

Organic Meat: an Overview

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ABSTRACT : Organic farming is an emerging area for crop and livestock production, processing, marketing, trade and consumption, and, therefore, for research all over the world. In developed countries it has made significant inroads but the developing countries especially the Asian countries are in the stage of conception only, as far as organic livestock production is concerned. Some Latin American countries have started exporting organic meat products to developed countries. In such a scenario, information needed in the area of organic livestock production has increased significantly. This paper reviews the developments so far and prospects for future for organic meat production in Asian countries. (*Asian-Aust. J. Anim. Sci. 2003. Vol 16, No. 8 : 1230-1237*)

Key Words : Organic Meat, Organic Livestock, Review, Asia, Organic, Standards

INTRODUCTION

Since pre historic times of human civilization, humans have killed animals to provide meat to eat. It can be assumed that most people in modern society enjoy meat in one form or another, as a daily item or an item of delicacy. However, the incidence of BSE (Bovine Spongiform Encephalopathy) epidemic in cattle, use of dioxin in animal feed, use of growth hormone and use of antibiotics as feed additives put a question mark on food safety (Watson and Redman, 1999; Givens, 1999). Food safety is now an important issue discussed more strongly now than ever before.

Confronted with the effects of environmental degradation, as well as with the increasing consciousness on animal welfare, the developed countries are searching for alternative livestock production systems, allowing for preservation of the environment and with a high standard of animal welfare without compromising food security and food safety. As a result, many consumers are seeking alternatives to conventionally produced meat. Organically produced meat is such an alternative to conventionally produced meat and the demand for this 'organic meat' is sharply increasing day by day in the so-called developed countries. The total market of organic food and beverages in 2001 was US\$ 21 billion, and is expected to be \$80 billion by 2008 with a growth rate of 20% per annum (ITC, 2002). The most recent estimates (Table 1) indicate that there should be at present more than 250,000 organic farms all over the world, covering a surface of about 17-18 million hectares. In relative terms, this is almost nil but the recent growth has been impressive and all experts forecast a continuous expansion.

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As most countries have signed the agreement of WTO, we can say that in the near future most trade will be in accordance with the WTO rules. Under the WTO regime strict compliance with production standards would be the first criterion for export. This is where the developing countries are lagging behind currently.

WHAT IS ORGANIC MEAT?

Before discussing 'what is organic meat' it is appropriate to give a definition of 'organic agriculture', as the production of 'organic meat' falls under the holistic approach of organic farming or organic agriculture.

Lampkin (1990)-defined organic agriculture as, "a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives. To the maximum extent feasible, organic farming systems rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients, and to control insects, weeds, and other pests". The concept of the soil as a living system that develops the activities of beneficial organisms is central to this definition. Apart from these inputs criteria, organically produced products are from added values like biodiversity, species preservation and protection of nature, landscape, ground water and of animals etc., which are closely related to the production process (Philips and Sorensen, 1993). Sustainability is the end goal of organic agriculture and as sustainability includes social, economical and ecological components, so social justice and social rights are integral part of organic agriculture (IFOAM, 2000). In a broader sense, we can say 'organic' is not only a matter of final product but the whole process of production has importance under the organic production system. It is a life style, which aims at broader sustainability of life and resources on this planet (Chander, 2001). As conventional livestock

Table 1. Worldwide recent evolution of organic farming

	Farms			
	1999		2001	
	No.	%	No.	%
Africa	661	0.4	12,800	5.2
Asia	9,288	4.9	16,256	6.6
N. America	36,539	19.4	38,190	15.5
S. America	9,890	5.2	34,301	13.9
Europe	130,454	69.1	143,070	57.9
Oceania	1,957	1.0	2,367	1.0
World	188,789	100.0	246,984	100.0

No. =Number, ha=Hectares, Source: Santucci, 2002.

production practices are frequently examined and criticised in the context of recent animal disease outbreaks and increasing food safety concerns, there is growing consumer and political pressure to apply higher safety standards. Often such policies imply a move away from the widespread use of antibiotics and feed additives, and a strengthening of animal welfare standards. Adoption of such standards by conventional livestock producers may limit overall demand for organic products. Such`- products could be seen as a "half way house" between organic and conventional agriculture.

