ELM FARM RESEARCH CENTRE

ELM FARM RESEARCH CENTRE CONFERENCE

DOES ORGANIC FOOD HAVE AN 'EXTRA QUALITY'?
New Research, New Perspectives and New Insights

A record of the Conference held on TUESDAY, 23RD NOVEMBER 2004

This Conference was sponsored by Sheepdrove Trust in collaboration with

FQH (International Network for Food Quality and Health)
Sustain (the alliance for better food and farming)

ELM FARM RESEARCH CENTRE
The Organic Research Centre
'For organic principles and best practice'

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For further information please contact the Director, Elm Farm Research Centre.

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DOES ORGANIC FOOD HAVE AN "EXTRA QUALITY"?
New research, New perspectives and New insights Conference
23rd November 2004

Proceedings Contents

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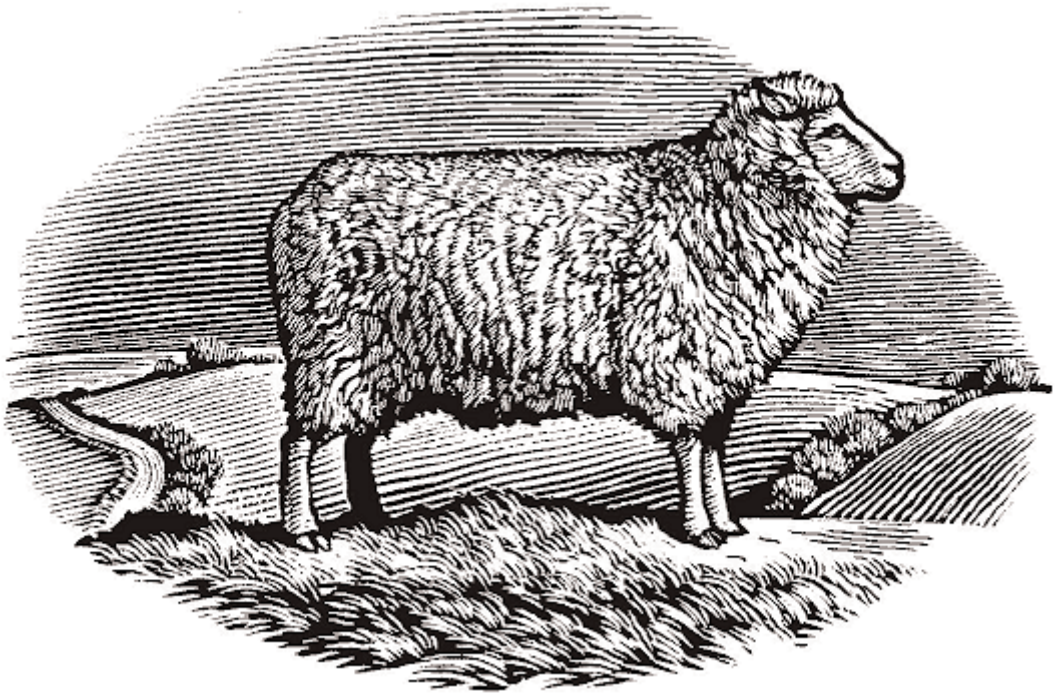
A special acknowledgement

We acknowledge and thank the Sheepdrove Trust for its financial support towards this Conference which allowed the use of the beautiful setting of the Kindersley Centre and its excellent facilities



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Acknowledgements

We would like to thank **all** those who participated in the Conference on 23rd November 2004 - those who gave presentations, those who chaired, those who responded and those who participated in asking questions and the discussions.

We also thank the team that organised the event so effectively.

The production of these proceedings has been supported by:

promar International

"Stressing the importance of differentiating between accepted dogma: "Organic food is better for you" and what is actually "true", i.e. the scientifically proven, Dr Brandt's interesting and balanced paper highlighted the need for a consistent approach and common understanding if claims about organic food are to be accepted.

