



QualityLowInputFood

SEMINAR

Measuring food quality: concepts, methods and challenges

Monday 12th, Tuesday 13th and Wednesday 14th of February 2007
At the Louis Bolk Institute, Netherlands

Organised by

Lucy P.L. van de Vijver, PhD
Program Leader Food Quality and Health



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Abstract

3rd QLIF training and exchange workshop “Measuring food quality: concepts, methods and challenges”

From 12 to 14 February, the Louis Bolk Instituut organised the 3rd annual QLIF workshop, titled “Measuring food quality, concepts, methods and challenges”. During these days a diverse and intensive program was presented. Participants came from, Belgium, Bulgaria, Germany, Greece, Hungary, Macedonia, Poland, Turkey. Participants were all very enthusiastic, both on the quality of the presentations and the total program. For all those of you who missed it, I give a brief impression.

On the first day definitions of food quality were discussed as well as the methods to measure this quality. Machteld Huber explained the inner quality concept, developed by the Louis Bolk Instituut. This inner quality concept is based on two main life processes in organisms; Growth and Differentiation and the balance or integration of these two processes. This in contrast to many other quality definitions based on the presence or absence of substances. Analytical methods for measuring food quality (measuring substances) and experimental methods (e.g. crystallisation, biofotons) measuring life processes were discussed. After the theoretical part, participants had the opportunity to work with biocrystallisation pictures and to visit the crystallisation laboratory.

The second day started with a visit to one of the largest organic greenhouses in the Netherlands. The farmer grows tomatoes and paprika on a contract basis. Recently he started with a speciality in tomatoes, the Wild Wonders, a mixture of different shaped and coloured tomatoes. The greenhouse therefore gave a good view on the combination of ‘volume’ production and quality growing.

In the afternoon, Jacob Holm Nielsen gave us a very interesting insight into the QLIF studies on organic and low input dairy. The type of feed showed to be very important for the milk composition and he emphasized that for organic high-quality dairy, maize can better be avoided as part of the feeding regime.

Joke Bloksma presented the studies performed on lettuce, apple and carrot quality and how management factors (for apple, the bearing of the tree, sun light, ripening etc) influenced the quality of the products. Finally Gabriele Wyss from FIBL gave a presentation on food safety and food risks in organic production. She explained that many food safety aspects and food risks in organic are covered by conventional safety regulations and additional rules for organic farming. Because of the precautionary principles in organic food production the product safety and process safety tends to be higher in organic than in conventional. At the end of the day 4 participants presented their own research. This gave a broad view on different studies in the field of food quality and it gave rise to many questions and suggestions from other participants.

The 3rd day taste and health were the main topics. Organic food might have a better taste than conventional, but how do we measure taste. Bob Cramwinckel of the Centre for Taste Research explained their 3-steps method to measure physical, psychological and total taste. Last presentation was given by Ruth Adriaansen on how we can study health effects of organic food. The necessity of a clear working definition of health showed to be very important for the design of a study, the choice of parameters and the effects to be studied. As an example, the study design of “Organic, more healthy ??”, the large feeding study in chicken, currently being performed by the Louis Bolk Instituut, was discussed.

According to one of the scientific contributors the program “gave a great insight in the discussion going on in the field of organic food quality”.

The overall conclusion was that for the evaluation of food quality you have to take much more aspects into account than nutritional content and contaminants only. An enlarged or holistic quality concept is needed to cover the ambitions of organic food production. Challenge is to further develop such concepts and to design robust scientific studies which account for all relevant quality aspects..

Next QLIF workshop

From 13 to 15 February 2008, the Louis Bolk Instituut will organise the 4th workshop, focussing on the relation between farm nitrogen management and food quality and the instruments at farm level to improve nitrogen management. We strongly encourage you and your (junior) colleagues to join.



Introduction

One of the reasons for consumers to buy organic foods is the idea that organic foods have a higher quality. This quality is defined differently by different consumers and is defined for instance as less pesticides, more healthy or more tasteful. Also within the organic community no clear and widely accepted norm for good quality is available at the moment. In this workshop we will give attention to different aspects of food quality. A concept of good quality, how different quality aspects can be measured, but also the gaps in our knowledge and the challenges that we face in achieving a guaranteed high quality of organic food produce will be discussed.

As part of the EU-programme Quality of Low Input Food (QLIF; see [www.qlif.org](http://www qlif.org)) a meeting is organised for researchers with as topic food quality and the association between food quality and health.

The training is organised by the Louis Bolk Instituut, the independent research institute for organic agriculture, nutrition and healthcare. Within the QLIF project two earlier meetings were organised by the Louis Bolk Instituut. The previous workshops were on "Healthy Soil, Healthy Crops, Healthy People" (2-4 February 2005) and "Towards animal oriented rearing methods in organic production systems" (20-22 February 2006). The theme of this 3rd workshop is "Measuring food quality: concepts, methods, and challenges".

The aims of the meeting are:

1. Getting familiar with the concept of food quality, the methods to measure it and the challenges that we face to achieve high quality of organic food.
2. Draw up a scientific framework for studies in this area
3. Exchange of ongoing research
4. Indicate future research needs and challenges

Goals

The goals of the workshop are as follows:

- Highlight the importance of food quality, the methods for measurement and the scientific background
- Get insight in different definitions of food quality.
- Exchange ongoing research
- Exchange of views and experiences
- Compare research findings to farmers' practice
- Get insight into the problems and challenges for research on food quality and research into the association between food quality and health.