Production of organic meat is founded upon a number of basic principles, which are embodied within the Standards for Organic Production. In India, The National Standards for Organic Production developed by Ministry of Commerce and Industry, Government of India, provide guidelines for organic production. Some of those relevant to organic livestock production are given below to illustrate the concept:

Origin of animals

All animals intended for final sale as organic meat or meat products must be born and raised on an organic farm. When organic livestock is not available, certification programme shall allow brought-in conventional animals according to the following age limits.

- Two- day old chickens for meat production.
- 18- week old hens for egg production.
- Piglets up to six weeks and after weaning.
- Calves up to 4 weeks old that have received colostrums and have been fed a mainly milk diet.

Breeding stock may be brought-in from conventional farms but maximum replacement rate will be 10 percent.

Breeds and breeding

- Breeds should be chosen which are adapted to local conditions.
- Reproduction techniques should be natural.
- Embryo transfer techniques are not allowed.

- Hormonal heat treatments not allowed.
- Use of GMO (Genetically Modified Organisms) not allowed.

Feeding

- The livestock should be fed 100% organically grown feed.
- More than 50% of the feed shall come from the farm unit itself or shall be produced within the region.
- However, in some cases 15-20% of total feed could be obtained from conventional farms.
- The use of synthetic growth promoter substance, synthetic appetizers, preservatives, artificial colouring agents, urea, animal by products to ruminants, solvent extracted oilcakes, pure amino acids, genetically engineered organisms or products thereof, are not allowed.

Animal health

An important objective of organic livestock husbandry is the avoidance of reliance upon routine and/or prophylactic use of conventional veterinary medicines.

- Natural medicines and methods, including homeopathy, ayurvedic medicine and acupuncture, shall be emphasized.
- The use of conventional veterinary medicines are allowed when no other non-allopathic alternative is available and where these are used, the withholding period shall be twice the legally required period.
- Vaccines shall be used only when diseases are known or expected to be a problem in the region of the farm and where these diseases can't be controlled by other management techniques. However, genetically engineered vaccines are prohibited.

Apart from the above-mentioned standards, there are several other standards concerning mutilation, record keeping, transport and slaughter. The principles and production standards outlined above are only a few illustrative once not an exhaustive list, according to Indian Standards on Organic Production, which may vary from other standards.

So, briefly, we can say, 'organic meat' is obtained from animals or birds raised in an organic system, which are based on the physiological and behavioral needs of animals. Animals are not caged, tethered or confined in buildings without adequate natural ventilation and lighting. They are given enough room for free movement and kept in appropriate size herds and flocks. Attention is given to

bedding materials, access to pasture and fresh water. The health and vitality of the animal is maintained by sound nutrition and good management practices, prophylactic antibiotics should not be necessary. All growth promoters and hormones are prohibited. Veterinary drugs are allowed only where there are no effective complementary treatments. Withdrawal periods after giving a veterinary drug are strict in order to prevent residues in meat (Saffron, 2001).

IS ORGANIC MEAT SAFER?

Though the situation is under control but the single incident, which put a big question mark over 'food safety', was the outbreak of BSE (Bovine Spongiform Encephalopathy) and its link with CJD (Creutzfeldt-Jakob Disease). The most acceptable theory of BSE outbreak was transfer of 'scrapie' from sheep to cattle via meat and bone meal which is widely used as a source of protein in livestock feed (Bear, 1997; Watson and Redman, 1999). The question of food safety is controversial and difficult to quantify. 'Organic meat production' undoubtedly reduces the risk of potential public health problems occurring by prohibiting the use of antibiotics, hormones and pesticides, which are suspected to have endocrine disrupting, carcinogenic, teratogenic, immunosuppressive and nervous effects (Lee et al., 2001), and by applying more stringent safety margins (i.e., withdrawal period) to acceptable practices such as use of antibiotics on individual sick animals (Redman and Holden 1994). Organically produced animal products have lower levels of veterinary drugs and pesticides. As regular use of antibiotics are prohibited organic meat potentially reduces the risk of contamination by antibiotic resistant bacteria particularly, *E. coli* 0157: A7 infection. The 'organic' label provides the assurance that no food ingredient is subject to irradiation and that genetically modified organisms have been excluded (Kouba, 2001). However, it seems that organic farming leads to higher risk for the contamination of products by parasites of livestock and by microbes present in the manure (Kouba, 2001; Avery, 2001).

IS IT BETTER FOR THE ENVIRONMENT?

The production of organic meat involves less intensive livestock farming practices than in conventional one. Synthetic fertilizers and pesticides sprays are prohibited in animal feed and fodder production, and animals are kept at lower stocking rates. This lowers the pollution risk (Younie and Watson, 1992) and it also minimizes the nutrient losses at the farm level (Sundrum, 2001).

