Organic meat and milk production: 2. Achieving the objectives?

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INTRODUCTION

This article is based on information obtained from the published proceedings of a joint conference on organic meat and milk production, held in Athens, Greece in October 2001(Kyriazakis & Zervas, 2002).

In Europe the BSE scare, dioxin pollution problem and the outbreak of foot-and-mouth disease frightened consumers and turned them to organic food because they feel it is safer, and that organic production practices are better for the environment than conventionally produced products and production systems (Kouba, 2002). According to Brown (2002) and Kristensen & Thamsborg (2002) human health and safety are the most important motives for buying organic foods. Consumption of organically produced food leads to a greater feeling of security, but is linked to the trust in the organic certification and labelling systems. Other considerations are environmental protection and nature conservation, animal welfare and an improvement in taste (Brown, 2002; Kristensen & Thamsborg, 2002). The ban on synthetic agricultural inputs, such as synthetic pesticides, herbicides, fertilisers, fungicides, veterinarian drugs (antibiotics, growth hormones), synthetic preservatives and additives and irradiation creates the expectation that organic products contain none of the residues from these products, implicating that organic is synonymous with superior qualities (Kouba, 2002). According to Kirk *et al.* (2002) the consumer perceives that organically produced meat is of a higher quality, more free from residues, is produced in a more environmentally friendly manner with better animal welfare, has a better taste and is better for health because of a lower fat content than conventionally produced beef. Whether these claims can be proven scientifically is not as important as the consumers' belief and perception. In general, organic farming systems are perceived by farmers and the public as having positive consequences on the health and welfare of animals, because of the organic production principle of raising animals in harmony with their environment (Athanasiadou *et al.*, 2002).

However, Kouba (2002) pointed out that the organic label is not a health claim, but a guarantee of a specific production system.

HUMAN SAFETY AND HEALTH

According to Kristensen & Thamsborg (2002) and Kouba (2002) there is only very limited scientific evidence that the consumers may become more healthy by eating food of organic origin than by eating conventionally produced food. Most arguments are based on assumptions. Kristensen & Thamsborg (2002) quoted a Danish study on the question: "How does organic food affect human health?", where the conclusion was: "there is some indication – but so far no scientific reliable evidence that organic food by itself ensures better human health".

Nutritional and sensory factors

Results are inconsistent regarding the differences in nutritional qualities between organically and inorganically produced livestock products. The determining factor is the kind of feed taken in by the animals. No major differences were observed between content of desirable ingredients in milk and dairy products produced from the two production systems (Kouba, 2002). The carotene content of eggs was higher in eggs from free-range hens compared to hens in batteries. The exclusion of synthetic amino acids resulted in a higher intramuscular fat content in organic pigs compared to pigs on conventionally produced food plus the amino acids (Kouba, 2002). Where both groups of lambs were finished on grass, Kirk & Slade (2002) reported no difference in the taste of the meat between the meat from the organic *vs.* the inorganic grass production systems. Kouba (2002) also stated that no trends have been established in terms of sensory quality differences between

organically and conventionally grown food, though Kouba made the remark: "if something tastes better to you, it doesn't matter what anyone else thinks"!

Hygiene factors

Since organic production bans the preventative use of chemically synthesised medical products, the emphasis is on the selection of breeds and strains resistant to diseases, the feeding of balanced high quality diets and the creation of a favourable environment. A public health concern is the resistance of microorganisms to certain antibiotics, and a negative perception of products such as Bovine Somatotropin (BST).