Programme

Measuring food quality: concepts, methods and challenges

Monday 12 February

- 13.00 Arrival and registration
- 13.30 *Welcome*
- 13.45 *Introduction Food Quality and Health - is organic better ?*
Dr. L.P.L. van de Vijver, program Leader Food Quality and Health, Louis Bolk Institute
- 14.30 *Inner quality concept – IQC*
M. Huber, MD, Senior scientist Food Quality and Health, Louis Bolk Institute
- 15.30 Tea Break
- Parameters of Quality*
- 16.00 *Conventional parameters of food quality*
Dr. L.P.L. van de Vijver,
- 16.30 *Holistic (picture forming) methods for measuring quality ?*
P. Doesburg, Louis Bolk Instituut
- 17.45 Discussion on methods

Conference Dinner

Tuesday 13 February

- 8.00 Food Quality for Organic Food Producers
Field visit - organic green house Frank de Koning, Tinte
- 12.00 Lunch break
- 13.00 *Organic milk quality*
J.H. Nielsen, Senior Researcher DARCOF

- 14.00 *Food safety and food risks*
Dr. G. Wyss, Group Leader of the Division Food Quality and Safety, FIBL
- 15.00 Tea Break
- 15.15 *Quality in Fruit and vegetables*
J. Bloksma, Louis Bolk Instituut
- 16.00 *Presentation of participants' research*
- 17.30 End of second day

Wednesday 14 February

- 9.00 *Taste as a quality criterion*
B.Cramwinckel, Centre for Taste Research
- 10.00 *Health aspects: relation between of organic food intake and immunologic parameters*
R. Adriaansen, Msc, Researcher Louis Bolk Instituut
- 11.00 Coffee break
- 11.30 *Final session: conclusions and main findings, indicate future research needs and priorities*
- 12.30 Lunch and departure

Scientific Contributors

3th QLIF workshop "Measuring food quality: concepts, methods and challenges"
Driebergen 12,13,14 February 2007

Name	Institute + address	contact
Ruth Adriaansen-Tennekes, MSc	Louis Bolk Instituut Hoofdstraat 24 3972 LA Driebergen Netherlands	e-mail: r.adriaansen@louisbolk.nl phone: +31 (0)343 523860 <i>www.louisbolk.org</i>
Joke Bloksma, MSc	Louis Bolk Instituut Hoofdstraat 24 3972 LA Driebergen Netherlands	e-mail: J.Bloksma@Louisbolk.nl phone: +31 (0)343 523860 <i>www.louisbolk.org</i>
Bob Cramwinckel, PhD	CSO, Centre for Taste Research Agro Businesspark 34 6708 PW Wageningen Netherlands	e-mail: info@smaakonderzoek.nl phone: +31 (0)317 479634 <i>www.smaakonderzoek.nl</i>
Paul Doesburg, BSc	Louis Bolk Instituut Hoofdstraat 24 3972 LA Driebergen Netherlands	e-mail: P.Doesburg@louisbolk.nl phone: +31 (0)343 523860 <i>www.louisbolk.org</i>
Machteld Huber, MD	Louis Bolk Instituut Hoofdstraat 24 3972 LA Driebergen Netherlands	e-mail: M.Huber@louisbolk.nl phone: +31 (0)343 523876 <i>www.louisbolk.org</i>
Jacob H. Nielsen, PhD	Aarhus University Faculty of agricultural sciences P.O. Box 50, 8830 Tjele Denmark	e-mail: Jacobh.nielsen@agrsci.dk phone: +45 8999 1163 <i>www.agrsci.dk</i>
Lucy P.L. van de Vijver, PhD	Louis Bolk Instituut Hoofdstraat 24 3972 LA Driebergen Netherlands	e-mail: L.vandeVijver@Louisbolk.nl phone: +31 (0)343 523872 <i>www.louisbolk.org</i>
Gabriela S. Wyss, PhD	Head of Unit Food Quality and Safety Research Institute of Organic Agriculture Ackerstrasse, Postfach CH-5070 Frick Schwitzerland	e-mail: gabriela.wyss@fibl.org phone: +41 (0)62 865 72 45 <i>www.fibl.org</i>

Participants

3th QLIF workshop "Measuring food quality: concepts, methods and challenges"
Driebergen 12,13,14 February 2007

Name	Institute + address	contact
Anna Divéky-Ertsey	Corvinus University of Budapest, Faculty of Horticultural Sciences, Dept. Of Ecological and Sustainable Farming Systems Budapest, 1118, Villányi út 29-43 Hungary	anna.ertsey@uni-corvinus.hu phone: +36-1-482-6235
Christine Hoefkens	Ghent University Faculty of Bioscience Engineering Department of Food Safety and Food Quality Research Group Food Chemistry and Human Nutrition Coupure Links 653 B-9000 Gent Belgium	Christine.Hoefkens@UGent.be phone: +32-(0)9 264 99 03
Sonya Ivanova-Peneva	Agricultural Institute 3 Simeon veliki blvd 9700 Shumen Bulgaria	ivanovapeneva@yahoo.com phone: +359 54 830 448; fax: +359 54 830 455 GSM: +359 888089236
Daniel Kusche	Universität Kassel Fachbereich Ökologische Agrarwissenschaften Fachgebiet Biologisch Dynamische Landwirtschaft Nordbahnhofstr. 1a, 37213 Witzenhausen Germany	daniel.kusche@uni-kassel.de phone: 0049- (0)5542- 981622 fax.: 0049- (0)5542-981609
Silvana Manasievska	Faculty of Agricultural Sciences and Food "Ss. Cyril and Methodius" University Blvd. Aleksandar Makedonski bb, 1000 Skopje Macedonia	silvanam@zf.ukim.edu.mk smanasievska28@yahoo.com phone: +389-2-3115277 ext. 124 fax: +389 2 3134310
Gultekin Ozdemir	Dicle University, Faculty of Agriculture, Department of Horticulture 21280-Diyarbakir Turkey	tekin@dicle.edu.tr phone: 0090532545072
Abdullah Sessiz	Dicle University, Faculty of Agriculture, Department of Machinery 21280-Diyarbakir Turkey	asesiz@dicle.edu.tr phone: 00905325055735

Name	Institute + address	contact
Malgorzata Sikora	Faculty of Human Nutrition and Consumer Sciences 02-776 Warszawa, Nowoursynowska 159c Poland	malgorzata_sikora@sggw.pl. phone: 48225937038 GSM: 0-698-878-430
Dr. Tahsin Sogut	Dicle University, Faculty of Agriculture, Department of Field Crops 21280-Diyarbakir Turkey	tsogut@dicle.edu.tr phone: 00905323126
Marsela Vaska	Mediterranean Agronomic Institute of Chania Greece	Marsela82@yahoo.com phone: 306998154387
Katarzyna Wisniewska	Faculty of Human Nutrition and Consumer Sciences 02-776 Warszawa, Nowoursynowska 159c Poland	kasiacherry@op.pl phone: 48 22 59 37 0 23 GSM: 0677882208

1 - Introduction Food Quality and Health - is organic better ?

