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Ecological farm management perspectives on pre-harvest food safety in meat and milk

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Introduction

Organic agriculture is considered to be an environmentally sound and socially acceptable land use system for "natural food" production (FAO 1999). It is based on specific independently certified and controlled standards of production (e. g. IFOAM 1998, FAO/WHO 1999). Organic farming has increasingly gained the attention of the public, politicians and farmers in the last twenty years (WILLER & YUSSEFI 2000).[1] About 10.5 M ha of farmland worldwide is managed organically.[2] The monetary market volume in 1997 was 11.8 B. US$ and for the year 2000 18.9 B. US$ are forecast (ITC 1999, CLAY 2000).[3]

Although organic farming is a claim about processes and not about products, consumers perceive organic products as healthy and safe (OPPERMANN 2001, JENSEN 2000, VAN VLIET 1998). Especially with the European BSE-crisis and the loss of consumer trust in food safety, organic farming is considered a possible and preventive solution for safe and healthy food (BMVEL 2001).

Safety and health are two sides of the same coin and should not be separated. 'Healthy' means good for the body and soul, 'safe' means not endangering the health of the body. This paper will not discuss the open question of whether organic food is healthier or of better quality than non-organic food (e. g. WOESE et al. 1995, WORTHINGTON 1998, WEIBEL et al. 1998).[4]

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[1] BSE has changed European agriculture. After the announcement of Mr. Stephen Dorrell (British Secretary of State for Health) on 20 March 1996 that a new variant of Creutzfeldt-Jakob disease - vCJD – is probably traceable to the consumption of BSE-infected beef, the British beef market crashed and with it British beef production and the British beef industry (MAFF 2000). Upon discovery of the first "mad cow" in Germany in November 2000, the whole continent followed. In January 2001 the German ministry for consumer protection, food and agriculture declared organic farming as the way out of the dilemma (BMVEL 2001). "*The BSE scandal marks the end of the old type of agricultural policy. ... I will do my utmost to ensure that all funds are used primarily for more organic land management, more species-specific animal husbandry and to safeguard jobs in rural areas.*" (KÜNAST 2001). The reason was the realisation that agriculture had lost the trust of consumers and was no longer safe for human health. The principles and standards of organic farming were now adopted as the conceptional framework for the whole of agriculture.

[2] Land use under organic farming in 2000: Europe 3.6 M. ha (2.5 % of farmland), Australia 5.3 M. ha (1.2 %), North America 1.1 M. ha (0.2 %), Latin America 0.5 M. ha, Africa 0.02 M. ha, Asia 0.04 M. ha (WILLER & YUSSEFI 2000).

[3] Market volume in billions of US$ 1997 (forecast 2000): Europe 6.2 (8.45), USA 4.2 (8.0), Japan 1.2 (2.5) and Oceania 0.15 (n. a.) (ITC 1999, CLAY 2000).

[4] A comprehensive literature survey on "Organic Foods and Human Health" was recently carried out at the Royal Veterinary and Agricultural University, Copenhagen, Denmark

Instead, the potential and limitations of organic farming to produce safe food from animal husbandry will be discussed using the examples of BSE, GMOs, chemical and natural hazards in the context of the standards and the certification procedure.

Standards of organic animal husbandry

In addition to the requirements for organic plant production, organic animal keeping is based on the principles of (IFOAM 1998):

- low stock densities,
- stock replacement from stock offspring (closed systems),
- the general prohibition of GMOs and derivatives,
- no synthetic disinfection strategies,
- converting periods for bought animals and fodder plants,
- farm fodder production,
- minimal purchasing of breeding animals from other organic farms (mainly males),
- no allopathic disease prevention,
- no antibiotics or hormones in animal feed,
- preventive health management and
- animal welfare in rearing, keeping, feeding, transportation and slaughtering.