Contaminants in animal feeds

Pesticide residues, agricultural and industrial chemicals and heavy metals can lead to safety hazards in foods of animal origin. Food contamination by chemicals is perceived as an important public health concern (Kouba, 2002). Kouba (2002) referred to a review in which it was concluded that the concentration of antibiotic residues in meat is most often too low to detect. Since organic foods are produced pesticide-free, they are likely to contain less pesticide residues than other foods, as confirmed by some studies (Kouba, 2002). Consequently, the fear of pesticide residues in foods is used to promote organic foods. However, Kouba (2002) referred to two surveys where it was found that food additives and pesticide residues pose a relatively minor health risk (in Europe 0.5%) to humans as compared to risks due to microbiological and naturally occurring toxins. It was concluded that, although pesticide exposure may increase the risk of reproductive impairment in humans, especially male infertility, exposure from both organic and conventional food is minimal. Furthermore, organic foods are not pesticide-free, because of contamination from persistent environmental pollutants. Other studies measured minimal differences in contaminant concentrations between organically and conventionally produced foods (Kouba, 2002).

Microbiological hazards

From natural fertilizers

Animal and other organic waste constitute the main fertilisers in organic farming. Untreated and improperly treated manure and biosolids used as fertilisers, whether in organic or non-organic agriculture, can lead to contamination of the products and of water sources. Animal and human faecal matter contain a range of human pathogens. As organic farming uses only animal manure and other organic waste as fertilisers, the microbial hazard could be higher than in conventional farming systems.

Bacterial contamination

The main source for human infection with *E. coli* is meat contaminated during slaughter. Grain fed cattle have much more *E. coli* in their digestive tracts than grass fed ones. Therefore, *E. coli* contamination is more likely on the carcases of grain fed animals than from cattle on grass-based diets, the basis of organic production (Kouba, 2002).

ENVIRONMENTAL PROTECTION AND NATURE CONSERVATION

Since the focus of the conference was on meat and milk production, the environmental impact of organic farming was covered mainly theoretically, without a critical testing and evaluation of the claims made. The following was summarised from the article of Siardos (2002) regarding the environmental impact of organic farming:

Soil protection techniques used in organic farming combat soil erosion, compaction, salinization and degradation of soils, especially through the use of crop rotation and organic materials that improve soil fertility and structure. Integrated trees and shrubs into the farm system also conserve soil and water and provide a defence against unfavourable weather conditions such as wind, droughts and floods. Techniques used in organic farming also reduce water pollution and help conserve water on the farm.

Organic farming leads to the cessation in use of pesticides through the use of natural pest control, e.g. insect pheromones, plants with pest control properties, rather than pesticides which are known to kill beneficial organisms such as bees and earthworms, cause pest resistance and pollute water and land. Crop rotation

encourages a diversity of food crops, fodder and under-utilized plants which in addition to improving overall farm production and fertility, may assist in the on-farm conservation of plant genetic resources.

Organic farming controls erosion and run-off through sod-based rotation, cover crops, green manure crops, contour farming and tillage methods that conserve surface residues. Shallow tillage is also used to mix the crop residue and manure or organic waste in upper soil layers. It assists in soil forming and soil conditioning through the protection of invertebrates such as earthworms, millipedes, termites, mites and nematodes that play a role in the development of upper soil layers through decomposition of plant litter.

It is argued that fungal diseases in conventional crops occur more frequently because plants receive high inputs of nitrogenous fertiliser, resulting in thinner cell walls and sap which is more sugary and therefore a more nutritious medium for pests and fungi. In organic farming diversity of crops in the rotation is a means of controlling weeds, insects and diseases. Weeds are controlled by tillage, mowing and grazing with inter-row cultivations and harrow comb weeding.

Reduction or cessation in the use of fertiliser in organic farming has resulted in increased biodiversity, allowing less-competitive plant species to become established. There is evidence that higher numbers and a greater range of bird species, invertebrates and wild plants are found on organic farms than on conventional farms.

