistance with the development of the Organic Health and Wellness Survey.*

## D 2

**EFFECT OF LAYING HENS' DIET SUPPLEMENTATION ON PHYSICAL EGG PARAMETERS IN THE CONTEXT OF ANOVA AND MULTIDIMENSIONAL STATISTICS METHODS****M. Oziębłowski<sup>1\*</sup>, B. Kosmalski<sup>1</sup>, B. Jarosz<sup>2</sup>, A. Kowalska<sup>3</sup> & M. Korzeniowska<sup>1</sup>**<sup>1</sup>Department of Animal Products Technology and Quality Management, Wrocław University of Environmental and Life Sciences, Wrocław, Poland<sup>2</sup>Department of Chemistry, Wrocław University of Environmental and Life Sciences, Wrocław, Poland<sup>3</sup>Wrocław Technological Park, Wrocław, Poland

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The aim of the study was investigation of laying hens' diet supplementation on physical egg parameters where not only classical ANOVA analysis took place, but also selected multidimensional statistics methods were considered as a potential tool for cheap classification of unknown egg raw material into existing product clusters. Samples of eggs, delivered by 'Tronina' firm, were derived from two main groups of hens: organic Greenleg Partridge (GP) and non-organic Lohmann Brown (LB). There were 2 investigated group for Greenleg Partridge (control and enriched) and 6 group for Lohmann Brown (control and enriched for three different seasons: spring, summer and autumn). Experimental diets contained standard feed enriched with *Humokarbomit* and *Humobentofent* mix, 1.5% of linseed oil and 1% of fish oil, but the diet of the control groups did not contain these components. The control layer hens were fed with standard feed. The next physical egg parameters were analyzed (n = 30 for each of 8 treatment groups) and average results were obtained: egg mass (GP: 54.7–60.6 g; LB: 56.1–69.9 g), egg length (GP: 5.62–5.85 cm; LB: 5.53–5.91 cm), egg width (GP: 4.26–4.39 cm; LB: 4.32–4.70 cm), shell mass (GP: 6.45–6.61 g; LB: 7.14–9.06 g), thick albumen length (GP: 8.73–10.84 cm; LB: 8.13–9.77 cm), thick albumen width (GP: 6.79–8.82 cm; LB: 6.87–8.54 cm), thick albumen height (GP: 3.82–5.43 mm; LB: 5.94–7.83 mm), Haugh units (GP: 50.4–74.0 [-]; LB: 74.5–85.6 [-]), yolk mass (GP: 17.3–19.1 g; LB: 13.6–18.1 g), yolk height (GP: 19.1–19.5 mm; LB: 17.0–19.6 mm), yolk color (GP: 11.9–12.4 [-]; LB: 9.7–13.3 [-]) and yolk length/width ratio (GP: 3.95–4.05 [-]; LB: 3.59–4.20 [-]).

It was found that all 12 investigated physical parameters differ statistically significant according to ANOVA and Duncan test. The next multidimensional test were also conducted: cluster analysis (CA), multidimensional scaling (MS), principal component analysis (PCA). All egg physical parameters were included into multidimensional calculations and standardized. Distance matrix was created for CA&MS calculations, as well as created correlation matrix was used in PCA methods. Obtained clusters in all methods (CA, MS and PCA) were compared and analyzed both for variables and individual scores describing each egg parameters. Example of 4 clusters of variables obtained in CA Ward method were: 1) egg mass, egg width, shell mass; 2) yolk length/width ratio, yolk mass, yolk color, egg length, yolk height; 3) thick albumen length and width; 4) thick albumen height, Haugh units. Similar clusters were created also for all experimental groups of organic and non-organic eggs. It was stated that multidimensional methods can be very helpful in detailed egg raw material characteristics, especially in the context of correct classification of unknown material into existing egg product clusters only on the base of cheap physical egg parameters measurements.

