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# Organic Livestock Systems – characteristics and challenges for improvement

*John E. Hermanse[1]n, Troels Kristensen[1], Bruno Ronchi[2]*
*[1]Department of Agroecology, Danish Institute of Agricultural Sciences, Denmark*
*[2]Department of Animal Production, University of Tuscia, Italy*

## Introduction

It is often a matter of discussion what is organic production or not. I find, that this discussion is beyond scientific reasoning. While science can contribute a lot in investigating and documenting effects of certain farming practise and create a deeper understanding of important phenomenon for a proper development of farming practises, in my opinion we have to accept that organic production is on the one hand a way of production based on common developed and accepted goals and on the other hand that this is accepted by the authorities in many countries, who implement particular regulations, which the production system needs to fulfil, if the products is allowed to be labelled 'organic'.

So, the starting point in discussing and understanding organic livestock production are the principle aims of organic production as formulated by IFOAM (The international federation of organic agricultural movements (IFOAM, 2000)). IFOAM is an umbrella organization covering associations in more than 100 countries.

Among these aims I will put emphasis on the following ones: (S2)

- Produce food of high quality in sufficient quantities
  - Consider the wider social and ecological impacts of the production and processing system
  - Encourage and a enhance biological cycles within the farming system
  - Create a harmonious balance between crop production and animal husbandry
  - Give all livestock conditions of life with due consideration for their basic aspects of their innate behaviour
  - Progress towards an entire production, processing and distribution chain which is both socially just and ecological acceptable

So, the principles concern to procedure food and take into account a range of scientific considerations not included in general agricultural regulation. These principle aims have guided the formulation of a range of specific regulations regarding animal husbandry, which is very detailed in the EU and North America (and which will be addressed at a later stage).

Within the EU, the EEC Regulation No. 1804/1999, provides a standard that involves the right to label food as organic (S3). It includes specifications for housing conditions, animal nutrition, and animal breeding, as well as animal care, disease prevention, and veterinary treatment, and creates a framework for organic livestock production in all European countries on an equal, legal basis. An important key principle is reliance mainly on the management of internal farm resources rather than on external input and, in relation to health management, reliance on preventative measures rather than on treatment.

As regards feed, the regulation intends to ensure safety animal products rather than maximum production, while meeting the nutritional requirements of the livestock at the various stages of their development. Livestock must be fed on organically produced feeding stuffs, preferably from the farm itself in order to support a strong connection between animal production and farm-land. A limited proportion of conventional feeding stuff is permitted within a transitional period expiring on 24 August, 2005.

The need for clear and harmonized rules has not only taken up by private bodies, IFOAM and state authorities, but as well by the UN-Organizations, FAO and WHO. The Codex Alimentarius Commission, a joint FAO/WHO Food Standards Program, began in 1991 elaborating Guidelines for the production, processing, labelling and marketing of organically produced food and in July 2001 the animal production was approved by the Codex Commission. The requirements in these Codex Guidelines are in line with IFOAM Basic Standards and the EU Regulation for Organic Food.

Besides guiding the regulation and reflection on improved farming practise the principle aims of IFOAM are also very useful as framework for scientific work.

The outline of this presentation (S4) is to give an overview of the magnitude of the organic livestock production in Europe, to reflect on the driving forces of the development including the motives of different parties, to summarise results obtained in organic production in terms of production, health environmental impact and product quality, and – based on this – to address the major challenges for organic production in its further development.

**Development of organic livestock farming in Europe**

There has been a tremendous growth in the number of organic farms in Europe over the last 20 years—from approximately 8000 in 1985 to more than 142,000 in 2001 and with a correspondingly increase in organically managed land (S5). The latest information shows a further increase in organic land, but at a lower rate (Willer and Yussefi, 2005).

The country with the highest number of farms and greatest number of hectares is Italy. Here 8% of the land is grown organically. In Austria and Switzerland, however the proportion of organically grown land is even higher (S6). Germany has the largest organic market with a sales value of approximately 2.5 billion Euro. In terms of per capita consumption of organic products, however, Switzerland, Denmark and Austria are the clear leaders (S7). Nevertheless, at present only 3% of the European agricultural land is managed organically and the market share is no more than 1–2% (Willer and Richter, 2003). It also appears that the market share in USA and Canada is estimated to be approximately 2% and with a similar expected high annual growth as in the European countries.