A life cycle assessment was conducted in the Netherlands to analyse the contribution of organic dairy farming towards ecological sustainability. The study

Table 2. EEC-Regulations on organic livestock farming in relation to selected minimal standards

Farm animals	EEC Regulation on organic livestock farming
Dairy cows	
Locomotion area per animal	6.0 m ² indoors+4.5 m ² outdoors
Floor characteristics	Lying space with litter (bedding)
Husbandry practices	Keeping tethered is forbidden
Calves	
Locomotion area per animal	1.5 m ² indoors+1.1 m ² outdoors
Floor characteristics	Dry litter bedding
Husbandry practices	Generally group penning
Sow with piglets	
Locomotion area per animal	7.5 m ² indoors+5.0 m ² outdoors
Fattening pigs	
Locomotion area per animal	1.3 m ² indoors+1.0 m ² outdoors
Husbandry practices	No tail cooking and tooth-clipping
Laying hens	
Locomotion area	1,660 cm ² indoors+ 4 m ² outdoors

Source: Sundrum, 2001.

showed that emission of green house gases (gCO₂-equivalents) and acidification potential (gSO₂-equivalents) per liter of milk were 14 and 40% less for organic than conventional dairy herds (Oosting and DeBoer, 2001), which could be an indicator for meat producing ruminants also. Higher amount of roughages in the diet of organic animals could be the causes.

IS IT BETTER FOR ANIMAL WELFARE?

There is no simple definition of animal welfare. Duncan and Fraser (1997) have pointed out that the term did not arise as a scientific concept but as a reflection of our value system, to express our concern for the appropriate treatments of animals. Hodges (1999) defined animal welfare as, "the care of animals kept in the service of mankind, so that their well-being is provided for, their natural needs are not restricted and their worth and dignity as individuals are recognized". In fact we have no scientific tools to decide 'good' or 'bad'. We have only personal views, background and experiences.

In spite of the difficulty in defining animal welfare, indirect approaches have been developed in order to assess the appropriateness of housing condition in terms of animal welfare and to distinguish poor and good living conditions. There is no general consensus on parameters, which are most suitable for an overall assessment of animal welfare. Models developed for the purposes are TGI 200 (Sundrum et al., 1994) TGI 135 (Bartussek, 1999) and the Ethical Accounting (Jensen and Sorensen, 1999), are based on different parameters of welfare. In the TGI 200 and TGI 135, a Welfare Index is calculated as a sum of weighted parameters. While in Ethical Accounting only verbal

summarizations are carried out. The studies of Bennedsgaard and Thamsborg (2000) indicated the welfare of animals was better in Danish organic dairy herds as compared to conventional herds in terms of general health (i.e. production, body condition, hock lesion, chronic infection) and udder health (mastitis occurrence, somatic cell count). The Table 2 shows the space requirements in organic farms, which is much higher than conventional farms.

The question sometimes raised on individual welfare of animals with respect to health care, as there is a prohibition on conventionally used veterinary medicines (except in emergencies) on organic farms. The most common health problems on organic farms are mastitis and parasitism. The studies revealed that the incidence of mastitis was of the same or even more for organic farms in comparison to conventional farms (Weller and cooper, 1996). However, a lower incidence of mastitis was reported by Hovi and Roderic (2000), among organic dairy herds in England and Wales.

All the leading animal welfare organizations support organic farming (OFFC, 1993). RSPCA (Royal Society for the Prevention of Cruelty to Animals) have stated, "we hope that more people/consumers will become aware of the potential for organic farming as one means of alleviating the suffering of farm animals" (Redman and Holden, 1994).

DOES IT TASTE BETTER?

Not only for meat but also for every food item taste plays an important role while buying the product. A consumer trial on steaks taken from organic and conventional cattle slaughtered at the same age revealed a significant preference for organic steaks in terms of overall eating quality, i.e. taste, Juiciness and tenderness (Lowman, 1989). However, controlled taste panel experiments conducted by Younie et al. (1990) and by Kirk and Slade (2001) showed no significant difference in taste between organic and conventional meat.

WHO BUYS ORGANIC MEAT?

