1 The Shift to Organic Food

This book is the first comprehensive text, based on an unbiased assessment of the scientific findings, on how organic production methods influence the quality of foods. In this context "quality" is taken to refer to nutrient content; freshness, taste and related aspects which are obvious to the consumer; also other attributes which are not immediately obvious to the consumer but which are perceived to be associated with organic foods. These are: relative freedom from harmful chemical and pesticide residues, and from hormonal residues; and also "healthfulness" (ability to enhance or promote health in the consumer). In some publications these latter attributes are designated "safety" aspects, but this is not a completely satisfactory designation since it implies that some foods are not safe.

Purchasers of organic foods believe that these products are superior to conventional foods in terms of quality and safety. The available data confirm that there is a growing market for organic foods, if they can be delivered at a price acceptable to the consumer.

The book addresses issues that the food industry and consumers raise about organic food in relation to conventional food, and assesses the relevant scientific findings in the international literature as well as the results of food monitoring programs in North America, Europe and Australia/New Zealand. Documented findings related to the nutritional quality and "healthfulness" of organic food are assessed, as are findings on the motivation of consumers to buy organic food.

Background

The organic system of farming was developed in Europe over 100 years ago by proponents such as Rudolph Steiner in Austria, Albert Howard in the United Kingdom, and Hans-Peter Rusch and Hans Müller who developed "biological agriculture" in Switzerland. The first use of the term "organic farming" appears to have been by Lord Northbourne in the United Kingdom. It derives from his concept of "the farm as organism". He differentiated between what he called "chemical farming" and "organic farming". Sir Albert Howard's concept of soil fertility was centered on building soil humus with an emphasis on a "living bridge" between the soil

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and the life it contained (such as fungi, mycorrhizae and bacteria), and on how this chain of life from the soil supported the health of crops, livestock and humans. Steiner went on to propose "biodynamic agriculture", a method of organic farming that has its basis in a spiritual view of the world, using approaches such as fermented herbal and mineral preparations as compost additives and field sprays and the use of an astronomical sowing and planting calendar. This farming method became popular in Australia.

Lady Eve Balfour was influenced by the work of Sir Albert Howard and set up the Haughley Experiment on adjacent farms in England in 1939 to compare organic and conventional farming. The experiment was taken over by the Soil Association in 1947, which for the next 25 years directed and sponsored it. The work had a design flaw – no replication – which probably explains why the results were never published in any scientific journal. Based on the early findings, Balfour published a book, *The Living Soil*, in 1943, which did not receive a good review in the journal *Soil Science*: "The author is an evangelist for organic farming. She has little understanding of scientific method. If the evidence does not favor her thesis, it is ignored" (Anon., 1951).

Ideally, the organic farm is self-sufficient in terms of needs such as fertilizers, seeds, feeds, etc. In the organic system the farm is treated as a whole entity, with an interrelationship between the soil, plants and animals in a closed recycling system. The organic farm is more generalized than the conventional farm, which tends to specialize in producing crops, hogs, eggs, milk, etc.

According to the Codex Alimentarius Commission (1999), organic agriculture is:

> a holistic production management system which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, ... as opposed to using synthetic materials.... The primary goal is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people ... the systems are based on specific and precise standards of production which aim at achieving optimal agroecosystems which are socially, ecologically and economically sustainable.

In many European countries, organic agriculture is known as ecological agriculture, reflecting this emphasis on ecosystems management. The term for organic production and products differs within the European Union (EU). In English, the term is organic; in Danish, Swedish and Spanish, it is ecological; in German, ecological or biological; and in French, Italian, Dutch and Portuguese, it is biological. The term used in Australia is organic, bio-dynamic or ecological. So, in this context, the term "organic" has a

different meaning from the one we learned in chemistry class. There we learned that "organic" was used to describe a compound containing carbon. A compound not containing carbon was called "inorganic". But in relation to food, "organic" is used to describe food that has been produced in a special way: organically.

As described in the preceding paragraphs, organic farming is a production method that is intended to be sustainable and harmonious with the environment. It prohibits the use of synthetic fertilizers and pesticides, products produced by gene-modification techniques, irradiation as a preserving process, sewage sludge as fertilizer, and synthetic processing aids and feed additives. When organic herds and flocks are established, the breed or strain of animal should be selected so that the animals are adapted to their environment and resistant to certain diseases. Livestock must come from holdings that comply with the rules governing organic farming, and must be reared in accordance with those rules throughout their lives.