Dr. L.P.L. van de Vijver, program Leader Food Quality and Health, Louis Bolk Institute

"The health of soil, plant, animal and man is one and indivisible". With this statement lady Eve Balfour (1943) indicated that there is a relation between the health of the soil, the plant products, the animals, the food and finally the human health. This thinking is very known in organic agriculture, however, when we look at the scientific evidence, we can only notice that insufficient scientific evidence exist to support the idea that a healthy soil leads to healthy products and finally to healthy men.

Based on the literature we conclude that you can say that on average organic dairy products contain a higher amount of good fatty acids (omega 3 and CLA), organic leaf vegetables have a higher vitamin C content, organic fruit and vegetables contain more antioxidants and that organic products have a higher dry matter content, resulting in relative more nutrients per portion (Heaton, 2001; Huber, 2006). Further, more recent work showed that with respect to mycotoxins and bacteria organic foods were equally good or slightly better than conventional (Van de Vijver, 2006). Though some differences between the cultivation systems exist when looking at a mean level, it is also clear that a huge variation in nutrient content exist between the products of the same cultivation system. When we aim at a high quality organic food, it is important to get insight in those factors influencing the quality of these products. When doing a comparison study it is therefore advisable to collect the products for the comparison on the farm, instead of in the shop. Information on e.g. managing factors, soil type and cultivar can then be collected. These information gives insight in the factors influencing the quality of the product and can be used to advice farmers in a further improvement of the production of organic food. Organic products have the potential to be of (very) good quality, only not all products do reach this quality at the moment. With well designed studies we can help organic farming in a further improvement of the quality.

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2- Inner quality concept – IQC

M. Huber, MD, Senior scientist Food Quality and Health, Louis Bolk Institute

Consumers expect organic producers to provide healthy and tasty products. But which qualities enhance health, and what is tasty? And how can all this be realised by crop or stock management?

In the conventional vision, product quality is mainly based on external, nutritive and sensory properties and is strongly directed by traders and trends. Besides tastiness and ripeness, organic consumers expect products to have properties such as 'vitality' and 'coherence', which are not easy to define and thus to explain and transfer.

In the past, experimental parameters have been proposed to estimate 'vitality' and 'coherence', but they were neither scientifically validated nor related to a validated quality concept with a relation to human health.

A quality concept which matches the expectations of the organic consumer with the organic view on agricultural production and human health was developed on the basis of two apple studies (Bloksma et al. 2001, 2004) and a carrot study (Northolt et al. 2004). The new quality concept is based on the life processes of growth and differentiation, and their integration (Bloksma and Huber, 2002). These life processes can be defined in plant physiological terms to link the concept to generally accepted science. Growth and differentiation (including ripening) are familiar processes for organic producers. A balance of growth and differentiation is important to obtain maximum quality. Farmers are aware that effective management of these processes is necessary to obtain a crop with higher resistance (against stress, pests and diseases) and a product with better taste and keeping quality and which may also be better for human health.

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- Northolt M, G J van der Burgt, T Buisman and A Vanden Bogaerde (2004), '*Parameters for carrot quality and the development of the Inner Quality Concept*', publication FQH 04, Driebergen, Louis Bolk Instituut,

3- Conventional parameters of food quality

Dr. L.P.L. van de Vijver, program leader Food Quality and Health, Louis Bolk Instituut

What is good food quality and how do we measure it? This are important questions without one clear answer. People have different definitions for food quality. Food quality can be looked at from different points of view; safety, nutritive, contributing to health, taste full, appearances, easy to process. The selection of parameters is depending on the definition of food quality.

Looks, firmness and shelf life are valuable "outside" parameters. "Inside" parameters are taste and analytical measurements. When food safety is of major concern, pesticide residues, mycotoxins levels, amount of heavy metals, dioxins, micro-organism can be measured.

Often food quality is also related to specific health promoting substances. Specific foods are expected to have health promoting effects through the presence of these specific nutrients. An overview of nutrients, their important sources and the association of these nutrients with disease outcomes are presented.

4- Holistic (picture forming) methods for measuring quality ?

Paul Doesburg, Bsc, researcher Louis Bolk Instituut (p.doesburg@louisbolk.nl)

Holistic methods for measuring the quality of food products are developed from the point of view that living organisms contain an 'inner structure' besides the compounds constituting the organism. This 'inner structure' is believed to be connected to the growth (i.e. farming system) and development of the organism. Different holistic methods are regarded to reflect this 'inner structure'.

The Louis Bolk Institute participates within the international Triangle network in the standardisation and validation of the biocrystallisation method; a so called (holistic) picture forming method. Parallel to this work the Steigbild or Capillary dynamolysis method, a second picture forming method, is standardised too.

Crystallisations are obtained by mixing a water soluble fraction (juice or extract) of a food product with copper chloride. This mixture is allowed to evaporate and finally crystallise under controlled conditions. Reference series show a clear correlation between certain aspects of the crystallisation images and the way the product was grown.

The standardisation of the method entails developing standardised crystallisation chambers, procedures and evaluation tools. The evaluation tools consist of computerised image analysis tools and a visual evaluation tool.