The science that proves the "extra qualities" of organic food, or equally that demonstrates the detrimental effects of "conventionally-produced" foods, on our health is still developing, as shown by other speakers. But Dr Brandt concluded that organic farming, which has distinct benefits for the environment and food produced, has that "extra quality" that was the Conference's theme.

For consumers, the key benefit of organic produce may simply derive from the fact that positive choices are made in food purchasing that enhance a sense of individual value and well-being".

Alara Wholefoods

"Projects that give statistically robust nutritional differentiation between organic and non-organic food are very welcome by organic food manufacturers".

Duchy Home Farm

FOREWARD

The following pages are a record of a conference that took place on 23rd November 2004 at the Kindersley Centre, Lambourn, Berkshire UK.

These pages have been produced from material provided by the speakers and from a transcript of the presentations given on the day and the ensuing discussions. They are therefore a faithful but edited representation of the day's events.

None of the major speakers presented in their native language and whilst we have "tidied up" somewhat we have not attempted to produce polished papers. Similarly references have been included for information but we have not attempted to follow a uniform style or order.

All the presentations have or will shortly be appearing in the scientific literature. Our aim here is to; firstly respond to the wishes of conference delegates who wanted to access the material they saw and heard on the day; secondly to disseminate information which we believe is very important to a greater number of people than could fit into the conference hall; and thirdly to provide access to those who would not normally consult scientific journals.

The addresses of the speakers are included to enable readers to follow up any issues directly with them.

Lawrence Woodward O.B.E
Elm Farm Research Centre

SPEAKER BIOGRAPHIES

DR. KIRSTEN BRANDT

Senior Lecturer

School of Agriculture, Food and Rural Development
University of Newcastle

Originally trained in plant biochemistry. Her research focuses on links between agricultural methods, plant chemistry, food quality and health of humans and animals. Until the end of 2003 worked as senior scientist in the Danish Institute of Agricultural Sciences, initiating several multi-disciplinary research programmes in these areas

Roles and Responsibilities

In a new FP6 IP project on organic agriculture "Quality Low Input Food" , coordinates the part on nutrition and health, comprising 3 work packages and involving 6 institutions across Europe. Presently an important part of her work is to coordinate the establishment of a Research Centre on Food Quality at University of Newcastle, linking a range of research groups with specialised expertise in food related areas, such as human nutrition, consumer science, agronomy and economics. The objectives are to enhance the impact and exploitation of the research and training activities in industry and society and to facilitate the creation and success of multidisciplinary research projects

Research Interests

Links between agricultural methods, plant chemistry, food quality and health of humans and animals, in particular:
Effects of plant secondary metabolites (natural pesticides) on humans, in order to improve the beneficial impact of vegetables and other herbs on human health.
Plant adaptation to low-input conditions regarding product quality and susceptibility to pests and diseases, in order to improve the balance of environmental and economic sustainability in agriculture and horticulture

DR. JOHANNES KAHL

1990	B.S. Department of Chemistry, University of Dortmund
1993	Diploma in Chemistry, Institute for Environmental Protection (INFU)
1997	Ph.D. in Chemistry (BMBF-Project), Institute of Spectrochemistry and Applied Spectroscopy (ISAS)
1997-1999	Postdoctoral Research, Max-Planck-Institute Chemical Ecology, Jena, Germany
1999-2001	Management Marketing of organic food and services
2000	Lectures at the University of Sao Paulo, Brazil, Teaching Travel Award, German Academic Exchange Service
since 2001	Head of the food quality group at the University of Kassel (together with N. Busscher)

PROFESSOR DR. ANGELIKA MEIER-PLOEGER

PHD at the Justus-Liebig-University, Home economics , Nutrition and Food Sciences. For 3 years scientific employee at the Institute for Nutrition Sciences (Prof Dr. C. Leitzmann). From 1976-1981 taught on the Government Teaching Institution for dietitians at the clinics of the Justus-Liebig-University in Gießen. Activity in industry (1981-1984) at the Alfa Institute GmbH, Eltville-Erbach (a Swiss Company, head of the Departments Nutrition Sciences as well as Economics).