Although an overall growth in the organic market is expected, for some products and in some countries, the organic market is not growing. This is the case in Denmark where the organic market share of liquid milk and table egg is approx 25% and is not growing further, at least for now. This fact is also reflected in the lowest estimate for annual growth in the organic market.

Information of the magnitude of the organic livestock production is difficult to obtain. It is obvious that livestock plays a different role in organic farming across Europe. For instance in Greece in 1999, 79% of organic land was producing non-livestock products, whereas in France and the UK more than 70% of the organically registered land was grassland as basis for livestock production and recent data shows that this proportion is expected to increase (Roderich et al., 2004).

Due to the difficulties in getting consistent data on organic livestock production the information on magnitude in different countries are examples rather than a comprehensive ranking (S8). The most "developed" organic sector within livestock seems to be the dairy production. In Austria and Switzerland the organic dairy production amount to more than 10% of total dairy production and in Denmark and Sweden it amounts to 8 and 4% respectively.

In countries, which have a large sheep production like GB and France, the organic proportion only amounts to less than 5%, but numbers of organic lamb produced are still very significant, i.e. 70.000 in France in 2001 (Benoit & Veysset, 2003).

As regards pig production the organic production amounts to less than 1%, but again, for Denmark and Germany this amount to 70.000 to 100.000 finishers per year and does represent a professional enterprise.

Another way of looking at the organic livestock production is to consider the structure compared to conventional livestock production. In the Danish situation the proportions of organic farms with dairy- or egg production are equal to the situation in conventional production, whereas this is not the case for pig production (Plant Directorate, 2004) (S9). There is no reason to believe that the weaker development of organic pig production compared to other branches is related to a different consumer preference (Bredahl, 2004). It is more likely that it reflect that it is more difficult for farmers to change the production system for pigs within reasonable costs.

**Driving forces**

The development of the organic sector is no doubt facilitated through a mutual interest among farmers, consumers and the authorities, although not necessarily for the same reasons (S10).

Looking at the consumers there are two major motives for buying organic products: health aspects for the consumers themselves and environmental concern. In addition, but less important, there are ethical issues, a major one being concern for animal welfare. So, there is no doubt that a large proportion of consumers relate organic production to healthier food, less harmful to the environment and a better animal welfare. Evaluated from the way retailers argue when marketing organic food, the emphasis, however, is different between countries ((Michelsen et al, 1999) (S11). In countries such as, for example, Germany, Denmark, France, and The Netherlands, the environmental aspect is dominant, whereas food safety seems to be the major concern in Finland, Great Britain, Italy, Luxembourg, and Switzerland.

Within the EU authorities, the support for organic farming is justified as an element in stimulating/regulating the agricultural sector to be more supportive of rural development, for diversifying production, and for reducing the environmental load of agriculture (S12). These are considered being important elements in improving the sustainability of the agricultural sector.

Looking at the farmers, the motives and driving forces seems to have changed over the years – at least in some countries i.e. Denmark. From being driven by a serious scepticism towards intensive farming with its use of chemical inputs, a motive now a days for many full time farmers seems to be that organic production may represent a potential of getting a better livelihood (Noe, 2005) (S13). On the other hand there is some evidence that farmers, once changed to organic production for whatever reason, become more and more affiliated with the organic ideals.

On the basis of experiences of organic farming in Italy, it seems that farmers who decided for the conversion from conventional to organic only for the perspective on financial supports or premium market, progressively renounced and came back to conventional. On the other hand good results have been obtained by farmers with professional experience and who understood, agreed on and adopted specific technological and management systems.

It appears, that organic livestock production are faced with a multitude of expectation and it may be expected that the ability of the organic systems to meet a range of these expectations will be crucial if the production is to expand much further.

**Production and health**

What is then the reality? Main differences in management, that may influence production and health are (S14)

- that the livestock should be allowed to graze,
- that livestock should have access to roughage which for herbivores must amount to at least 60% of total dry matter intake,
- that only feed appearing in a positive list can be used,
- that use of chemically synthesized or GMO derived amino acids and vitamins are prohibited,
- that use of protein sources produced by use of chemical solvents cannot be used, and
- that preventive veterinary treatments with allopathic medicine is not allow which excludes use of preventive antibiotics, coccidiostats and anthelminthics.

Furthermore, curative treatment with antibiotics may mean that livestock cannot be sold with the organic label. Within the EU the restriction refer to repeated treatments with antibiotics, whereas in the US even a single treatment disqualifies an animal for being sold as organic (Nardone et al., 2004). This regulation must not be interpreted so that sick animals should not be treated, which is specifically mentioned in the regulation, but alternatives to antibiotics are preferred.