The computerised image analysis tools increase the objectiveness of the method and allow the analysis of large numbers of crystallisation images. The currently applied texture analysis tool evaluates the images on their pixel grey-level distribution (a textural approach). As the crystallisation method yields images with a clear structure, attempts are being made to develop a structure analysis tool with criteria that resemble the visual evaluation criteria.

The visual evaluation is developed according to the ISO standards used for sensory analysis. In this way, 14 textural and structural morphological criteria have been developed and validated.

At the Louis Bolk Institute, the visual evaluation is connected to the *Inner Quality Concept*. This concept is based on the universal life-processes Growth and Differentiation and the balance or Integration between these processes. A crystallisation is regarded to relate to good product quality when the characteristics of both life-processes are sufficiently present in the crystallisation and are found in a balanced manner (Integration).

Discussion on methods:

Question: Crystallisation method is not scientifically accepted. Is it wise to use this method?

Answer: The crystallisation method is in a process of validation, taken into account all necessary steps for a scientific validation.

From our experience the crystallisation method shows insights which can not directly be distracted from the analytical data. Therefore, the method, like other holistic methods can be a valuable method complementary to existing analytical methods.

5- Organic milk quality

J.H. Nielsen, Senior Researcher Aarhus University

Trends in consumer patterns show that consumers are willing to pay an excess price for special milk types.

The introduction of new milk types from a certain region, a certain cattle breed or based on a certain production form is given a lot of attention at present. Furthermore, several countries focus on production of milk with a modified fatty acid composition with either a high CLA (conjugated linolic acid) content or an increased content of omega-3 fatty acids, which are associated with prevention of cardiovascular diseases. Feeding different diets makes it possible to produce differentiated milk, and especially roughage seems to play a significant role in this. Through recent years the use of corn in diets for conventional milk production has strongly increased, and in many dairy herds the cows are fed a diet with considerable amounts of corn silage all the year round. This affects the composition and taste of the milk. Corn silage contains a low level of vitamin E and carotenoids, which means that milk from dairy cows fed corn also has a low content of these potential antioxidants. Moreover, corn contains a low level of the omega-3 fatty acid α -linolic acid, which means that milk from cows fed a corn-based diet also will be low on this fatty acid compared with milk from grazing cows or cows given grass silage, where the α -linolic acid content is considerably higher. Grazing thus results in an artificial relationship between omega-3 and omega-6 fatty acids. Feeding with corn silage gives the milk a sweetish and creamy taste with a faint taste of cornflakes.

A basis for production of milk with different compositions or tastes based on the use of different types of roughage is thus established.

6- Food Safety and Food Risks

Gabriela S. Wyss, Research Institute of Organic Agriculture (FiBL), Switzerland

Health and safety considerations are among the most important incentives for buying organic food. Public worries about food safety relate mainly to the different specific problems that have been encountered in Europe. These include e.g. the discovery of animals with BSE, large amounts of pesticides, antibiotics and food additives in food, the presence of toxic fungi in stored fruits or GMO-polluted food products.

The definitions of organic production methods are based on ecological, precautionary and cyclical principles. Plants and animals must be allowed to grow and live according to their needs, handling and processing must be carried out with special care and attention using gentle and often traditional methods, so the use of most pesticides, additives and animal medicines is prohibited or very restricted. Special rules are established for the production such as spatial separation and complete documentation and control of produce flow (traceability) to ensure compliance with these principles, and all producers and processors must be subject to control from certifying bodies, so this compliance can be documented. Food safety in organic agriculture should be seen from an holistic point of view which relates food safety to the safety / security of the production system (Hansen et al., 2002). Both national and EU regulation of organic farming is meant to secure high level of food safety due to (a) lower impacts on the environment, and (b) the provision of more information through the labelling of organic food. Consumer influence is an integral part of food safety. Trustworthy and adequate information is a way to minimise risk. A prerequisite for using labelling is the fact that consumer recognise, understand and trust the label. This holds for organic because there is a well established control system with clearly defined rules for production methods and the labelling of certified products.

There are many effects of regulation that affects organic plant and animal production such as e.g. a ban on synthetic pesticides, mineral fertilisers, genetic engineering and GMO's as well as restrictions on animal feeds or double retention time after medicine treatment.

The lecture will highlight facts, potential risks and improving measures by means of three examples of food safety topics such as chemical contaminations (pesticides and dioxin) and fungal contaminations (mycotoxins).

It can be followed that the low levels of pesticides sometimes detected in organic foods, in the range of a few micrograms per kilogram, do not harm human health but might represent an image problem. There is an ongoing discussion among the organic sector, trade and official food control authorities which level of contaminations can still be accepted as organic. However, the risk for pesticide contamination is very small in comparison with conventional foods.

Dioxins in organic eggs may be from spoiled fodder or from contaminated soil and grass in the chicken run in close vicinity of industrial sites. The EU follows the strategy to lower the presence of dioxins in foods by the determination of MRL's accepting that there is an overall background contamination in organic as well as in conventional foods.

Mycotoxins represent major contamination sources in all farming systems. A well maintained quality assurance needs to be established on occurrence, detection and prevention independent on organic or conventional farming systems. Studies have shown that conventional samples of food contained mycotoxins about 50% more frequently than the organic samples in a set of comparison studies.

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7- Quality in fruit and vegetables

Joke Bloksma, Louis Bolk Instituut alsoon behalf of Geert-Jan van den Burgt, Paul Doesburg, Machteld Huber, Pieterjans Jansonius, Lucy van de Vijver, Marleen Zanen.

At the Louis Bolk Instituut a concept of Quality was developed. For the validation of the concept several studies were executed in both fruit and vegetables. The practical meaning of the Inner Quality Concept is explained by these experiments on leaf lettuce, apple and carrot. Afterwards the used quality parameters for crop and product are categorized as growth, differentiation or integration parameters.