Organic farming relies almost entirely on no chemical methods of nutrient supply and crop protection. The main source of nitrogen is from legumes in the rotation. Much of the grain and forage on organic farms is used for animals and crop residues and manures are returned, reducing the need for chemical fertilizer. Crop protection relies on natural pest controls, e.g. insect pheromones, plants with pest control properties, or by enhancing self-regulation, e.g. changing planting times. Crop rotation is valuable in weed control, maintenance of soil structure and organic matter recycling of plant nutrients, contribution to overall species and habitat diversity, preventing erosion, (with application of cover crops) and controlling pests and diseases (since agricultural pests – fungi, insects and weeds are often specific to the host, and will multiply as long as the crop is there). Legumes form a high percentage of cropland as cover crops, green manure or forages, as seed and as animal and human food.

Protecting soils and enhancing their fertility or land stewardship implies ensuring productivity capacity for future generations. Deteriorating soil quality is often a major reason for adopting organic management. Sufficient research has shown that organic agricultural methods have positive influences on soil quality.

On organic farms mechanisation is often replaced by labour, especially for weeding and harvesting in highly diversified systems, using natural rather than synthetic fertilizers saves non-renewable energy and nitrogen leaching. However, it is stated that: synthetic inputs may be necessary in some tropical countries because of low soil fertility.

Oosting & de Boer (2002) presented some calculations on the impact of organic and conventional farming on global warming (emissions of CO_2, CH_4, and N_2O), acidification (emissions of SO_2, NO_x and NH_3) and land use, expressed per litre of fat and protein corrected milk (FPCM). They found that organic farming per litre of FPCM produces less CO_2 (14% less) and NO_2, but more CH_4. Also, organic dairy farming produced per litre of FPCM 40% less acidification potential than conventional farming, but required 42% more land than conventional farming.

ANIMAL WELFARE

In the presentation by Athanasiadou *et al.* (2002) a critical evaluation was made of the claims on animal health and welfare claimed in organic farming. They introduced the presentation by stating that organic systems of livestock production are perceived as having positive consequences on the health and welfare of animals because of the principle in organic farming to raise animals in harmony with their environment, e.g. the ban on pharmaceuticals to control diseases. "However, the general belief that 'natural' systems are always best for animals has recently been challenged as being naïve and unjustified", e.g. the ineffectiveness of many of the alternative treatments used to control livestock diseases in organic systems. Furthermore, the welfare of organically reared animals is often more compromised than that of animals in conventional systems. (It is stated that the supporters of these views are mainly veterinarians and animal scientists).

Organic standards in Europe

Regulations regarding organic animal production in the EU became effective in August 2000. In general, management of animal health in organic systems should be based mainly on "disease prevention by measures such as appropriate selection of breeds, a balanced, high quality diet and favourable environment, in particular as regards rearing density, livestock housing and husbandry practices". It is assumed that prevention rather than treatment, and disease control without the routine use of chemically synthesized products would be possible in organic livestock production systems. Therapeutic use of chemically synthesised products is allowed following the advice of a veterinarian, provided that 'natural' or homeopathic products are neither available nor seen as capable of curing the disease. Vaccination against disease is allowed only if that disease is a threat to the health of the animals.

"To ensure high welfare of organically reared ruminants, farmers should provide housing conditions that satisfy the needs of animals, as regards ventilation, space and comfort". Organic standards also require that farmers should "minimize any systematic operations that lead to stress, harm or disease; however, specific interventions to certain types of production may be permitted", e.g. castration under some circumstances. Other operations such as tail-docking, dehorning and teeth cutting should not be performed.

Health issues arising in organic ruminant production systems

Evidence (with references) is provided in the article by Athanasiadou *et al.* (2002) that the health status of organically reared animals is sometimes being compromised, e.g. higher incidences on organic farms of both internal (17% vs. 5%) and external parasitism (62% vs. 42%) than on conventional farms; higher somatic cell counts for mastitis on dairy farms in cows on organic farms than in conventional systems; lower reproductive performance, measured as milk yield, calving interval and number of returns per cow in organically than in conventionally reared cows. "Even where the health of organically reared livestock was not worse, it was not found to be any better than conventionally reared livestock". Effective disease treatment in organic systems is less straightforward than the therapeutic use of drugs in conventional systems. Furthermore, the use of homeopathic and herbal preparations encouraged in organic farming has been found inconsistent in action, they have a poor efficacy, sometimes with undesirable side effects. "It appears that disease control in organic ruminant production systems is problematic at two levels: the prevention of a disease and its treatment when it occurs. As a consequence, health challenges such as parasitism, mastitis, metabolic disorders and mineral deficiencies are often observed amongst organically reared ruminants."