These principles are the basis for state regulations, which protect organic products by law. They define the minimum requirements[5] for being certified as organic farming product inside the country and for foods imported from other countries. The EU regulation 1804/99 is the most precise state regulation on organic animal husbandry in the world and will be used in the following assertions (EU 1999).

Bovine Spongiform Encephalopathy (BSE)

BSE infections are nearly impossible in organic farming. The cause of BSE, the feeding of meat and bone meal (MBM) to ruminants, is prohibited by organic standards. Even fish protein as animal feed is not allowed by some private organic standards (e. g. BIOLAND in Germany) in order to avoid exploitation of the oceans for feeding animals. Fodder protein is produced by a farm's own legume cultivation (beans, peas, legume shrubs, clover etc.). Breeding stock has to be bought from other organic farms (exceptions possible until the end of 2003). The general idea is to replace livestock using the animals' own young. Animal products cannot be sold as organic until defined conversion periods have passed. The farmland is not fertilized with MBM, except for horns and hairs in organic gardening. This is how BSE infections on organic farms are minimized, based on recent knowledge. But BSE-infected cattle are possible even in organic farming:

(MARCKMANN 2000). An evaluation of literature surveys about the question of whether organically grown foods are of better quality than conventionally grown foods is made by Alföldi et al. (2001).

[5] Private organic farming associations often have higher standards than those laid down in EU 1804/99.

- The organic farm has just been converted. The animals are born and reared before the conversion under conventional animal husbandry conditions (feeding via milk powder, MBM in concentrates). These converted cattle might be infected with BSE.
- Breeding stock was bought from conventionally managed stocks. This is permitted when no breeding stock from organic farms is available (up until the end of 2003). After a defined conversion period products from these animals can be sold as organic. These bought animals might be infected with BSE.
- Up until August 2000 EU-certified organic farms were only restricted in plant production under EU regulation 2092/91. The stock keeping on these farms had no restrictions until the EU organic animal husbandry regulations (1804/99) became law in August 2000.[6] On EU-certified organic farms, which have fed their stock with conventional concentrates and/or milk powder until August 2000, BSE infected cattle are a possibility.
- Other, unknown infections are a possibility.

Genetically Modified Organisms and derivates (GMOs)

Public acceptance of GMO foods is low and decreasing (AMMAN 1999). Consumers fear negative effects on their health. The toxic, allergic and/or carcinogenic effects of recombined and cross-effected natural proteins in GMOs are not clear (FRANCK-OBERASPACH & KELLER 1996). The best way of obtaining GMO-free foods is from organic farming. In the standards of organic farming GMOs and their derivatives are excluded in production and processing (KOECHLIN 1999). All farm inputs have to be certified as GMO-free. Even in processing (e. g. milk to yoghurt) all ingredients have to be certified as GMO-free when they are sold as organic product. In organic farming circles GMOs are considered to be the most dangerous development in conventional farming, one that has an impact on organic farming even when not used. It is becoming more and more difficult to guarantee totally GMO-free production and processing:

- Particularly in processing, the origin of permitted conventional ingredients (5%) is not obvious. Contaminations with GMOs are possible when ingredients come from countries where the separation of GMO and non-GMO crops is not obligatory (e. g. maize and soy beans in the USA).
- Permitted conventional animal feeds (10% for ruminants and 20% for monogastric animals) could be contaminated by GMOs even when there is a GMO-free guarantee.
- GMOs could infiltrate into animal products through veterinary treatments of the animals (white genetic technology). Vaccines in particular are produced using GMOs.
- Pollen transport by insects (e. g. bees) and alluvial drifts from other plots with GMO-cultivations.

[6] Many private organic farming associations prohibited MBM for ruminants in their standards as early as the Eighties in the understanding that ruminants are vegetarians and not cannibals or carnivores (e. g. AGÖL in Germany).