To learn about the influence of a specific cultivation factor for quality and to find optimal growth/differentiation in the cultivation practices, the experimental design must have:

- only 1 factor changing in one series, all other factors stay equal.
- 5 levels of this factor will give a better chance of the desired optimum and of finding significant results.

'Organic production' as such does not guarantee a high inner quality! Cultivation determines inner quality: good balance between growth and differentiation.

For the current practice in organic growing two warnings are made:

- Be careful to speed up growth rate to increase production. This often results in less taste, less colour, less storage quality, more pests and diseases.
- Be careful to harvest earlier to have more handling time between field and consumer, this results in less aroma.

In the table the results of the studies are presented. For the different crops several cultivation determinants are influenced during growing. In the table the influence of this determinant on parameters of growth, differentiation and/or integration is indicated.

crop	harvest	series in	Growth	Differentiation	Integration
Lettuce	1991	High-tech versus organic	??	??	??
Apple Elstar	2000	bearing (= yield, 5x)	??		
		sunlight (3x)	?	??	?
		ripening (5 harvest dates)	?	??	
		post-harvest ageing (5x)	??		?
Apple Elstar	2002	nutrients (5x)	??	?	
		compost/ comm.fert. (2x)			??
Carrot Rodelika	2003	nutrients (3x)	??	?	
		sunlight (3x, shade nets)	?	??	?
		ripening (3 harvest dates)	?	??	

Conclusion:

From these studies it showed that determinants of quality can be related to cultivation determinants and that these aspects can be related to the Inner Quality Concept as was developed by the Louis Bolk Instituut.

8- New developments in taste research

Bob Cramwinckel – Center for Taste Research, Wageningen

The two main disciplines of taste research are:

1. Analytical research: to find out taste differences between products,
2. Consumer research: to find out the preferences of consumers.

A new sensory discipline is coming up. It combines the analytical and the consumer research and it includes the influence of packaging on the taste perception. The main reason for this new development is the learning that taste is a holistic experience. A change in packaging design implies a change of the taste impression. That means that taste is not a rigid construction. It is comparable with a spider web: a flexible form.

The 3-taste model combines the advantages of the analytical and the consumer research. Research with this model shows possible influences of brand name and packaging on the taste perception.

Therefore, the experimental design of the 3-taste model is an effective tool to optimize the concept of a product by improving product properties and / or improving the design of the packaging and add values, with respect to the target group.



Discussion: What is the best way to perform taste tests, a university setting with white boxes or tables so that you can see other persons. Answer: both settings are possible. At the Center for Taste Research all tasters sit at a separate table in a room, thus able to see each other. Of main importance for a good taste test is that the panel is familiar with the product and like the product under investigation.. Persons who do not really like the product are not able to give a good opinion. Further, the tasters should be at ease and preferably can taste at their own pace.

9- Health Aspects. Relation between (organic) food intake and immunological parameters

Ruth Adriaansen-Tennekes, Louis Bolk Instituut, Driebergen

Health, what is health and how can we define it in such a manner that we can work with the definition in our research?

The current status of health research in relation to organic produce is reviewed. First it is important to have a clear definition on health. The WHO definition 'a state of complete physical, mental, and social well-being and not merely the absence of disease, or infirmity' summarizes all health aspects. But, it is very difficult to use this definition in health research.

During the presentation we will discuss how "health" can be defined and why we need to narrow our definition into a working definition of health.

As defining health already proves to be very difficult, there are more problems that occur in this type of research. Some difficulties are on the product level and some on the level of the definition of health. Thus far only few studies on organic food intake in relation to health have been performed. The problems and shortcomings of these studies are addressed. When health effects of organic food compared to conventional products is measured, it is important to have insight in for instance pesticide levels, mycotoxins levels, cultivars used and other potential confounding factors. It depends on the research question whether or not all these confounding factors need to be measured. But it is very important to be aware of them and to mention them. Further it is important to have a good working definition of health. Depending on this definition parameters of health can be chosen, and this parameter should also give an indication on health. When for instance IgG is measured and a high amount of IgG is found in one of the study groups, what does this mean with respect to health. Is this either good or bad?? If no conclusion with respect to health can be drawn, this parameter is not a good biomarker for health effects.

In the Netherlands an intervention study with chicken was executed. The study design of: "Organic, More Healthy?" is presented as an example of this type of research and the choices that have been made using working definitions for health as well as organic produce. For this study the immune system was chosen as an important parameter of health. Because the immune system is the main system under study, we choose chickens which were selected on immunological status (high responders/low responders) as animal model. The comparison between production systems is made, thus allowing for different cultivars and other differences existing between organic and conventional produce. However, we searched for ingredients from controlled systems, all ingredients were screened beforehand and we made a full analysis of ingredients before the producing of the feed. Our working definition of health "*Is there a difference in the development and functioning of the innate and adaptive immune systems of chicken fed with the two different feeds?*" resulted in the measurement of many immunological parameters. Thus, the research question plays a pivotal role in the choice of health parameters. At this moment the study is still being executed, results will come medio this year.

Conclusion: Within health research many dimensions play a role, making it very complex and expensive in execution and interpretation.

Discussion: For the comparison of health effects of organic and conventional food, do we always need to measure pesticides and compare the same cultivars, as these are important differences inherent to the organic or conventional system?

Answer: Whether you need to do so is depending on the research question. When comparing the systems, differences in cultivars can be accepted and pesticide differences might be accepted too. It is however good to know the amount of pesticides or other negative compounds in the products, so that you have a better understanding whether a potential health effect can be ascribed to a positive effect of the organic food or the negative effect of pesticides in conventional food. When you really want to compare the composition of the products, the same cultivars are needed, because a large diversity in vitamins, minerals and other compounds between cultivars exist. These differences between cultivars may be greater than the differences caused by the agricultural systems. Furthermore it is important to make all assumptions explicit, e.g. if the hypothesis is that organic is more healthy; is this because the assumption is that organic products are of better quality or because they lack pesticides?