**Key words:** egg quality, Lohmann Brown, Greenleg Partridge, supplementation, multidimensional tests



### D 3

## DISPUTED HEALTH? A COMPARISON OF AUSTRIAN ORGANIC AND NON-ORGANIC FARMERS' HEALTH BELIEFS AND PRACTICES, AND THEIR UNDERLYING VALUES

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This study examines the hypothesis that organic and non-organic farmers in Austria have different health beliefs, which constitute separate cultural models. Evidence from cognitive anthropology suggests that mental models of health affect individuals' health seeking behaviours. Farming affects human and environmental health through agricultural practices, and many farmers have adopted a range of health seeking farming and non-farming practices, including conversion to organic. However, these farmers are in the minority (in the industrialised world), and this may be due to different worldviews. Little research has been carried out identifying what health beliefs and practices individuals within these groups hold, or to what extent these beliefs constitute culturally cohesive models of health. Using methods from cognitive anthropology, this study seeks to identify the similarities and differences in health beliefs and practices within and across the populations of organic and non-organic farmers in Lower Austria. Results will include an empirical basis for detailing organic and conventional health models. These models, and their links to practices help increase understanding of how health promotion through farming styles may be achieved. The study will also serve as a basis for further research into sources of health beliefs in farming communities, and stereotyping between organic and conventional farmers.

**Key words:** health, organic, farming, mental models, cognitive anthropology

## D 4 COMPARISON STUDY OF THE HEALTH-BENEFICIAL AND TECHNOLOGICAL USEFULNESS OF MILK PRODUCED AT ORGANIC AND CONVENTIONAL FARMS IN POLISH MAZOVIA REGION

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The aim of the study was a comparison of the nutritional value and technological parameters of the milk selected from organic and conventional farms (with TMR diet) in Poland. The study was carried out at 20 farms in summer and winter feeding season from 2009 to 2012 years. Totally 2400 of milk samples were collected. The major criterions of choosing organic farms to the experiment were as follows: obtaining certificate for at least 10 years and abidance of the organic farming standards, possessing a herd of Black and White Polish Holstein-Friesian breed only counting minimum 30 cows. Selected farms were located in Mazovia region, in close neighborhood (in radius of about 10 km) to provide comparable climate and soil conditions.

Cows from conventional farms characterized themselves by higher yield if compared to organic ones (24.5 kg/day vs. 15.6 kg/day). Cytological quality of the milk was slightly better in organic farms.

The milk from organic cows had significantly higher concentration of the most health-promoting compounds, including nearly doubled level of CLA9 (1.040 g/100 g of fat). However, milk from conventional herds was more suitable as raw material for dairy industry with better technological parameters, especially higher protein/casein ratio and as well as density.

In both organic and conventional farms milk from cows grazed on pastures were characterized by significant higher concentration of health-beneficial compounds if compared to TMR diet. The lowest level of SFA (58.455 g/100 g of fat) and the highest of functional fatty acids (36.105 g/100 g of fat) and PUFA (5.204 g/100 g of fat), as well as D<sub>3</sub> vitamin (15.390 µg/l) and α-tokoferol (1.950 mg/l), was reported when cows were fed *ad libitum* on pasture. Optimal profile of fatty acids was observed in milk of grazed organic cows. Additionally statistical analysis confirmed that milk from organic farm cows had significant lower AI and TI index during both season if compared to the conventional. Differences of concentration of major whey protein (β-LG and α-LA) were not significant, but casein level was significant higher in milk from cows feeding TMR diet.

Milk produced by organic farms can be valuable source of easily digestible health-beneficial nutrients for demanding consumers.

**Key words:** organic milk, nutrient value, PUFA, CLA, AI, TI, casein, whey protein

**Acknowledgement:** Research was supported by the Ministry of Science and Higher Education and realized within the project NN 311 320 135 entitled 'Bioactive components and technological parameters of milk produced at ecological and conventional farms'.

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