On the other hand, Conington *et al.* (2002) and Siardos (2002) pointed out that increased yields in dairy cattle in conventional farming systems are closely correlated with increased culling due to fertility problems, mastitis and hoof ailments. Nitrates from fertilized pastures may be toxic, and high levels of concentrates may reduce the rumen pH, resulting in acidosis and associated problems.

Parasitism

External parasites such as lice, mites and blowflies and internal parasites have been found to be a major problem on organic farms. Because of the problem of drug resistance, alternative approaches to the control of especially internal parasites are sought. This is relevant to both conventional and organic farming systems. In conventional systems alternative approaches such as pasture management are combined with the strategic use of drugs. However, the organic farmer has to rely on "chemical free" prevention only. Evidence suggests that there are practical difficulties in controlling parasitism using management techniques only. At present the therapeutic use of anthelmintic drugs is allowed in the EU to control nematode parasites, and this is apparently widely used. An approach to reduce the use of drugs is the breeding of parasite-resistant animals, which is a long-term approach. Short-term approaches are the identifying of antiparasitic properties in plants, e.g. the use of tannins is under investigation, and the biological control of parasites, e.g. introducing nematophagous fungi.

Mastitis

Athanasiadou *et al.* (2002) quoted a number of studies where mastitis was indicated as one of the most predominant problems in organic dairy herds. This seems to be related to the withdrawal of long-acting antibiotics during the dry cow stage. The use of antibiotics is permitted to treat clinical mastitis. However, cows

treated more than three times a year have to go through the conversion period again. Unfortunately, the efficacy of homeopathic or herbal remedies is low.

Nutrient deficiencies and metabolic disorders

Nutrient deficiencies, especially mineral and vitamin deficiencies, seem to be a problem on some organic farms. These problems are region-related as a result of the reliance on home-grown products used in organic systems. In a presentation at the conference, Coonan *et al.* (2002) compared the results of chemical analyses performed on grass silage and compound diets used on conventional *vs.* organic farms. The feed produced on the organic farms did not contain a satisfactory balance of trace elements for dairy cows. Once mineral or vitamin deficiencies are diagnosed, supplementation is permitted in the organic system. Metabolic disorders related to nutrition are encountered on organic dairy farms, e.g. ketosis due to a lack of available energy in the diet of a high producing cow.

Welfare issues in organic ruminant production systems

According to Athanasiadou *et al.* (2002) a problem with this issue is the definition of welfare: conventional farmers relate welfare to production efficiency or whether the housing conditions of their livestock fulfilled the regulations, while organic farmers relate the concept of welfare mainly to the ability of animals to express "natural" behaviours. It is claimed that organically reared livestock have higher welfare than conventionally reared animals, mainly because they are given more freedom to demonstrate their natural behaviour patterns. However, according to Athanasiadou *et al.* (2002) there is a lack of scientific evidence to support any claims, mainly because of the difficulty in assessing welfare. Fears have been expressed that there is an increasing tendency in organic farming to aim for increased production efficiency at the expense of welfare considerations, probably because of the high consumers' demand for organically produced products. The rules regulating animal welfare in organic farming "are often consumer rather than animal oriented".