The main motivations for buying organic food are concerns about the personal health, environment and food safety, although many consumers also prefer to buy organic food for enhanced flavor and freshness (Badertscher et al., 1998; Grueff, 1998; Worner and Meier-Ploeger, 1999; Krystallis, 2001). Ethical concerns regarding animal welfare and support organic farmers were also motives for some organic consumers (Aitchison, 1999; Woodward and Meier-Ploeger, 1999). Health was the primary concern among 70% and 46% organic consumers in Germany and U.K., respectively. Whereas, for environment, it was 10-30% in

Table 3. Consumer's premium prices in European Union (%), 1997-98

Country	Dairy	Beef	Eggs	Sheep	Pork	Poultry
Austria	25-30	25-30	25-30	Nd	Nd	Nd
Belgium	30	35	70	Nd	40	60
Germany	25-80	35-50	30	10-30	50-80	40-100
Denmark	20-30	20-50	7-50	Nd	30-60	50-100
Spain	15-75	Nd	15-100	Nd	Nd	Nd
Finland	31	33	Nd	Nd	-2	Nd
France	20-150	30	Nd	Nd	Nd	Nd
United kingdom	20	25-50	Nd	20-50	50-100	100
Greece	Nd	Nd	Nd	Nd	Nd	Nd
Ireland	Nd	20	Nd	Nd	Nd	Nd
Italy	20-50	25-50	50-200	20-50	Nd	Nd
Luxembourg	10	40	50	Nd	40	50
Netherlands	38	Nd	43	Nd	Nd	Nd
Portugal	Nd	Nd	Nd	Nd	Nd	Nd
Sweden	15-20	20	25-115	20	40	Nd

nd=no data available, Source: Santucci, 2002.

Germany and 41% in U.K. Taste was rated high at 40% in U.K. and 13-24% in Germany. Animal welfare was cited as a reason for buying organic products by 26% of U.K. organic consumers, and 17% of German organic consumers buy organic products to support organic farmers (Meier-Ploeger and Woodward, 1999). Food safety is long been important to Japanese consumers with 80% of buyers in 1996 citing assured safety as the prime reason for purchasing organic foods (Naka, 1996). In U.K., 80% of organic food consumer buy organic product because it is GE free (Conlon, 2000).

Because organic foods are generally priced higher than conventional food (Table 3), organic consumers generally have above average income (Wetzel and Ferris, 2000). They are also usually relatively well educated (Hager, 2000; Wetzel and Ferris, 2000) and are aware of environmental and health issues (Aitchison, 1999; Worner and Meier-Ploeger, 1999). Consumer of organic foods are often young or with young families (Grueff, 1998, Aitchison, 1999). Consumers with high meat consumption were more likely to purchase the labeled ('Organic' or 'Bio' or 'Green') meat (Badertscher et al., 1998).

Vegetables & Fruits are the most common type of organic product but a significant proportion of organic consumers buy organic meat as well. For instance, in U.K. 20% of organic consumer bought organic poultry and 15% bought red meat, whereas, in Germany, around 10% bought organic meat and another 7.5% bought organic sausage (Meier-ploeger and Woodward, 1999).

STANDARDS FOR ORGANIC MEAT PRODUCTION

Organic Standards are the detailed rules defining (a) the production and processing practices that are permitted in the

growing and manufacturing of organic food, and (b) the precautions that must be taken to protect the integrity of an organic product or process. (Michaud et al., 1994). Standards whether international or regional, are linked to a specific philosophy and they are not simply a collection of prohibitions describing what is not allowed in organic farming. Standards reflect clearly the positive approach and definition of organic farming by emphasizing what ought to be done in order to farm organically (Sharma, 2001). Implementing organic standards require inspection and the end product of the inspection is certification. Certification ensures that organic products are produced, processed and packaged according to organic standards. Certification also ensures that consumers, producers and traders against fraudulent labeling of non-organic products. The accreditation process, which is conducted by an independent accreditation body, evaluates a certifier's inspection and certification procedures, as well as that organization's ability to remain free from vested interests (USDA, 2001).

There are a few international standards for organic production like the IFOAM Basic Standards, EU Regulation No-1804/1999 and Codex Alimentarius ALINORM 99/22A. (Schmid, 2000). Although the philosophy behind these standards is the same, they differ in some criteria like conversion period, feeding, and veterinary treatment. Apart from these international standards most of the main countries in organic production have their own national or local standards, like UKROFS in UK, JAS in Japan, California Organic Standards in state of California, USA (USDA, 2001; Michaud et al., UKROFS, 1994). India too has developed National Standards for Organic Production (NPOP, 2000).