Synthetic chemical contaminations

Veterinary drugs and contaminations of animal feeds are the most serious safety risks in milk and meat. These substances are minimized under organic farming methods. Synthetic chemical substances are minimized in organic foods. Conversion periods of two to three years without the application of chemical inputs represent an attempt to remove any contaminants from the soil. Not only crops for human consumption but even the roughage and the feed concentrates in animal husbandry are subject to these restrictions. Chemical additives are not permitted in organic animal feeds. Positive lists and quotas determine the purchase of fodder, veterinary drugs and disinfectants. The goal is fodder production on site, utilisation of natural drugs (e. g. homeopathy, herbal curing) and natural disinfectants (e. g. lime). The feeding of antibiotics and hormones and the use of Bovine Somatotropine (BST) is prohibited. Pesticides, fungicides and sludge (heavy metals and other contaminants) are not applied on fodder crops. If veterinary treatments are necessary a double withhold period is obligatory. Synthetic preservatives and additives are prohibited. These production claims are what inform consumer expectations that organic foods are healthier. Nevertheless, chemical contaminations are possible in organic animal products because of:

- pesticide residues and
- environmental contamination. [7]

A large French pesticide contamination study of 10 types of products with 9,133 samples was carried out by SETRAB from 1993-97 (BITAUD 2000). Only 420 milk product samples and 17 meat samples were part of the study. Most of the samples (90.4%) were free from pesticide contamination or showed only minor traces and only 6.4% showed contamination levels higher than S2 (10% of European food law limits LMR). Milk and meat was more contaminated than the average of the total samples.. The assumed cause of chemical contamination is environmental pollution or previous land use methods. Contaminants such as heavy metals, chlorinated hydrocarbons (CHC), toxic organic compounds (e. g. dioxin, PCBs and persistent pathogens) and even radioactivity are equally found in conventional as well as in organic foods due to general environmental pollution. Such contamination is not a question of organic land use, nor can it be avoided by employing organic land use methods. Many natural pesticides, disease control substances and disinfectants are permitted in organic animal husbandry. They too can have a negative effect on human health (FAO 2000).

Natural hazards

Natural hazards such as microbiological contaminations and diseases can happen more often in organic foods than in conventionally produced foods. Most of them appear during processing and preparation, but they can also occur in production, when the work is not done properly and/or the farm organism is effected from outside (FAO 2000). The prohibition of powerful disinfectants, mycotoxins in foods and feeds, human health affecting animal diseases (e. g. listeriosis, E. coli) are safety risks. Animal faeces can contain a range of human pathogens and many pathogenic organisms can survive up to 60 days under compost conditions (RAUPP 1996). If contaminated faeces are used as fertilizer in gardening human health can be negatively affected. Particularly on organic farms a proper disease prevention strategy and an understanding of pathogenic organisms (parasites, bacteria, viruses) is necessary in order to avoid foods safety risks (LAMPKIN 1999).

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[7] Nitrate content in organically grown foods is significantly lower than in conventionally grown crops. Nitrate content is crop-related but not milk- and meat-related.

Mycotoxins are important pre-harvest and post-harvest contaminations and risky for human food safety. Aflatoxins are the most toxic of these compounds and can induce liver cancer. Since fungicides are not allowed in organic farming, many studies have been conducted on this issue (OLSEN & MÖLLER 1995, KUIPER-GOLDMAN 1998). These studies do not reveal more mycotoxin contamination than conventionally produced foods (WOESE et al. 1995).

Summary

Consumers expect organic food to be safe and healthy. The standards of organic farming are able to prevent contaminations and diseases effecting human health both directly and indirectly:

- Direct food safety means the prohibition of specific production and processing inputs. Organic farming minimizes the use of external inputs (positive lists), it prohibits use of synthetic fertilisers, pesticides, preservatives and additives, there may be no GMOs or irradiation, no human waste water slurry (heavy metals, chemical hazards etc.) used on fields, no preventive use of antibiotics, there must be a double withhold period after veterinary treatments, and finally no hormones may be used in animal production.
- Indirect food safety means the protection of the a-biotic and biotic environment. Pesticide residues, veterinary drugs, nitrates or heavy metals do not contaminate ground water, and pesticides or fungicides do not pollute air during application or by dust from animal enclosures.