Appointment as professor at the University of Applied Sciences Niederrhein (1984-1986).

1986 appointment as professor to the University of Applied Sciences in Fulda, Dep. for Food and Nutrition. Emphasis on investigations in the field of nutrition ecology as well as food quality.

Since October 2001 Professor at the University of Kassel, Head of the Dep. for Organic Food Quality and Food Culture at the Faculty of Organic Agricultural Sciences, Witzenhausen, Germany.

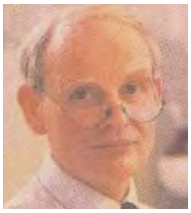
Member of the Scientific Advisory board (Consumer and Nutrition policy) for Ministry of Consumer Affairs, Food & Agriculture.
Member of the Scientific Advisory board (Genetic Resources, Biodiversity) for Ministry of Consumer Affairs, Food & Agriculture.

Chairperson of the International Research Association for Organic Food Quality and Health (FQH).

Board member of the German Association for Nutrition Behaviour (AGEV e.V.)

SPEAKER BIOGRAPHIES

Dr. JURGEN STRUBE



Dr Jürgen Strube is managing director and head of the biophysics department of the quality research company KWALIS Qualitätsforschung Fulda GmbH located in Dipperz, Germany. KWALIS specializes in food research, testing and analysis.

Jürgen Strube studied electronics and microwave science at the University of Bremen (Germany). It was his involvement in industry technical projects while at the university that led to his interest in biophysics and, more specifically, to the light emission of plants (induced luminescence).

After a number of research projects he founded KWALIS GmbH where his primary focus is on the differences between crops grown organically and those grown conventionally. Jürgen Strube was chosen as an external expert for the German Federal Research Institutes' working group on the differences in food from organic and conventional farming. The method he developed, known as fluorescence excitation spectroscopy of whole parts of plants, was validated according to ISO 17025 in a project for the German federal program for organic farming in cooperation with the University of Kassel. KWALIS investigates plant samples originating primarily from controlled farming systems of different institutions (such as the FiBL, Switzerland and Louis Bolk Institute, Netherlands). An overview of the method, typical results of samples and their significance is contained in a book that was published in German language in August 2004. This book, entitled "Lebensmittel vermitteln Leben", was written by Jürgen Strube together with Dr. Peter Stolz, who investigated the samples from a chemical point of view.

LAWRENCE WOODWARD OBE

1980	Formation and development of **Elm Farm Research Centre (EFRC).**
1980 - 1994	Co-ordinator Elm Farm Research Centre
now	Director Elm Farm Research Centre
2002	Awarded an **OBE** for Services to Organic Farming

POSITIONS HELD include:

1982	Chairman - **British Organic Standards Committee**. An organic movement initiative to produce the first agreed UK organic standards. Founder member of British Organic Farmers.
1982 -1984 -	Chairman of the **International Federation of Organic Agriculture Movements** -1986 Vice President
1985	Expert Consultant to **EU** Commission on the EU Organic Directive/Regulation
1984 - 5	Chairman of the **Soil Association** Standards Committee
1985 - 1991	Member of the Soil Association Council and Management Committee.
1987 - 1999	Member of the government-backed **UKROFS** Board (United Kingdom Register of Organic Food Standards)
1995	Chairman UKROFS R&D Committee.
1997 - 1999	Chairman UKROFS Certification Committee.
2000 -	Member Steering Group SUSTAIN Organics Target Bill campaign
1998 -	IFOAM EU Group member
2000	Founder member ECOPB European Consortium of Organic Plant Breeding
2003	Organic Action Plan Working Group member

Has advised and spoken about the methods of organic agriculture to a wide range of government bodies, NGOs, research bodies, academic institutions and farmer groups in the UK an internationally. Has played a pivotal role in the strategic and practical development of organic sector in the UK. Has written and contributed to numerous publications including scientific journals, technical publications, conference proceedings and press, as well as many contributions to radio and television broadcasts.