Breed selection

There is evidence that animals selected for high production efficiency are more likely to reduce herd fitness, e.g. a higher incidence of ketosis in high producing dairy cows, double muscling in beef cattle, etc. Such traits do impair the welfare of animals and are considered a major issue in organic systems of production. "The modern ruminant breeds as have been 'modified' due to selective breeding, are not appropriate anymore to fit in a traditional and more natural environment that organic farming aims to promote". It is suggested that dual-purpose breeds with a lower production potential will fit better into organic farming than single purpose breeds. Also, breeding goals in indigenous breeds could be based not only on production traits, but also on health, welfare and behavioural traits, e.g. mastitis resistance, longevity, etc.

Conington *et al.* (2002) suggested that genetic improvement offers permanent and cost–effective solutions to many of the problems in organic farming. They pointed out that narrow breeding objectives, such as improving production, might be antagonistic to animal health and welfare. Broader breeding goals for organic sheep production systems such as selection against high birth weight, greater ability of sheep to survive and adapt to extensive management practices, improved flock efficiency (reducing lamb losses) and sustainability (improving ewe longevity), disease resistance and behaviour and adaptive characteristics could be considered to address issues of sustainability, health, fitness and flock efficiency.

Husbandry management issues

Regulations set the minimum space allowances in organic farming to ensure freedom of movement and easy access to feed, water and pastures. There is a concern that specifications which are derived from conventional farming systems might not be sufficient to cover the needs of animals in organic systems. Furthermore, some practices such as dehorning are sometimes allowed in organic systems, but may not be compatible with the principles of organic farming.

According to Siardos (2002) the divorcing of livestock production from the soil runs counter to nature of animals themselves. In intensive systems a massive reliance is placed on feedstuffs from elsewhere. This also creates the problem of the disposal of livestock waste in environmentally harmful quantities and concentrations.

Weaknesses of organic ruminant production systems

It is emphasized that 'natural conditions' of rearing do not automatically imply 'better for the animal'.

The organic standards suggest that vaccinations should be used only when the health and welfare of animals are being threatened. There seems to be a concern that veterinary surgeons are likely to encourage excessive vaccination, but that organic farmers are not qualified to make such decisions. Veterinarians in the EU often lack the appropriate education and/or training to help farmers to cope with diseases under organic conditions.

A concern is that even though organic farmers are people who converted their farms out of respect for the environment and the well being of the animal, some of them are motivated only by the premium prices of organic products.

Chemically synthesised drugs are not permitted in organic farming because they contain substances that are toxic to certain microorganisms and can upset the balance of the system. The lack of alternatives to control disease in organic production systems contributes to poor health and welfare of organically reared livestock. However, naturally synthesised herbal preparations which are meant to improve the immune status of animals may act in a similar way as synthetic drugs, i.e. causing unhealthy animals. It is advisable that the mechanisms involved in the efficacy of these drugs, should be evaluated before acceptance.

ECONOMIC RETURN AND PRODUCTIVITY

It is generally accepted that organic farming leads to a reduction in crop yields, lower animal production and because of lower stocking rates, lower output per unit land. This means higher production cost (Siardos, 2002). Yields per unit land or animal are usually between 10 and 30% lower in organic than in conventional farming, e.g. cereal production is only 60–70% and dairy production 70-75% of conventional farming output (Siardos, 2002). According to Wright *et al.*, (2002) organic systems which rely on grass/clover swards as forage resource has a 23% lower stocking rate than the conventional system. After weaning, finishing of calves is a problem because organic feedstuffs have to be fed. Because the production yield is reduced (30-40%) under the regulations of organic farming, the fixed costs (buildings) per kg milk or meat produced are much higher than in conventional farming (> 50% higher fixed costs is possible).

Prices of organic feeds often have a premium on, reflecting higher production costs, but also the consumers' willingness to pay for the difference, e.g. milk has a premium of 20-30% in Austria and Denmark, while organic beef and mutton are sold at premiums of between 20 and 50% (Kristensen & Thamsborg, 2002). Siardos (2002) argued that because of lower input costs and higher prices, the profitability of organic farming is not lower than that in conventional farming (Siardos, 2002). Kristensen & Thamsborg (2002) reported that between 5 and 20 % of consumers are willing to pay the price premium when it is higher than 30%. If the price premium is 5-10%, 45-80% of consumers will buy organic foods.