As regards feed a limited proportion of conventional feeding stuff can be used. Originally this exception was planned to be terminated by August 2005. The most recent information indices that the period will be extended (S15).

*Dairy*

In recent years a number of papers have addressed production and health of dairy cattle reared under organic conditions (S16). There is a clear pattern that milk production per cow is reduced, that mastitis is unaffected, and that the overall health of the cows is improved. However endoparasites in young stock are a problem and may be also coccidiosis in young calves at pasture at a very early age.

The results obtained are related to a lower allowance of concentrates in the organic systems (see Rosati and Aumaitre, 2004). In the Danish situation where it in practise in mandatory since 2002 to feed entirely on organic feed in order to obtain a premium prize for organic milk the protein rich concentrates mix often amount to less that 10% of the total diet and cereals to approx 20% of the diet, leaving 70% of the dietary energy to roughage. (S17)

It has been a surprise that such a strategy has not increased the metabolic disorders since in many situations the same high genetic merit cows are used in organic as in conventional production. This is at least clear in Denmark (S18), although the gap in milk yield per cow seems to increase over time.

*Small ruminants*

The information of production results in organic compared to conventional small ruminants production is scarce. Furthermore, the production strategies among small ruminants are widely diversified and adjusted to a local context, which make general comparisons less interesting (S19).

The process of conversion of small ruminant livestock from conventional to organic seems apparently less complicated in terms of management procedures than in other livestock species. The extensive/traditional sheep and goat production systems, with some minor adjustments, could obtain certification. Many of Mediterranean sheep and goat farming systems are based mainly on extensive use of non-fertilized natural pasture resources (Zervas et al., 2003). Thus, in this respect these extensive sheep and goat production systems are believed to be more close to organic and to be converted mere easily from conventional to organic ones (S20).

Bernoit & Veysset (2003) estimated that lambing rate was expected to reduce in intensive upland farming of suckler ewes due to difficulties in such system to maintain an adequate feed intake, a.o. related to the prize of supplementary feeds. On the other hand in less intensive and low land systems in France similar production result per animal could be obtained.

A particular issue is that, in the southern part of Europe and elsewhere, there are a considerable number of small ruminant farmers who are landless but who have grazed their stock for decades on state owned land (common grazing land), or on rented land, due to exiting complicated ownership legislation. According to the regulation 1804/99/99/EC, this landless form of animal husbandry cannot be certified as organic. An other constraints related to small ruminants organic farming are an often lower educational level of sheep and goat farmers compared with farmers of other animal species, which may reduce the ability to comply with formal demands of an organic production.

The main health related issues in small ruminants are lameness, mastitis, fly strike, and helminthosis (Thamsborg el al., 2004). Of these issues, the helminthosis seems to be particular related to the organic system, due to the band of a preventive use of anthelminthics. Although some non-chemical preventives measures are more widespread in organic farming the problem is aggravated by the fact that only one treatment are allowed per year if the animal are to be sold as organic. In a Swedish investigation number of liver fluke determined at the abattoir was slightly higher in organic reared lambs compared to conventional reared lambs and considerable higher in older sheep.

*Pig production*

Main differences compared to conventional production are, that the pigs should be allowed to graze in summer time and have access to roughage at any time, that the weaning age should be at least 40 days, that no tail dogging is permitted, and that synthetically produced amino acids cannot be used. Though, regards finishers, rearing can take place in barns if they have access to an outdoor run. In such systems the minimum space requirements are about the double as for conventional production.

I different countries or different certification bodies stricter rules may be implemented. For instance in Denmark the minimum weaning age is 49 days and in Sweden the finishers must be allow grazing during summer time.

In some countries like Spain the organic production is mainly devoted to particular high quality pork products, whereas in other countries the aim is to produce the more common pork products. The latter is the case in Denmark. Typically, sows are kept in outdoor systems all year round, while the piglets at weaning are transferred to an indoor unit with access to an outdoor yard, often made of concrete.

While the production of piglets per litter is not necessarily affected, the number of piglets per sow and year are reduced due to the longer weaning period, which reduces the number of litters per year (S21). Metabolic disorders are often lower than in indoor systems. The feed consumption under outdoors rearing is often considerable increased.