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ABSTRACTS

Towards Whole Food Quality

Lawrence Woodward
Elm Farm Research Centre

Organic agriculture is the only farming system that has as its underpinning philosophy the achievement of positive health. In the words of Lady Eve Balfour, " the health of soil, plant, animal and man is one and indivisible". This is implies that a narrow sensory perspective of food quality is inadequate. A broader view encompassing the entire food chain and its impact on the social and ecological environment is required - especially as the onset of genetic engineering raises questions about the very essence of food and health.

A definition of total or holistic food quality has been formulated for some years but has yet to be widely taken up. However, although it is valuable this perspective does not address the core question of whether health is a dynamic state where its components are "one and indivisible". Indeed very little progress has been made in assessing or developing McCarrison's observations concerning the diets of the "healthiest peoples" upon which Balfour's statement is based.

However, some notable progress has been made using both mainstream and alternative methods in assessing some characteristics of food and their relationship to production methods. These will be discussed during this conference. At the same time it is reported that there has been a decline in beneficial components of food whether organically or conventionally produced. So even if we can determine that organic food can have an "extra quality" that is important to health, can we manage production and processing systems "on the ground" to consistently deliver it?

Understanding the relationships between production methods and food quality using mainstream scientific concepts.

Kirsten Brandt
University of Newcastle

Almost all research on food and health has been focused on avoiding harmful extremes, either deficiencies or toxic effects. Other effects have rarely been investigated. Due to this we know almost nothing about the consequences for health of differences in food composition, when it is clear that neither deficiencies nor toxic effects are involved.

Formally this means that a modest difference in composition or other measurable characteristic, no matter how significant and systematic, is not evidence for any difference in effect on health. Also an observation of an improvement in health correlated with such a modest change in dietary composition does not prove a causal relationship with the measured characteristic, if untested confounding factors are present (as they normally are). For example, the benefits of a high intake of fruits and vegetables does not prove that a high antioxidant intake benefits health, unless it can be shown that such a benefit is also consistently observed in studies where everything else is kept constant or equivalent while the antioxidant intake is increased.

So the existing generally accepted knowledge on this topic is clearly inadequate, indicating a need for development of new methods for evaluation of food quality. The question is then whether this should be done by a critical revision of the interpretation of existing and new data within the framework of the existing mainstream scientific concepts (as defined below) or if radically different concepts are needed.

In my understanding, the mainstream scientific concept is that new methods must build on the same overall understanding of the laws of nature and of generally accepted scientific principles as is reflected in the present scientific literature, and provide the best model of reality obtainable with the present level of knowledge - for food quality, reality is represented by sensory tests and/or assessments of health indicators. It is possible, and should be encouraged, to challenge existing dogmas and paradigms, whenever their predictions are shown not to fit with actual observations. However, such a challenge should be constructive, defining flaws in the existing theories that result in mismatch with documented observations, and explaining how the new ideas

correct these flaws. In this concept, a new theory can result in a radically new interpretation of existing data, but it must be able to account for all documented facts.

This means that a theory which requires rejection of generally accepted scientific data, or the introduction of aspects that cannot be measured using generally accepted scientific methods, does not correspond to the mainstream scientific concept.

For me this is not an issue of science being reductionist or holistic, the relevant categories are good and bad science. Good science constantly strives for consistency with all known data, by testing the predictions of its hypotheses and implementing revisions whenever inconsistencies are identified. Any theory that ignores data that fail to correspond to its predictions is bad science, irrespective of whether this is due to simple oversight, unreflecting acceptance of well-established but inadequately tested dogmas or (rarely) conscious manipulation.

The presentation will provide examples of applications of the mainstream scientific concept in food and health research, and descriptions of some of the relevant, novel options for the improvements in our understanding of food quality that can be formulated within this concept.

A major advantage of using the mainstream scientific concept is that it is relatively easier to communicate results constructively and obtain acceptance of them by the scientific community than for results obtained using otherwise equivalent alternative concepts. Still, the resilience of established scientific dogmas should not be underestimated; the history of science is that of a continued struggle of reason against authoritarianism.