GLOBAL ORGANIC MEAT MARKET

In markets where demand for organic food has become more widely accepted, demand and production of organic animal products has also grown. Markets reflecting this trend includes the USA and EU, and to a lesser extent Argentina and Brazil. In USA, organic meat and meat products including poultry are the sixth fastest growing commodity group, with total sales forecast to \$617 million by 2003. Organic meat products are expected to capture 5% of total domestic organic food sales by 2003 (USDA, 2001). In Austria, a total of 96% of all organic farms raise livestock of some kind, 87% of them raise cattle, 49% and 51% keep pigs and poultry (Eder et al., 2000). Organic meat and cheese are the main exported organic products of Austria. In Spain, 52% of the organic livestock farms produce organic beef and 28% are engaged in mutton and lamb production and another 5% are in goat meat production (Ameztoy, 2000; Trujillo, 2000).

Table 4. Overview world market for organic food and beverages (estimates)

Market	Retail sales (million US\$)	% of total sales food	Expected growth sales-medium term (million US\$ 2001)	retail
Germany	2,100-2,200	1.6-1.8	10-15	-
U.K.	1,100-1,200	1.0-2.5	15-20	-
Italy	1,000-1,050	0.9-1.1	10-20	-
France	800-850	0.8-1.0	10-15	-
Switzerland	450-475	2.0-2.5	10-15	-
Denmark	350-375	2.5-3.0	10-15	-
Austria	200-225	1.8-2.0	10-15	-
Netherlands	275-325	0.9-1.2	10-20	-
Sweden	175-225	1.0-1.2	15-20	-
Belgium	100-125	0.9-1.1	10-15	-
Other Europe*	400-600	-	-	-
Total (Europe)	7,000-7,500	-	-	8,500-9,000
U.S.A	7,500-8,000	1.5-2.0	20	9,000-9,500
Japan	2,000-2,500	-	-	2,500-3,000
Total Ca.	17,500	-	-	21,000

Note: Official trade statistics are not available. Compilations are based on rough estimates. Retail sales in US\$ are based on average exchange rates. The figure for Japan is particularly uncertain. (This figure also includes non-certified products, e.g. some "Green Products").

* Finland, Greece, Ireland, Portugal, Spain, Norway

Source: Compiled by ITC, January 2002, based on trade estimates

French sales of meat products are expected to reach \$2 million by 2003 and in 1998 the organic meat accounted for 3% of total organic production in France (USDA, 2001). Countries like Poland, Slovakia, Hungary, Russia, currently have smaller internal organic markets and they export most of what they grow on their expanding numbers of organic farms (Soltysiak, 1997; Fruhwald, 2001).

Latin American countries, like, Argentina, Brazil and Uruguay produce substantial amounts of organic meat (ITC, 1999). In Argentina, more than one million hectares of land are dedicated to organic livestock production, the majority of which produce organic beef cattle and 80% of the produce is exported to the EU. Though little organic beef is produced in Brazil, organic poultry, egg and milk production are growing day by day (USDA, 2001; Lernoud, 2001).

Oceania accounts for almost half the global organic farmland, exports most of the organic food produced. New Zealand also exports organic meat to UK and Germany. Japan is the third largest market for organic foods after USA and EU and account for the bulk of Asian market revenues (Table 4).

SCENARIO FOR DEVELOPING COUNTRIES

The problems of developing countries are entirely different from those of developed countries. In most of the developed countries, the problem is over production. Whereas, in developing countries the problems are poverty,

malnutrition and unemployment, so here food security is the prime goal rather than food safety. In this situation, development of the organic sector itself is very difficult and development of an organic meat sector is more difficult. Except some Latin American countries, whatever developments have taken place in developing countries are mainly restricted to crop sector. Reports from different countries such as China (Pennarz and Huilai, 2001; Lianzheng, 2001), India (Chander and Kumar, 1999; Singh, 2001), Srilanka (Jayakody, 2001), Philippines (Bantiles, 2001), and Korea (Sohn and Jarg, 2001) reflect the trends. However, the most significant thing about Latin American countries is the presence of strong internal markets for organic meat and the presence of producer co-operatives.