10- Contribution of participants

Environmentally friendly products using in ecological tomato growing

Anna Divéky-Ertsey, Corvinus University of Budapest, Department of Ecological and Sustainable Farming Systems, Hungary

Goals

The aim of the 3 years experience is to elaborate using time tests and on reference fields new and in organic farming applicable, environmental friendly nutrients methods of growing vegetables. Further aim is to investigate the possible effect of immunity increasing conditioner which can increase the resistance against fungi. During the experiment the taste and nutritional value caused by different fertilization methods also will be analyzed.

Research question

Which one of the selected combinations have a positive effect on plant health? Are there any differences in inner quality of tomato fruit according to the different applied fertilization methods?

Methods

The different combinations of nutrients are used during organic field tomato growing. The materials used as nutrients are combinations of antagonistic fungi, bacteria, plant extracts.

Every treatment is carried out in six repetitions on 25 m² plots.

The rate of growing of plants, yield, state of health and inner quality of crop will be measured. Measuring method is a visual survey to assess the health condition of plant and fruit and inner quality will be examined in analytical laboratory.

Surplus Value of Organic Food and Farming

Joris Aertsens (project coordinator, Joris.aertsens@ugent.be), Koen Mondelaers, Guido Van Huylenbroeck, Christine Hoefkens (Christine.Hoefkens@ugent.be)

Abstract – This document presents a multidisciplinary research project concerning a possible surplus value for Organic Food and Farming (OFF). The project has started January 1st 2006 and ends November 30th 2007. By weighing results collected through a review of the literature it will be scientifically assessed whether or not OFF outperform conventional food and farming from a point of view of environment friendliness, nutritional value and safety. Net benefits for society will then be calculated indicating whether the present support given to OFF is at the optimal level. The scientific evidence will be compared with the perception of 400 Flemish consumers. Based on potential gaps between evidence and perception, combined with consumer characteristics, interesting suggestions for communication and promotion strategies concerning OFF will emerge.¹

A lot of studies mention that organic production is more environment friendly, especially on the basis of the prohibition of synthetic fertilizer and pesticides. The prohibition on these products directly reduces the risk of environmental contamination and contributes to a higher biodiversity which is observed on or close to organic fields. By means of a general and more detailed overview of the literature losses of nitrogen and phosphor and spread of pesticides are studied. Moreover for pesticides the comparison will be made specifically on the basis of an existing evaluation system for pest management resources (POCER). The impact on the environment will be also studied by means of life cycle analysis. Costs and benefits of organic product(ion) for the overall society are estimated. This leads to recommendations concerning the optimal level of support for organic agriculture.

This research of the potential surplus value of organic products for human health is focused on vegetables. A number of studies indicate that organic vegetables have a higher nutritional value, also there are indications for a surplus value concerning food safety. Within the framework of this project a literature overview will be made, but not in a traditional way. The collected data from the literature will be screened and weighed on their reliability and level of detail. In this way we create a much larger and powerful database.

Concerning nutritional value organic vegetables possibly score better on the level of vitamin c, carotenoids and polyphenoles. To this last group of components anti carcinogenous properties are assigned. Concerning food safety especially the residues (of pesticides and nitrates) and natural contaminants (mycotoxine alternariol) are relevant. Concerning microbiological safety there are possibly differences in the presence of pathogenic micro organisms such as Salmonella, Listeria and E. Coli.

By linking these data to a consumption database and using probabilistic techniques also the direct impact of the possible differences with regard to nutritional value and food safety between organic and conventional food for the consumer population is assessed (EU Scientific Steering Committee, 2000). The impact of government policy in promoting organic food on the intake of relevant feeding components can thus be calculated.

The following researchers at Ghent University, Belgium are involved in the project: Unit of "Agricultural Economics": Guido Van Huylenbroeck, Wim Verbeke, Joris Aertsens, Koen Mondelaers;; Unit of "Food safety and quality": John Van Camp, Bruno De Meulenaer, Frank Devlieghere, C. Hoefkens, K. Baert, I. Vandekinderen, I. Sioen; Unit of "Crop protection": Walter Steurbaut, S. Vergucht, E. De Backer; Faculty of Medicine: Stefaan De Henauw and the consumer organisation vzw VELT (Geert Gommers)

In a last part of the project the perception of the consumer is examined with respect to OFF. A lot of attention is given to the possible gap between consumer perception and scientific facts. The facts on nutritional value, environment friendliness and food safety as found in the first parts are compared with the perception. A potential surplus value of organic food is its taste. This research will provide insights concerning the information that can be communicated to the consumer. Also the sensitivities of consumers, and optimal media for communication are examined. Recommendations for future communication strategies are communicated.

Preliminary studies on the effect of herbs on the growth and health of suckling piglets, East Balkan Swine in Bulgaria

Sonya G. Ivanova-Peneva Agricultural institute, Shumen, Bulgaria

The aim of this study was to test the prophylactic and treatment effect of some herbs from Bulgaria on the growth and health of suckling piglets.

Materials and Methods

The duration of the experiment in the first trial was 40 days. 80 piglets from 8 litters in total were studied: - control group of 38 piglets from 4 sows (CP); - experimental group of 42 piglets from 4 sows (HP). Bulgarian herbs (*Origanum vulgare*, *Hypericum perforatum*, *Thumus*, *Mentha piperita*, *Teucrium polium*) in the first trial were used. The duration of the experiment in the second trial was 33 days. 113 piglets from 15 litters in total were involved: - control group of 41 piglets from 5 sows (CP); experimental group of 35 piglets from 5 sows, receiving additionally water with herbs (WP); - experimental group of 37 piglets from 5 sows, receiving additionally water with herbs (FP). Bulgarian herbs *Origanum vulgare* (white), produced by tissue cultivation at Agricultural Institute) and *Potentilla erecta* Raus.