The main differences between organic and conventional farming that emerged from these early developments were that no chemical fertilizers or chemical pesticides can be used on organic crops, and animals raised organically have to be fed on organic or natural sources of feed. Thus organic production differs from conventional production, and in many ways is close to the agriculture of Asia.

The result is that organic food has a very strong brand image in the eyes of consumers and thus should command a higher price in the marketplace than conventionally produced food. It is, however, more expensive to produce than conventional food, therefore it is more costly to the producer and consumer.

About the same time as developments in organic food production were taking place in Europe, similar developments were evident in other countries, including the US and Australia. The publication of *Silent Spring* by Rachel Carson in 1962 was important in that it brought the issue of pesticides and the environment to the attention of the public. As a result, an increasing number of consumers began to seek out organic foods since these had been produced without the use of chemical pesticides.

Organic regulations

"Organic" is a production claim and not a food safety claim. According to the USDA there are four labeling categories for organic foods:

(1) "100 percent organic" foods contain only certified organic ingredients and use certified organic processing aids.
(2) "Organic" foods must contain at least 95 percent certified organic ingredients.

(3) Foods "made with organic" (specified ingredients) must contain at least 70 percent organic ingredients.
(4) Foods with less than 70 percent organic ingredients may not display the USDA "organic" seal on the package but may identify which ingredients are organic on the ingredient panel.

Other countries and organizations have derived their own standards for defining foods as organic. Organic production also requires certification and verification of the production system. This requires that the organic producer maintain records sufficient to preserve the identity of all organically managed crops and stock, and records of all inputs and all edible and non-edible organic products from the farm.

The whole organic process involves four stages:

(1) Application of organic principles (standards and regulations).
(2) Adherence to local organic regulations.
(3) Certification by local organic regulators.
(4) Verification by local certifying agencies.

Currently there is no universal standard for organic food production worldwide. As a result many countries have now established national standards. These have been derived from the standards originally developed in Europe by the Standards Committee of IFOAM (International Federation of Organic Agriculture Movements) and the guidelines for organically produced food developed within the framework of the Codex Alimentarius. Within the Codex, the Organic Guidelines include Organic Livestock Production. The pertinent regulations from several countries are listed in the References (see European Commission 1991, 1999; MAFF 2001, 2006; NOP 2000).

IFOAM Basic Standards were issued in 1998 and updated in 2005. A current review to be published in 2011 is expected to define terms such as "organic" and "sustainable". The IFOAM standard is intended as a worldwide guideline for accredited certifiers to fulfil. IFOAM works closely with certifying bodies around the world to ensure that they operate to the same standards.

The Codex Alimentarius Commission (CAC) is an international standards-setting body for food and food products that is run jointly by the UN Food and Agriculture Organization and the World Health Organization. As such, it is recognized as a standardizing body by the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures. WTO member governments are required by the Agreement to base their standards on international standards, including those of the Codex Alimentarius (www.codexalimentarius.net/web/index_en.jsp). The main purpose of the Codex is to protect the health of consumers and ensure fair trade practices in the food trade, and also to promote

coordination of all food standards work undertaken by international governmental and non-governmental organizations. The Codex is a worldwide guideline for state and other agencies to develop their own standards and regulations, but it does not certify products directly. The standards set out in the Codex and by IFOAM are quite general, outlining principles and criteria that have to be fulfilled. They are less detailed than the regulations developed specifically for regions such as Europe.

Although there is as yet no internationally accepted regulation on organic standards, the World Trade Organization and the global trading community are increasingly relying on the Codex, IFOAM and the International Organization of Standardization (ISO) to provide the basis for international organic production standards, as well as certification and accreditation of production systems. The ISO, which was established in 1947, is a worldwide federation of national standards for nearly 130 countries. The most important guide for organic certification is ISO Guide 65:1996, General requirements for bodies operating product certification systems, which establishes basic operating principles for certification bodies. The IFOAM Basic Standards and Criteria are registered with the ISO as international standards.