Looking at the finishers the gain and feed conversion are often slightly impaired as a result of the difficulties in matching the optimum nutritional requirements including balance in amino acid profile. However, the effects are often lesser than forecasted, maybe as a result of the higher space allowance, which may reduce the metabolic load of the pigs. It is a particular benefit that the lung health is markedly better than in conventional production. For instance Strudsholm (2004) found that post mortem lung lesions were only 9.7% in organic finishers compared to 22% in the conventional production.

In a recent investigation comparing different strategies for outdoor rearing of finishers all year round with indoor rearing, we found daily gain was not affected, but that feed conversion were 13% poorer in organic production, when ad lib feeding was used. Reduced allowance of concentrates mixture reduced growth rate considerable but made it possible to obtain the same feed conversion as under indoor conditions.

**Environmental impact**

The aim and the practise of relying more on internal farm resources than on 'imported' feeds does have an impact on the environmental load related to the production, at least as regards rather intensive livestock systems. This can be illustrated by the N cycling in Danish dairy systems (tab). Although the N-utilization is slightly poorer in the herd, the overall N-utilization on the farm is much improved due to a lower N-input in the total system. The same relative figures have been obtained in Austria. However, the production per ha is often also lower and this may change the results of the evaluation when considered per kg of product produced on the farm.

Halberg et al (2005) reviewed examples of a more comprehensive evaluation of systems in different countries in terms of impact on global warming ($CO_2$ and Methane), acidification (ammonia), and euthrophication (NO3, PO4) and evaluated on a per ha basis as well as on a per kg product basis (tab).

On a per ha basis the environmental impact was generally lower, although this was not the case for global warning potential and acidification in the Dutch case. However, using the product-based approach, which take into account differences in production and also include the environmental impact attached to the production of feed ect outside the farm, the picture becomes more diverse.

We would conclude that GW and acidification of organic and conventional production are almost equivalent, although differing among countries due to the country specific conditions of production. As regards euthrophication the impact was much lower in 3 of 4 countries. This difference was due to different assumptions regarding the fate of surplus phosphorous. In the Swedish case only small differences in P losses was assumed despite a difference in P surplus. In the other countries the P surplus contributed more to euthrophication.

I think that an overall conclusion is, that organic dairy in fact is beneficial in terms of environmental impact since it is strongly based on a rational connection between animals and environment. But it is widely recognized that rules regarding stocking rate should be better defined at regional and local level, since many differences exists among areas also inside a country, due to soil, climate, vegetation, etc.

The same exercise for pig production has been performed in France (Basset-Mens and van der Werf, 2005) (tab). On a per kg pig basis the analysis shows that the organic production had a lower contribution to acidification, not much difference to euthrophication and a higher contribution to global warming.

Besides this, the outdoor rearing may form a particular environmental risk for N leaching. Although there are regulations on the livestock density allowed on the outdoor area, often very high nutrient loads are experienced, partly due to a high feed consumption and partly because the rooting of the pigs reduces the crop growth and thereby the removing of nutrients with the crop. A surplus of 300-600 kg of N per ha has been observed in paddocks used for outdoors rearing of sows (picture) and finishers. The level of N as potential for leaching in the before mentioned investigation of outdoor rearing of finishers was thus very high (fig). The Figures can be compared with typical surpluses of 100 kg/ha for organic dairy and 250 kg for high fertilized conventional grazing land for dairying. However, the investigation also showed that it was possible through appropriate management to have a fairly equal distribution of the N.

So, while it is pretty clear that organic dairy is beneficial in reducing the environmental impact of production, this is not clear as regards pig production.

**Product Quality**

The quality of livestock products are highly sensitive to the actual feeding and management and in many cases it may not be meaningful in general to compare organic and conventional production. Kouba (2003) concluded in a review, that there is no evidence of consistent differences in flavour or nutritional qualities between organic and conventional ones. Organic products showed lower level of veterinary drugs and pesticides, which however also in conventional production was at a very low level. There was no clear evidence to indicate that organic foods were more prone to mycotoxin contamination or more or less microbial safe than conventional foods.

Having said that, in the particular situations whereby the production takes place in different countries, differences may occur for specific product categories due to use of different genotypes or feeds.

In Danish bulk milk collected at the dairies it has been demonstrated that organic milk contained significant more vitamin E expect for the summer month July and August (Figure) (Nielsen et al., 2004). This was the case despite the fact that the organic milk producers used less supplement of

Vitamin E – documented through a much lower content of the synthetic alpha-tocopherole isomers in the milk.