Results and Discussion

In the first trial in 25 days in CP versus 11 days in pigs treated with herbs in the water (HP) were counted; percentage of mortality was 5,26% in CP vs. 2,38% in HP. In the second trail no mortality in CP, WP and FP was recorded. Score of diarrhea was at minimum level on the fourth and fifth week after birth in FP, middle was in WP during the whole suckling period and highest on the end of the third and fifth week in CP.

Conclusions

More studies, establishing the most effective combination of herbs, influencing positively growth and health in suckling piglets and then in weaning period are needed. Supplement of herbs in the water or in the fodder of suckling piglets improved growth and health status of piglets. Treatment of diarrhea in suckling piglets with *Potentilla* is an effective tool.

Association of Breeding, Preservation and Use of East Balkan Swine

East Balkan Swine is the only aborigine pig breed that is preserved in a natural pure condition.

Advantages: • good adaptation to the extreme conditions of the region; • robust constitution; • strongly expressed herd instinct; long life; • effective assimilation of natural feed resources • good sustainability to diseases; • meat of very high quality and taste.

Main range of distribution: East Stara planina (Balkan) and Strandzha.

Economic use: for meat and lard.

Volume of the population: about 3000.

Prospects for the breed: supporting selection

Phenotypic traits of the adult animals:

- Live weight: - boars 100-200 kg; sows 80-100 kg;
- Live-born piglets per litter 5-8 piglets;

Origin of the breed: Bulgaria

Method of development: mainly natural selection

Year of appearance: about 2500 years ago

Management of the breed: all-year grazing and additional feeding with concentrated fodder



Milk quality and health issues - Is there a quality potential of organic milk to prevent food intolerances and allergies?

MSc. Daniel Kusche, Department of Biodynamic Agriculture, Kassel University

Abstract

This research project is embedded in a larger interdisciplinary research project from the Department of biodynamic Agriculture which is focussed on the quality of organic milk and the main quality influencing factors. A combination of analytical and holistic methods will be used to assess the quality characteristic of cow (raw) milk from different origins. The ongoing research shows a high impact of management practices (feeding regime, pasture, region) on milk quality and composition (DE WIT et al 2006; ADRIAANSEN et al 2005; LEIBER 2005; DEWHURST et al 2003). The condition of an organic production system seems to benefit quality characteristics and health related milk compounds (f.i. CLA, Omega 3, Vitamins). Milk is still one of the most important nutritional sources especially in the nutrition of children but has today also become one of the major food allergens (MÜLLER...). What are the reasons for this development and are there any differences in the quality, composition and health related properties of milk from different origins and processing? Practice and single-cases report from a better digestibility of organic and biodynamic raw milk in case of food intolerances and allergies (SAHM 2006). In this trial organic milk will be tested in a double-blind placebo-controlled oral food challenge (DBPCOFC) versus milk from conventional origin in a clinical trial with children suffering from diverse allergic disorders. A monitoring of the farms and management factors and the accompanying analysis with classical analytical and holistic methods should reveal new insights in the production process of high quality milk and its effect on human health. In the following an introduction will be given, the research question and aim will be explained and the study design been described.

Quality of wheat and organic agriculture in Republic of Macedonia

Silvana Manasievska-Simic. Faculty of Agricultural Sciences and Food "Ss. Cyril and Methodius" University, Skopje

Wheat accounts for more than 20% of the total food calories consumed throughout the world and the greatest single source of protein in human diet. In Republic of Macedonia wheat production is based on domestic and some foreign cultivars. The natural and climatic conditions in Macedonia are favourable for the development of organic agriculture, especially in the mountain and semi-mountain regions. It is therefore possible to study a range of varieties which were recently developed through Macedonian breeding programmes for their suitability in organic, "low input" and conventional crop management systems. Production of organic seed is based on: resistant varieties, biological and agricultural techniques, some classical pesticides, plant and mineral oils, crop rotation, self regulation, etc.

One of the activities of our breeding program is creation of new cultivars of soft and durum wheat that are suitable for different environmental conditions and have a good quality and high yield. Quality is determined by the molecular structure of the storage proteins of wheat, which in turn, controls the interactions of the proteins during the bread-making process. Glutenins and the distribution of its subunits with different molecular weight are genetically controlled and independent of the environmental conditions. High molecular weight glutenins have crucial impact on the quality of flour and final wheat products. High molecular weight (HMW) glutenin subunits 2* and 5+10 are significantly positively related to wet gluten content, while subunits 2*, 7+9 and 5+10 are significantly positively related to bread loaf volume. Gliadins are generally considered to contribute to the viscosity and extensibility of gluten. The 1BL/1RS translocation has been widely used in bread wheat breeding programs, mainly because of the presence of genes for resistance genes, but is responsible for lowering the soft wheat technological quality by decreasing the Glu-1 value. In the Mediterranean areas, where durum wheat is traditionally grown, farmers are increasingly under pressure, to guarantee grain quality such as protein content. High quality pasta begins with good quality grain. Presence of γ gliadin 45 and HMW glutenins 6+8 in durum wheat is positively correlated with high pasta quality. In durum wheat protein content higher than 13% reported to yield a satisfactory final product, whereas protein content lower than 11% gave a very poor product. Wheat protein content appears to account for 30-40% of the variability in cooking quality.

Cultivars with positive HMW-GS and high Glu-1 score having acceptable end-use quality for milling and baking industry is an important objective in our breeding program. Results from our previous research illustrates that protein content in our investigated durum wheat cultivars was higher than 13 % and suggests that this new varieties will yield high quality products and presence of γ gliadin 45 was dominant. Presence of HMW glutenins 6+8 that is was positively associated with good quality was also observed in our domestic new durum wheat varieties. Soft wheat cultivars have mostly medium quality and Glu-1 score is 7. Allele d (subunit 5+10) from locus Glu-D1 related with high quality was present in several cultivars, Glu-1 score was high (9 or 10) and absence of rye translocation was observed. Wild representative *Triticum dicoccum* has unique subunits and can be used to improve wheat quality. Improvement of wheat quality can be advanced by crossing between cultivars with high or medium quality and utilization of wild relatives with good protein quality and resistance to diseases.