It is likely that exporting countries introducing organic legislation will target the requirements of the three large markets, i.e. the European Union, the United States (National Organic Program, NOP) and Japan (Ministry of Agriculture, Forestry and Fisheries, MAFF). Harmonization will promote world trade in organic produce. It is apparent that equivalency among the systems operating in various countries is limited. Discussions in a number of forums including FAO, IFOAM and UNCTAD (the United Nations Conference on Trade and Development) have indicated that the volume of certification requirements and regulations is considered to be a major obstacle to the continuous and rapid development of the organic sector, especially for producers in developing countries. In 2001, IFOAM, FAO and UNCTAD decided to join forces to search for solutions to this problem. Together they organized the Conference on International Harmonization and Equivalence in Organic Agriculture, in Nuremberg, Germany, February 18–19, 2002. This event was the first of its kind where the partnership between the private organic community and United Nations institutions offered a forum for public and private discussions. One of the key recommendations of the conference was that a multi-stakeholder task force, including representatives of governments, FAO, UNCTAD and IFOAM, should be established in order to elaborate practical proposals and solutions. In response, the International Task Force on Harmonization and Equivalence in Organic Agriculture (ITF) was launched on February 18, 2003, in Nuremberg, Germany. Its agreed aim is to act as an open-ended platform for dialogue between private and public institutions involved in trade and regulatory activities in the organic agriculture sector.

The Global Organic Market Access Project is an extension of the work of the International Task Force on Harmonization and Equivalence in Organic Agriculture (ITF, www.itf-organic.org). The latter documented the world situation in 2003 (UNCTAD, 2004). The group listed 37 countries with fully implemented regulations for organic agriculture and processing.

Although there is currently no universal standard for organic food production, the production process involves the same four stages in all countries (as outlined earlier in this section). The organic designation for foods is thus based on documented certification, and no test is applied to confirm that the food in question is organic. Some observers (e.g. Popoff, 2010) have viewed this aspect as a flaw in the system since cases of fraud have occurred, and it has been suggested that an objective chemical test needs to be devised to verify the authenticity of organic food. At present, organic production requires that the producer maintain records sufficient to preserve the identity of all organically managed crops and animals, all inputs of all edible and non-edible organic products produced, in order to certify that the product is indeed organic.

Organic foods are also subject to international and national standards regarding the respective food laws. For instance, in North America organic milk has to be heat-treated and fortified with vitamin D in the same way as conventional milk, and organic white flour has to be fortified in the same way as conventional flour. In time, it is expected that organic foods will be sampled in the marketplace and subjected to chemical testing as part of the foods regulations in the same way that conventional foods are monitored now.

Currently, therefore, the consumer must accept that any organic food offered for sale has been produced according to the prevailing regulations. Possible tests to prove authenticity are being researched and will be outlined in subsequent chapters. Several cases of fraud have been reported, sellers passing off regular food as the more expensive organic food. Unfortunately, there is no way of proving that food is indeed organic just by inspecting it. Authenticity has to be verified by records. As a result many consumers prefer to buy organic food directly from the grower, who is able to provide information on how the food was produced.

The difficulty in proving a product is organic has been experienced by the author of this book. Every spring my wife and I plant a few Yukon Gold potatoes in our garden because we like the texture and appearance of its flesh. Since we can never buy seed potatoes of this variety, we buy some cooking potatoes in a grocery shop and plant these. Usually we have a good crop. In 2010, however, the potatoes did not grow. When some of the potatoes were dug up to find out why, no sprouting buds or shoots could be seen. A check on the internet and a column in the local newspaper provided the answer. Table potatoes are now being sprayed with a product that prevents sprouting and makes the potatoes more attractive in the grocery store. The obvious answer was then to buy organic Yukon Golds at an

organic grocery store and plant these, since no such spraying is allowed on organic produce. The potatoes we bought looked very nice and clean, each bearing an organic label and with no sign of sprouting. They cost twice as much as the regular Yukon Golds. Did they grow in our garden? Unfortunately, no. At the end of the growing season they were still not showing any shoots. When we checked back at the store the answer we got was that the store had bought them as organic produce and no, they had not been sprayed. So were the potatoes in question organic or not and had they been sprayed? These questions have to remain unanswered. We, like the average consumer, have to accept what appears on the label.

Consumer perceptions

The growth of organic farming is a response to an increased consumer demand for food that is perceived to be fresh, wholesome and flavoursome, free of hormones, antibiotics and harmful chemicals and produced in a way that is sustainable environmentally and without the use of gene-modified (GM) crops. Purchasers of organic foods believe that these products are superior to conventional foods in terms of quality and safety. What is not clear from the published data on organic foods is the extent to which these consumer perceptions are correct. A large number of studies has been conducted on this issue, particularly in relation to nutritional quality, but no clear consensus has emerged. Several authors have claimed that organic food is nutritionally superior to conventional food but, conversely, bodies such as the UK Food Standards Agency have concluded that organic foods are nutritionally similar to conventional foods. Also, the results of food monitoring programs in several countries indicate that a growing proportion of conventional foods meets or exceeds the high standards set for pesticide and chemical residues and cannot be considered as "unsafe".