Complementary methods of food quality determination - their value and validation

Angelika Meier-Ploeger
University of Kassel, Faculty of Organic Agricultural Sciences,
Dept of Organic Food Quality and Food Culture

Food is more than just a necessity to many people. It is a way to express their values and their lifestyle. Nowadays when the term "quality" is used with respect to food, a value judgement is made. The partners in the market - producers, processors, medical doctors or consumers - might have different judgements. To keep expanding the market, processors and retailers have to come up with new products or new results from scientific work that prove a better quality.

Food quality is composed of various partial aspects and represents the sum of all characteristics scored highly by partners in the market. Six criteria are used to identify important components of quality (authentic, functional, biological, nutritional, sensual, ethical; EFRC, 1996):

The quality of food for humans is estimated by comparison of their nutrient contents with the recommended dietary allowances (RDA) and the amount of nutrients in the food. The value judgement is nutrient driven and therefore the methods for food quality assessment, too. In contrast to that development in nutritional sciences, a significant number of people like to practice so called alternatives in nutrition e.g. vegetarian, macrobiotic or wholefood nutrition, in which not single nutrients but the whole dietary regime with its many interactions is considered.

Results of feeding experiments with animals support a wider view of nutritional food quality. Some investigations have shown that even if the proportion and amount of chemically determined feed components are equal, the fertility and survival rate of newborn animals is different (Staiger, 1988). The scientific work of Werner Kollath and Rudolf Steiner in Germany, Bircher-Benner in Switzerland and McCarrison in GB is based on the following premises: "The living whole is more than the sum of its parts". They conclude from this that: Life is bound to forms / structures and their maintenance; Life is bound to light; Life is linked to communication; Life is reproduction.

To verify the validity of these premises it was and will be necessary to develop and to test new methods for the determination of food quality. The aim of the paper is to present the results of a validation process for some holistic methods (with coded blind

samples). Holistic approaches in organic food quality analysis requires a strict coordination, well defined samples, a good sample storage and delivery, comparative samples, scientists willing to understand the principle and language of alternatives, scientists eager to discuss results and willing to argue about concepts and interpretation.

The challenges will be to compare and correlate data from chemical analysis to those of the holistic methods. There remains the question of whether these holistic methods do show more than the sum of different single nutrients from chemical analyses? And crucially whether these "pictures/structures/ forces/ energy" are important for animal and human health.

Fluorescence excitation spectroscopy method as applied on selected plants

Jürgen Strube
KWALIS Qualitätsforschung Fulda

The purpose of the method is to distinguish culture conditions on the samples. By fluorescence excitation spectroscopy data are gathered from integral parts of a plant sample. The sample is excited by light and the total light emitted by the sample is measured after the end of excitation. The process of excitation is repeated eight times in total for eight different excitation colours out of the visible part of spectrum and near UV. For the evaluation of different samples the spectral data of the samples are compared to each other. Measurements are performed with special equipment, developed for this purpose.

In order to show reliability of data and results, the method was validated according to ISO 17025. Validation means, to show that process is reliable and the method is suited to answer the question, which sample is grown under which conditions.

In a project funded by the German federal program for ecological farming the method was applied to carrots and wheat. Carrots were grown under controlled conditions at the University of Kassel (two fertilisation steps) and the Forschungsinstitut für Biologischen Landbau (FiBL) at Frick (Switzerland), with different sorts (hybrid and open pollinating). Wheat samples were out of the well-known DOK-trial of FiBL and included organic, biodynamic, pure mineral, mineral with manure and neutral variants. All samples were coded with numbers until the results were delivered to the coding institution, the Institut für ökologischen Landbau (Trendhorst) as part of the German federal Forschungsanstalt für Landwirtschaft.

Under the blind conditions it was possible, to separate the fertilised carrots from the non-fertilised ones and to identify in all four repetitions the same samples. Furthermore it was possible to identify which carrots were fertilised. The hybrid variants could be separated from the open pollinating variants.

For the blind wheat samples it also was possible, to separate the group which was fertilised by mineral fertiliser from the organic samples. Furthermore it was possible to identify which samples were grown under mineral fertiliser and which ones under organic conditions.