CONCLUSION

Though the development of organic sectors in Asian countries is not on a par with the European countries, some development has already taken place in the organic crop sector and now the Asian countries are exporting a substantial quantity of organic tea, fresh and dried fruits, vegetables, nuts, rice, dried legumes, coffee, sugar, herbs and spices (ITC, 1999), but the export as well as production of organic meat in most of the developing Asian countries is still an utopia. Though these countries have some excellent breeds of livestock, which are well suited in these climatic conditions, are more resistant to disease, and thrive well on crop residues. Most of the animal husbandry practices are traditional with a close resemblance to prescribed organic practices but we failed significantly to convert our advantages into fruitful gains. Small land holding, low level of literacy, lack of information, high stocking density, inadequate production of feed and fodder, high cost of certification, absence of marketing facilities are some hindrances in the way of conversion from traditional to organic. The most important areas where the policy initiatives need to be taken are:

(a) **Improvisation of Organic standards:** The present standards for organic production, which are based on IFOAM- Basic Standards, should be modified according to regional agro-climatic conditions.

(b) **Development of Regional Standards:** To bridge the gap between the National and International standards Regional standards should be developed to promote the marketing of organic products within the region.

(c) **Establishment of a low cost certification agency** that small farmers can afford.

(d) **Development of a strong domestic market:** Without a developed domestic market, the benefits of producer's can't be protected as international markets are always fluctuating. As such, the urban meat consumers pay 70-80 percent more price for free-range poultry meat and

eggs (Pathak and Chander, 2001), which is a fair indicator of their willingness to pay more for quality products.

(e) **Establishment of a 'Growth Center' for organic production:** Some potential areas of the countries (hilly areas, forest areas, rain fed areas), where agriculture is not so well developed, should be identified and some nodal agencies should be established. These agencies will provide the technical support to the farmers, will make arrangement for certification and will help in marketing. The success of these areas will be a model to the rest of the countries.

(f) **Research and development:** Organic farming needs research and development in order to apply the most modern knowledge and improve its performance. Universities and research centers should start research programme together with farmers.

(g) **Training and extension** should be provided to all categories of stakeholders.

(h) **Governments have to make legislation** in order to ensure the much-needed regulatory framework, where all stakeholders can play on a fair level ground.

REFERENCES

- Aitchison, A. 1999. The Organic Meat Myth Revealed. Opportunities for New Zealand Organic Beef and Lamb in Europe (<http://www.organicnewzealand.org.nz/secure/reports/angela's.pdf>)
- Ameztoy, J. M. 2000. Organic animal husbandry conversion in Navarra, Spain. Proceedings of Second NAHWOA Workshop, Cordoba, Spain, 9-11 January.
- Anonymous 2001. Global organic sales Reach \$26 billion. (<http://www.organicmonitor.com/research.htm>).
- Avery, T. D. 2001. The Hidden Dangers in organic food (http://www.americanoulook.org/articles/|_fa98/avery.htm).
- Badertscher, F. R., Jorin. R. and Rieder, P. 1998. Demand for meat from particularly animal friendly production Systems. *Agrarforschung*, 5, 57-60.
- Bantiles, N. A. 2001. Divergence and convergence in the Philippine organic Movement. Proceedings of 5th IFOAM-Asia scientific conference, Hangzhou city, China, October 31-November 4.
- Bartussek, H. 1999. A review of the Animal Needs Index (ANI) for the assessment of animal's well being in the housing systems for Austrian proprietary products and legislation. *Livest. Prod. Sci.*, 61, 179-248.
- Bear, S. 1997. A system analysis of BSE: lessons to be Learned. Proceedings of an International conference on Agricultural Production and Nutrition (Ed. Willam Lockeretz). School of Nutrition Science and Policy, Tufts University, USA. pp.35-45.
- Bennedsgaard, T. and S. M. Thamsborg. 2000. Comparison of welfare assessment in organic dairy herds by the TGI 200-Protocol and a factor model based on clinical examination and production parameters. Proceedings of Second NAHWOA Workshop, Cordoba, Spain, 9-11 January.
- Chander, M. 2001. Organic milk in India: Looking beyond tomorrow. *Indian Dairyman*, 53, 35-39.
- Chander, M. and S. Kumar. 1999. Indigenous cattle and buffalo