A particular recent finding is that the content of phytooestrogenes was considerable higher in milk from organic farms compared to conventional farms probably related to the more widespread use of legumes in organic production (Purup et al., 2005). This may have significant effects, in relation to human health of which I will not try to elaborate.

Such effects may not be exclusive for organic milk since apparently the actual feeding has a major influence, but the results illustrate that the particular way organic milk production is carried out (as a result of relying on internal farm resources like clover-grass) may have positive effects on quality parameters which can be recognized at a large scale (like the bulk of organic milk in Denmark).

**Challenges**

It's an overall challenge within organic livestock production to keep up with the expectations from different parties. Two major expectations should be met

- the contribution to added value on farm and the local economic environment, including to conjugate organic products (e.g. cheese) with "local", traditional products to the aim of obtain additional market value, to increase "on farming selling" as a system to promote rural tourism and agriculture multifunctionality
- that consumers experience it as a benefit for themselves to buy organic foods, i.e. related to expected health effects

Although these topics are outside the scope of the present paper, I mention them because there are central to focus on in future. For now I will concentrate on some immediate concerns, i.e

- for dairy cows either to match the increased nutritional demands following an increased genetic merit for milk production or to develop strategies that reduce the nutritional stress
- for small ruminants to get hold on the endoparasitic infections
- for pork to develop production strategies for products with distinct qualities from conventional pork

*Dairy*

Although so far the high genetic merit cows have been able to cope with the conditions in organic farming and the fact that recent investigations does not show a genotype-environment interaction in relation to production, reproduction and health parameters, it is documented that such interaction is present in i.e. poultry systems where the genetic 'progress' is more pronounced (Boelling et al., 2003). Therefore it might be expected that such interaction also may be significant in dairy at a time. The challenge here is to improve the roughage intake to match the higher nutritional demands of the dairy cows.

Maybe also the total farm set up and herd structure should be considered changed. Longer calving intervals reduces the number of young stock required at a farm and shorten the proportion of milking days in which the cows are under nutritional stress. Recent investigations at the Danish organic exp station showed that the total milk yield per day was not affected by increasing the planned calving interval from 12 months to 18 months (slide) (Christiansen et al., 2005).

*Small ruminants*

In order to control helminths infections the adoption of novel anti-parasitic crops, biological control, selection for resistance, and more efficient nutrition have all been identified as possible control options. However, practical implementation has yet to be realized. Consequently most organic farmers have to rely on grazing management procedures to control the infection. Such management initiatives are, however, not always simple to apply and there is a considerable risk that the livestock in reality will suffer from illness. Probably a further clarification and development of pasture species with an anthelminthic effect (e.g. *lotus pedunculates*) will be really important in addressing this problem.

*Pig systems*

The production costs in organic pig production are considerable higher than in conventional production, and a premium prize of for instance 20%, which seems sufficient in organic dairy production to be competitive, will not be sufficient in organic pig production. This calls for higher premium remuneration to the farmer, which in turn may limit the consumer's willingness to buy. Also rearing of the finishers the way it is often done in Denmark at the moment, where the pigs are kept under housing conditions, may not comply with the consumer's expectations. Not least, the local environmental effect of the present systems in terms of risk for nitrogen leaching may make the production less attractive from an environmental point of view. Probably there is a need for development in two ways. First, new systems where the pig production is fully integrated in the land use, where the pasture really support the feeding of the sows and where the rooting of the pigs are taken advantage of should be considered. Second, efforts should be made to produce a pork quality that *per se* is different from the conventional qualities in order to raise the consumer's willingness to pay.

## Conclusion

The organic production has moved from being a niche production to constituent an important segment of livestock production. Besides that, organic production in several countries is seen to represent a particular contribution to a reduced environmental impact of farming and to rural development. The latter, however, is far from being exploited fully. Although such a contribution is not excluded to organic livestock production, the organic ideas and the current regulation pulls in a direction, where more added value takes place on the farm or locally. It could be considered to go gradually towards as a system of "district certification", taking into consideration not only the strict farm, but also the surrounding environment. This could be useful to create a process of valorisation of organic products on the market.

When considering the need for research, the organic systems would benefit from a markedly increased understanding of how the natural behaviour of the different livestock can support crop-livestock interactions e.g the ability to maximise intake by foraging, to select species and herbs that may counteract helminth infection, in conservation areas to maintain a high biodiversity, and in intensive production to have an acceptable distribution of the manure. Such an effort may enhance the difference in praxis from mainstream livestock production and thereby sustain the consumer interest.

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