Other samples illustrate differences of the products that are in relation to the culture method. In general terms organic farming leads to more ripeness of fruits and more 'seed-like' seeds in the case of cereals.

Characterization of the biocrystallization method on using computerized image analysis

Johannes Kahl, Nicolaas Busscher, Angelika Meier-Ploeger
University of Kassel

The growing market of organic food products demands product oriented quality control (Tauscher et al. 2003, Statusbericht 2003, Senatsarbeitsgruppe). One major concern is the differentiation of organically from conventionally grown food. In addition to standard methods of analysis, several screening methods are applied. The biocrystallization screening technique is based on the crystallographic phenomenon that when adding organic substances to an aqueous solution of dehydrate CuCl2, reproducible

patterns are formed during crystallization (Morris & Morris 1939, J. Phys. Chem. 43, 623-629; Kleber & Steinike-Hartung 1959 Zeit.Kristall. 111, 213-234; Andersen et al. 2001, Biol. Agr.Hort. 19, 29-48). The effects of additives on the morphological features are not a mono causal phenomenon, but a complex interaction involving chemical structure, hydrophilic properties of the additives, and colloidal properties of the crystallization solution (Morris & Morris 1939; Selawry 1957, Die Kupferchloridkristallisation in Naturwissenschaft und Medizin. Fischer-Verlag, Stuttgart; Beckmann 1959, Diss. Univ. Bonn). A favoured field of successful application of the method are comparative studies of the effects of different farming systems on the crop and product quality, as a complement to chemical analysis of minerals, vitamins etc. (Granstedt & Kjellenberg, 1997 Proceedings Tufts University, 79-90; Maeder et al. 1993 Acta Hort. 339, 11-31; Soil Association 2001, Bristol; Andersen et al. 2001; Weibel et al. 2000, Acta Hort. 517, 417-421). Recently initial efforts have been made to standardize the method, including optimization of crystallization technique and development of computer software for image analysis of the patterns (Andersen et al. 1999, Computers and electronics in agriculture 22, 51-69; Meier-Ploeger et al. 2004, final project-report 02OE170, BÖL). The requirements for validation were tested for the biocrystallization method for the statistically proofed discrimination of products from different farming systems (defined field trials, e.g. DOC-trial at FIBL/CH, Maeder et al. 2002, Science, 296, 1694-1697) and also from different single production factors. A systematic assessment of the factors influencing the result was carried out as one of the criteria for the determination of the performance of the method. This includes a control system for the crystallization process and a computer based laboratory documentation system. Furthermore the method parameters repeatability and reproducibility are determined for the samples used. Intercomparisons were carried out together with laboratories in Germany, the Netherlands and Denmark.

Food Quality and Health - Concepts into Practice

Angelika Meier-Ploeger
University of Kassel

Organic food - in the consumers view - is an important component for good health and wellbeing. A change in the structure of organic buyers in Europe will force the market and science to prove that organic food is healthier for humans. Therefore politicians in several states of Europe asked for scientific reports about product orientated differences in organic produce. This paper will present the results of the scientific reviews in France and Germany. The aims and projects of the International Research Association for Organic Food Quality and Health will also be presented in the paper.

Although there is some evidence that nutrients differ between conventionally and organically produced vegetable - and animal produce the question has to be discussed as to which methods can be used to show "health" and "wellbeing" as defined by WHO in 1942. This definition accepted that human beings are creatures with physiological and psychological characteristics. System (human) orientated methods are needed to evaluate these different parameters alongside methods used for product assessment.

Elm Farm Research Centre (EFRC) is one of the UK's leading research, development and advisory institutes for organic agriculture.

For more than 20 years EFRC has played a central role in the development of policy and standards for organic farming and food within the UK, EU and internationally.

The Centre's alliance of practice and policy – on-farm and desk research and consultancy and advice is unique.

We acknowledge and thank Sheepdrove Trust for its financial support towards this Conference and the use of the beautiful setting of The Kindersley Centre and its facilities.

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