- wealth of India: exploring its role in promoting organic farming practices. Proceedings of 4th IFOAM-Asia Scientific Conference, Tagaytay city, Philippines, November 18-21.
- Conlon, M. 2000. Gain Report#UK0008 UK Organic food Product Brief. Voluntary Report for public distribution, Foreign Agricultural Service, USDA. (http://www.usembassy.org.uk/fas/pdf_reports/organic.0008.pdf).
- Duncan, I. and D. Fraser. 1997. Understanding animal welfare. In: Animal welfare, Wallingford, U.K., CAB international. pp. 19-31.
- Eder, M.; L. Kirner and W. Zollitsch. 2000. Animal husbandry in Alpine organic farming- regional diversity and critical obstacles in Austria. Proceedings of Second NAHWOA Workshop, Cordoba, Spain, 9-11 January.
- Fruhwald, F. 2001. A focus on Central and Eastern Europe. *Ecology & Farming*, 27, 21-26.
- Givens, H. 1999. Aims and aspirations of the organic trade Association. *Ecology and Farming*, 21, 10-11.
- Grueff, J. 1998. Agricultural Situation Attaché Query Detail, Report Code 24, Post Report Sequence Number 006. Report for public distribution, Foreign Agricultural Service, USDA.
- Hager, R. 2000. Gain Report#AR0005 Argentina Organic Food Report 2000. Voluntary Report for public distribution, Foreign Agricultural Service, USDA. (<http://usembassy.state.gov/posts/ar1/www.forgf.pdf>).
- Hodges, J. 2000. Why Livestock, Ethics and Quality of life? In: Livestock Ethics and Quality of Life (Ed. J. Hodges and I. K. Han). Wallingford, U.K., CABI Publishing. pp. 1-26.
- Hovi, M. and S. Roderick. 2000. Mastitis and Mastitis control strategies in organic milk. *Cattle Practice*, 8, 259-264.
- IFOAM 2000. International Federation of Organic Agricultural Movements, Internal letter, 72, 63.
- ITC 1999. Organic food and beverage: World supply and major European market, Geneva, International Trade Center, UNCTAD/WTO.
- ITC 2002. Overview world markets for organic food and beverages (estimates). International Trade Center, UNCTAD/WTO, Geneva (<http://www.intarcen.Org/>).
- Jayakody, A. N. 2001. Organic farming in Sri Lanka: Past, present and future. Proceedings of 5th IFOAM-Asia scientific conference, Hangzhou city, China, October 31- November 4.
- Jensen, K. K. and J. T. Sorensen. 1999. The idea of Aethical accounting for a livestock farm. *Jr. Agric. Envir. Ethics*, 11, 85-100.
- Kirk, J and K. Slade. 2001. An investigation into consumer's perception of organic Lamb. Book of Abstracts of the International Conference on Organic Meat and Milk from Ruminants, Athens, Greece, 4-6 October. pp. 33.
- Kouba, M. 2001. The product quality and health implication of organic products. Book of Abstracts of the International Conference on Organic Meat and Milk from Ruminants, Athens, Greece, 4-6 October. Pp.33.
- Krystallis, A. 2001. The profile of the Greek organic consumer: acceptance or rejection reasons and potential buyer identification in a countrywide survey. Book of Abstracts of the International Conference on Organic Meat and Milk from Ruminants, Athens, Greece, 4-6 October.
- Lampkin, N. 1990. Organic farming, Ipswich, U.K., Farming Press Books.
- Lee, M. H., J. H. Lee and P. D. Ryu. 2001. Public health risk: chemical and antibiotic residues. *Asian-Aust. J. Anim. Sci.* 14:402-413.
- Lernoud, P. 2001. Organic agriculture in the Latin continent, *Ecology and Farming*, 26, 18-21.
- Lianzheng, W. 2001. The sustainable development of agriculture and protection of environment in China. Proceedings of 5th IFOAM-Asia scientific conference, Hangzhou city, China, October 31- November 4.
- Lowman, B. G. 1989. Organic beef production. In: organic meat production in the '90s. Canterbury, Chalcombe publications, as quoted in: Redman and Holden (1994).
- Meier-ploeger, A. and L. Woodward. 1999. Trends between countries. *Ecology and Farming*, 20, 15.
- Michaud, M., M. Redman. and J. Dalby. 1994. Organic certification and the importation of organically produced foods. In: Handbook of organic food processing and production (Ed. Simon Wright), Glasgow, U.K., Blackie Academic & professional, pp. 31-55.
- Naka, C. 1996. The Japanese Market for Organic Products and Produce. Wellington, Tradenz.
- NPOP. 2000. National Programme for Organic Production containing the standards for the organic products. Department of Commerce, Ministry of Commerce, Government of India.
- OFFC 1993. Animal welfare groups in the United Kingdom. A report to the Royal Agriculture Society of England, Stone light, Warwickshire, U.K., as quoted in: Redman and Holden (1994).
- Oosting, S. J. and I. J. M. De Boer. 2001. Sustainability of organic dairy farming in the Netherlands. Book of Abstracts of the International Conference on Organic Meat and Milk from Ruminants, Athens, Greece, 4-6 October. p. 15.
- Pathak, P. K. and M. Chander. 2001. Awareness on organic livestock production at farmers' level: A study in two North Indian villages. Proceedings of 5th IFOAM-Asia scientific conference, Hangzhou city, China, October 31- November 4.
- Pennarz, J. and Z. Huilai. 2001. Development of organic farming in China: Experiences and recommendations from the Sino-German Project. Proceedings of 5th IFOAM-Asia scientific conference, Hangzhou city, China, October 31- November 4.
- Philips, C. J. and J. T. Sorensen. 1993. Sustainability in cattle production system. *J. Agric. Environ. Ethics*, 6, 61-73.
- Redman, M. and P. Holden. 1994. Organic meat and meat products. In: Handbook of organic food processing and production (Ed. Simon Wright), London, U.K., Blackie Academic & Professional, 84-110.
- Saffron, L. 2001. Cancer and organic meat (<http://www.positivehealth.Com/permit/articles/saffron.htm>).
- Santucci, F. M. 2002. Market issues in organic meat and dairy markets. Draft of the paper for the symposium on organic markets for meat and dairy products, FAO, Rome.
- Schmid, O. 2000. A comparison of organic livestock production standards: the new EU Regulation No- 1804/1999. IFOAM Basic Standards of November 1998 and the new draft guidelines of codex Alimentarius ALINORM 99/22A. Proceedings of Second NAHWOA Workshop, Cordoba, Spain, 9-11 January.
- Sharma, A. k. 2001. A handbook of organic agriculture, Jodhpur, India, Agrobios (India).
- Singh, R. V. 2001. Untapped potential, *Down to Earth*. 10, 34-41.