The food industry, researchers and academics need to have an authoritative and up-to-date source of unbiased information on how organic production affects food quality. Some of these effects are positive, others negative. Documentation of these findings will allow the concerns of consumers to be adequately addressed, relevant marketing programs to be established and appropriate information to be disseminated. Organic producers with some technical training in nutrition or food science will also benefit from the treatment of the topic.

The need for food professionals to have access to accurate and unbiased information on organic foods was highlighted by a Michigan study by Schuldt and Schwarz (2010) which found that consumers infer that organic food is lower in calories and can be eaten more often than conventional food, even when the nutrition label conveys identical calorie content. A comment overheard by one of the authors in the checkout lane of a

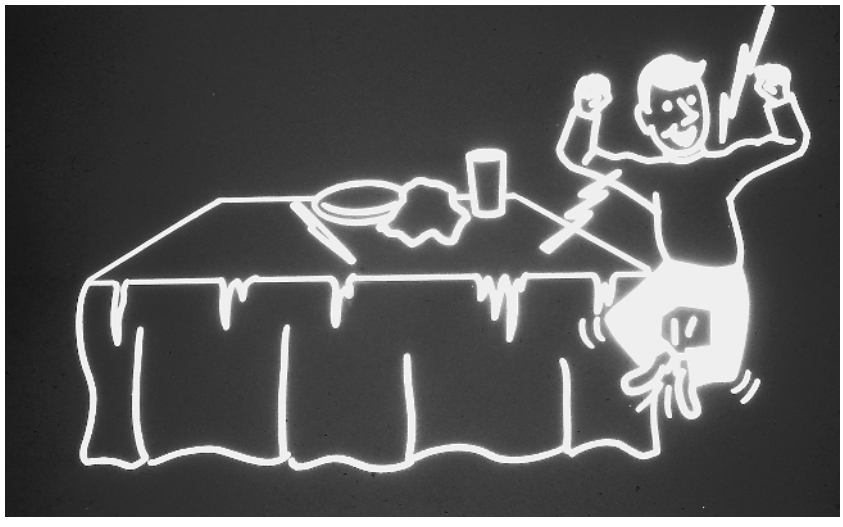

Figure 1.1 An organophile's view of organic food

natural foods store typified the confusion. "Mom, look! Organic gummy bears!" "Yes, I see. No more sweets." "Mom, but they're organic." Figure 1.1 depicts how an organophile (lover of organic food) perceives organic food.

The inference reported by Schuldt and Schwarz (2010) was more pronounced among consumers with a strong view on pro-environmentalism. Their results also indicated an "organic/natural"–"healthy" association that is capable of biasing everyday judgements about diet and exercise. Similar confusion about organic foods was found in results of an online survey of 1662 British consumers commissioned by website www.MyVoucherCodes.co.uk and reported by Halliday (2010). This website features numerous discount codes for nationwide supermarket chains online, and therefore is able to collect data on actual purchases in supermarkets. The survey found that one in four people admitted confusion and one in five believed that organic food is lower in fat. Only 16 percent said they understood the term to mean "free from synthetic chemicals". Fourteen percent said they thought it means "healthy" and 12 percent answered "expensive". Respondents were also asked questions about their purchase of diet foods, and 72 percent claimed to buy diet food regularly, three quarters of whom claimed they did so in order to lose weight. Of these, 23 percent admitted to buying 'low/reduced sugar' food as a means of weight loss, whilst 15 percent claimed to buy organic produce for the same reason. Mark Pearson, managing director of MyVoucherCodes.co.uk, is reported as commenting on the findings as follows: "The organic message has clearly been misinterpreted by a large number of the British public, many of whom seem to regard it as a diet or health food" (Pearson, 2010).

These findings raise another important issue: who should be responsible for informing consumers about the real facts relating to organic foods?

Analysis of the topic

This book addresses the topic of how organic production methods affect food quality, based on published facts. Each chapter contains the references relating to the information contained in that chapter.

In this chapter I have summarized the growth of the organic food industry and explained the motivation for its growth. This chapter also outlines how organic food is produced and certified as organic.