However, the "certified organic" label is no guarantee of safe food in general. Food safety control is not part of the organic farming certification process. Contaminations of animal products such as meat and milk as a result of chemical and natural residues in feeds and diseases are possible even under organic standards. Safety hazards can occur if the production was not carried out properly or if circumstances arise that cannot be controlled by the farmer (environmental contaminations).

Food safety standards and food hygiene requirements (e. g. food safety programmes based on Hazard Analysis and Critical Control Point HACCP and Maximum Residue Limits MRLs) are equally valid for conventionally and organically produced food and need to be subject to controls and checks.

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Table 1. Pesticide residues in organic food samples in France 1993 to 1996 (BITAUD 2000)

	Number of analyses	No detection (%)	S1 < % > S2	% > S2
Milk products	420	85.7	7.6	6.7
Meat	17	88.2	0	11.8
Cereals	5855	93.3	3.3	3.4
Fruits	1113	94.7	1.9	3.6
Vegetables	601	93.7	1.3	5.0
Soya	231	99.1	0.45	0.45
Oils	433	88.9	6.4	4.7
Arom. & med. Plants	258	63.6	10	26.4
Alcoholic drinks	93	95.7	2.1	2.2
others	112	99.1	0.9	0
Total and average	9133	90.2	3.4	6.4

S1 = detection limits of laboratories, S2 = contamination 10 times lower than LMR.

	++	+	0	-	--
Quality of produced food		X			
• Pesticide residues	X				
• Nitrate		X			
• Mycotoxins			X		
• Heavy metals			X		
• Desirable substances			X		
• BSE risk		X			
• Antibiotics	X				

Source: STOLZE et al., 2000

WHO/CDS/CSR/EPH/2002.9

Pre-harvest food safety

Report of a WHO consultation with the participation of the Food and Agriculture Organization of the United Nations and the Office International des Epizooties.

Berlin, Germany 26-28 March 2001

World Health Organization
Department of Communicable Disease,
Surveillance and Response

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Preamble

The WHO Consultation on Pre-harvest Food Safety was held with the participation of the Food and Agriculture Organization of the United Nations (FAO) and the *Office International des Epizooties* (OIE) from 26 to 28 March 2001 at the Federal Institute for Health Protection of Consumers and Veterinary Medicine, BgVV, in Berlin, Germany.

The recommendations provide a framework to improve on-farm measures for increased safety of food of animal origin. They will support and guide national authorities in their respective activities and in the establishment of control programmes.

The Consultation is part of WHO activities to develop sustainable and integrated food safety systems for the reduction of public health risks along the entire food chain, from primary producer to the consumer. Foodborne diseases are an important cause of ill-health, have economic implications and are furthermore subject to increasing public concern. This makes pre-harvest food safety an essential element of any sustainable animal production and integrated food safety system.

During the Consultation (Annex 3, Agenda), national and international experiences gained in the implementation of pre-harvest food safety programmes and activities were reviewed. Challenges and future opportunities were highlighted. The discussion focused on those activities and measures related to farm-animal production which contribute to the protection of human health from diseases transmitted to humans via food of animal origin. This includes particularly meat and other products that are not subject to additional food processing steps.

The Consultation elected Dr Henrik Wegener as chair and Dr Patricia Desmarchalier as rapporteur. Dr Peter Braam (WHO) served as secretary. Experts from various disciplines and representatives from various international organizations and institutions having both interests and important activities in the area of pre-harvest food safety participated (Annex 2).

The challenge will be to further develop and implement pre-harvest food safety strategies. There is a clear need for reliable and well functioning pre-harvest food safety systems. These should include the reduction, prevention, control and surveillance of the public health risks in farm-animal production and should be guided by risk analysis.

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