The main possibilities are to compare the performance such as yield and baking quality characteristics of different wheat varieties in different management systems (organic, "low input" and conventional) and in different rotation positions. Evaluation of the expression of Fusarium resistance/tolerance of different wheat varieties in different management systems (organic, "low

input" and conventional) in order to identify potential interactions between variety resistance/tolerance and production systems with respect to overall levels of Fusarium grain infection. Determination of the economic viability of different management systems (organic, "low input" and conventional) and varieties choice.

Organic agriculture is able to produce adequate supply of food with high quality, remove the ecological problems in agriculture and introduce wheat varieties with high quality and good resistance.



Evaluation of commodity, nutritive and sensoric value and storing quality of selected varieties of carrots and red beets from organic and conventional production system.

Malgorzata Sikora, Ph.D. student, Faculty of Human Nutrition and Consumer Sciences, Warsaw Agricultural University

The main aim of the work is to evaluate nutritive value of carrots and red beets. In carrots there will be carried out content analysis of dry matter, total sugars reducing sugars, vitamins (provitamin A, beta-carotene, lutein, vitamin C), free aminoacids, organic acids, fenolic acids, nitrates and nitrites. In red beets there will be carried out analysis of: dry matter, total sugars reducing sugars, vitamins (provitamin A, vitamin C, B₂), free aminoacids, organic acids anthocyanins, nitrates and nitrites. The next purpose is to estimate the storage quality and commodity value of the above-mentioned vegetables. The last analysis will concern culinary usefulness and sensory quality of carrots and red beets from organic and conventional production systems.

According to scientific literature we expect that carrots and red beets from organic produce will have more dense consistency because of the higher content of dry matter, phenolic aminoacids, total sugars, vitamins, as well as better sensory quality (more clear smell and taste), better conditions of storage and in a result - smaller mass waste caused by transpiration, rooting and decay process.

Evaluation of several parameters of reproductive physiology and behaviour of rats feed with organic versus conventional fodder. (title of Ph.D. thesis)

Katarzyna Wisniewska, Ph.D. student, Faculty of Human Nutrition and Consumer Sciences, Warsaw Agricultural University

The main purpose of the research is to analyse the influence of the long-term feeding with fodder from different agricultural systems (organic, low-input, conventional) on the chosen aspects of rats' reproductive physiology, behaviour and health state.

In the field of reproductive physiology we will compare the number of stillborn and live born offspring within the litter and the weight of newborn animals. We will evaluate the rat's sperm morphology to identify the percentage of normal spermatozoons.

The evaluation of the rats behaviour will be carried out on the basis of twenty-four-hour computer monitoring with infrared light emitted by diodes. We will assess the regularity of the diurnal rhythm and sleep patterns.

We estimate the food intake and weight growth in every analyzed group of rats (growth patterns). Post mortem we analyse the body composition: dry matter, fat, protein, and ash content in the carcass.

Field visit

On Tuesday morning a field visit was planned. The greenhouse of Frank de Koning in the neighbourhood of Rotterdam was visited. With 25.000 m² of tomatoes and paprika's is Frank one of the largest organic greenhouse growers in the Netherlands. The products are produced and sold on a contract to a large organic food distributor. Amount and cultivar are discussed with this distributor. Next to the large quantities of "normal" organic tomatoes, Frank also grows a speciality. Together with the distributor the "Wild Wonders" tomatoes were developed. These tomatoes are differently shaped and coloured and go to the market as a speciality. Specially selected on quality and because of their exclusiveness higher priced.

Frank explained how he manages aspects of food quality by water gift, thinning out, fertilization, protection against heat etc. In the management the balance between aspects of growth and differentiation are looked for.

According to the participants, the visit gave a good insight into organic agriculture in the Netherlands. However, this example of organic growing gave not the idealistic idea of organic growing of the optimal organic food quality.

Evaluation

From 12 to 14 February, the Louis Bolk Instituut organised the 3rd annual QLIF workshop, titled "Measuring food quality, concepts, methods and challenges". During these days a diverse and intensive program was presented. Participants came from, Belgium, Bulgaria, Germany, Greece, Hungary, Macedonia, Poland, Turkey. Participants were all very enthusiastic, both on the quality of the presentations and the total program.

The participants had a very diverse background. In the contributions a wide range of food quality aspects were addressed. Every participant therefore found presentations which were of specific interest for themselves. Because of the wide diversity of background knowledge, in depth discussion were more difficult.

For most participants it was clear that we do not have one definition of food quality. There are many aspects related to food quality. Therefore it is important to have a clear idea what your specific study question is (working definition), so that the matching parameters of food quality and, if applicable, parameters of health can be chosen. Participants were enthusiastic to know more about the picture forming methods (e.g. biocrystallisation) and their usability additive to more conventional analytical parameters.

Some quotes of the participants

"To evaluate the quality of a product you have to take much more aspects into account than only the nutritional content and content of contaminants

✍ whole picture is important

✍ look at the context of the compounds."

"Research in quality of organic food is more and more important. We should study more in the whole system and then very conventional also, to be accepted in science life".

"I have now different opinion about the food quality, organic agriculture and future. I learned a lot, upgraded my knowledge and I hope, I can use it in my projects. There were a lot of very interesting lectures in my field of interest."

"Very interesting. Some topics were a little bit to basic, sometimes it was difficult to have such a diverse participant group. Sometimes it was a bit too much telling of the "organic story" to people. Excellent job done, thanks"

"It was a busy but very useful workshop"

"Nice workshop, a lot of new interesting holistic methods I've learned and touched to"

The overall conclusion was that for the evaluation of food quality you have to take much more aspects into account than nutritional content and contaminants only. An enlarged or holistic quality concept is needed to cover the ambitions of organic food production. Challenge is to further develop such concepts and to design robust scientific studies which account for all relevant quality aspects..