In some European countries a subsidy is paid to encourage the conversion to organic production and for the production of organic products. Concern is expressed that organic producers will have to become more competitive if the demand for organic produce is met by the supply, resulting in a reduced premium for organic produce (Wright *et al.*, 2002).

RESEARCH

Investigations are conducted on various aspects of organic farming, such as the scientific evaluation of homeopathic and herbal preparations. According to Häring & Dabbert (2002) there is strong support within the organic farming sector that a holistic approach to research should be adopted, i.e. integrating all aspects of organic production systems.

PERSONAL COMMENTS

Few people could probably object to the basic philosophy of organic farming practices. However, it seems as if a strong driving force in the expanding of the system is the increasing consumers' demand for organically produced food, based on the perceived notion that organically produced food is more healthy than conventionally produced food. Since is seems in many countries to be economically feasible and viable to

produce organic food, it would and probably does unfortunately attract producers with little consideration for the philosophy of organic farming and who might consider it as purely an economic venture to be exploited. Strict control, supported by legislation, is therefore necessary. Legislation regulating organic farming in South Africa producing for the local market is urgently required. One would hope that consideration would be given to farming conditions in this country when such legislation is finalised, rather than copying blindly the conditions of registration applicable to the temperate climatic regions of the world with their pollution problems and overproduction of food.

REFERENCES

Conference proceedings

Kyriazakis, I. & Zervas, G., 2002. Organic meat and milk production from ruminants. Proceedings of the Joint International Conference of the Hellenic Society of Animal Production and the British Society of Animal Science, Athens, Greece, October 2001. EAAP publication No 106, ISSN 0071-2477 (ISBN 9076998086 paperback), Wageningen Academic Publishers, P.O. Box 220, NL-6700 AE Wageningen, The Netherlands. 253 pp.

Individual articles from proceedings

Athanasiadou, S., Arsenos, G. & Kyriazakis, I., 2002. Animal health and welfare issues arising in organic ruminant production systems. pp. 39–56.

Brown, C.M., 2002. Marketing and consumer awareness for organic produce. pp. 65-71.

Conington, J., Lewis, R.M. & Simm, G., 2002. Breeding goals and strategies for organic sheep production. pp. 135-142.

Coonan, C., Freestone-Smith, C. Allen, J. & Wilde, D., 2002. Determination of the major mineral and trace element balance of dairy cows in organic production systems. pp. 181-183.

Häring, A.M. & Dabbert, S., 2002. Research on organic food production: status, requirements and perspectives. pp. 87-97.

Kirk, J. & Slade, K., 2002. An investigation into UK consumers perception of organic lamb. pp. 157-161.

Kirk, J., Soffe, R. & Hall, R., 2002. Attitudes and beliefs towards organic meat in the South West of England. pp. 163-167.

Kristensen, E.S. & Thamsborg, S.M., 2002. Future European market for organic products from ruminants. pp. 5-13.

Kouba, M., 2002. The product quality and health implications of organic products. pp. 57-64.

Oosting, S.J. & de Boer, I.J.M., 2002. Sustainability of organic dairy farming in the Netherlands. pp. 101-106.

Siardos, G.C., 2002. The impact of organic agriculture on socio-economic structures. pp. 73-86.

Wright, I.A., Zervas, G. & Louloudis, L., 2002. The development of sustainable farming systems and the challenges that face producers in the EU. pp. 27-37.

Useful websites addresses:

www.soilassociation.org
www.organicinfo.ndirect.co.za
www.ofrf.org
www.fibl.ch
www.ers.usda.gov/emphases/harmony/issues/organic