- Sohn, S. M. and J. Y. Jung. 2001. Government policy, Implementation, Certification for Organic Farming in Korea. Proceedings of 5th IFOAM-Asia scientific conference, Hangzhou city, China, October 31- November 4.
- Soltysiak, U. 1997. IFOAM and organic agriculture in Central-Eastern Europe. *Ecology and Farming*, 14, 18-21.
- Sundrum, A., Andersson, R. and Postler, G. 1994. Tiergerechtheitsindex-200, Ein leitfaden zur Beurteilung von Haltungssystemen für Rinder, Kalber, Legehennen und Schweine, Verlag Kollon, Bonn, Germany, as quoted in Vaarst (2000).
- Sundrum, A. 2001. Organic livestock farming: A Critical review. *Livest. Prod. Sci.*, 67, 207-215.
- Trujillo, G. R. 2000. Organic livestock production in Spain. Proceedings of Second NAHWOA Workshop, Cordoba, Spain, 9-11 January.
- UKROFS. 1994. UKROFS Standards for Organic Production. United Kingdom Register of Organic Food Standards, London, U.K.
- USDA 2001. Implications of U.S and global organic dairy, livestock and poultry production for international trade (<http://www.fas.usda.gov/organics/product.html>).
- Vaarst, M. 2000. Methodology in animal health and welfare research in organic livestock. Proceedings of the Second NAHWOA workshop, Cordoba, Spain, 9-11 January.
- Watson S. J. and M. Redman. 1999. BSE-counting the costs of a crisis. *Ecology and Farming*, 21, 20-21
- Weller, R. F. and A. Cooper. 1996. Health status of dairy herds converting from conventional to organic dairy farming. *Vet. Rec.*, 139, 141-142
- Wetzel, H. and G. Ferris. 2000. Gain Report#HK0008 Hong Kong Organic Products, Organics 2000. Voluntary Report for public distribution, Foreign Agricultural Services, USDA (<http://www.usfoods.hongkong.net>)
- Woodward, L. and A. Meier-Ploeger. 1999. Does 'organic' mean quality? *Ecology and Farming*, 20, 16-17.
- Worner, F and A. Meier-Ploeger. 1999. What the consumer says. *Ecology and Farming*, 20, 14-15.
- Younie, D. and C. A. Watson. 1992. Soil Nitrate-N Levels in organically and intensively managed grassland systems. *Aspects of Applied Biology*, 30, 235-238.
- Younie, D., M. Hamilton. and I. Nevison. 1990. Sensory attributes of organic and conventional beef. *Animal Production*, 50, 565-566.