Chapter 2, covering consumer concerns about food, notes that consumers now have more interest in the link between food and health. Some also have concerns about the quality of food from so-called "factory farms" and question the safety of the food supply. The concerns include the possible presence of chemical and pesticide residues in food, "mad-cow disease", issues such as cloning and gene-modified (GM) foods, antibiotics, hormones, and concerns over the way plants and animals are being grown commercially as food sources and environmental sustainability.

Chapters 3 to 8 assess the documented findings related to questions concerning vegetable produce, fruit, cereal grains, meats (including fish), milk and dairy products, and eggs.

Chapter 9 asks, "Is organic food safer?" It reviews the documented evidence presented in previous chapters on the relative health aspects of organic and conventional food, based on parameters such as pesticide and chemical residues, indices of human health, and the findings of animal studies.

Chapter 10, Is organic food more nutritious and "tasty"?, discusses the documented evidence presented in previous chapters on the relative quality of organic and conventional food, including attributes such as freshness, taste and nutritional composition.

The motivation of consumers to buy organic food is explored in Chapter 11, which examines the psychology of organic food choice and presents the results of surveys. "Healthfulness" appears to be a key driver of consumer perceptions of food quality, but taste, consistency and nutritional value are also important. Of lesser importance are humane treatment of animals and environmentally sustainable production practices. Psychological issues such as the "halo effect", which are related to the choice and consumption of organic food and which may be akin to religious experiences in some people, are additional important motivating factors in the purchase of organic food.

Chapter 12 summarizes and discusses the documented findings, and makes pertinent recommendations for the various sectors of the food industry, researchers and academics.

References

Anon. (1951). Review of *The Living Soil* by E.B. Balfour. The Devin-Adair Company, New York, 1950, pp. 270. *Soil Science* **71**, 327.

Carson, R. (1962). *Silent Spring*. Houghton Mifflin, Boston.

Codex Alimentarius Commission (1999). Proposed draft guidelines for the production, processing, labelling and marketing of organic livestock and livestock products. Alinorm 99/22 A, Appendix IV. Codex Alimentarius Commission, Rome.

European Commission (1991). Council Regulation (EEC) No. 2092/91 of June 24, 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs. *Official Journal of the European Communities* **L 198**, 1–15.

European Commission (1999). Council Regulation (EC) No. 1804/1999 of July 19, 1999 supplementing Regulation (EEC) No. 2092/91 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs to include livestock production. *Official Journal of the European Communities* **L 222**, 1–28.

European Commission (2005). Commission Regulation EC No. 1294/2005 amending Annex I to Council Regulation (EEC) No. 2092/91 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs. *Official Journal of the European Communities* **L 205**, 16–17.

European Commission (2007). Council Regulation EC No. 834/2007 on organic production and labelling of organic and repealing regulation (EEC) No. 2092/91. *Official Journal of the European Communities* **L 189205**, 1–23.

Halliday, J. (2010). Survey shows confusion between organic food and low-fat. *Food Navigator* August 10, 2010 (www.foodnavigator.com), accessed August 11, 2010.

IFOAM (2005). IFOAM Basic Standards. International Federation of Organic Agriculture Movements, Tholey-Theley, Germany.

MAFF (2001). The Organic Standard, Japanese Organic Rules and Implementation, May 2001. Ministry of Agriculture, Forestry and Fisheries, Tokyo. http://www.maff.go.jp/soshiki/syokuhin/hinshitu/organic/eng_yuki_59.pdf, accessed January 2006.

MAFF (2006). Japanese Agricultural Standard for Organic Livestock Products, Notification No. 1608, October 27. Ministry of Agriculture, Forestry and Fisheries, Tokyo. http://www.maff.go.jp/soshiki/syokuhin/hinshitu/e_label/file/Specific JAS/Organic/JAS_OrganicLivestock.pdf, accessed October 2007.

NOP (2000). National Standards on Organic Production and Handling, 2000. United States Department of Agriculture/Agricultural Marketing Service, Washington, DC. http://www.ams.usda.gov/nop/NOP/standards.html, accessed January 2006.

Pearson, M. (2010). http://www.meattradenewsdaily.co.uk/news/060810/uk___one_in_five_think_organic_means_low_fat_.aspx, accessed May 31, 2011.

Popoff, M. (2010). *Is It Organic?* Polyphase Communication, Osoyoos, British Columbia, Canada.

Schuldt, J.P. and Schwarz, N. (2010). The "organic" path to obesity? Organic claims influence calorie judgments and exercise recommendations. *Judgment and Decision Making* **5**, 144–150.