

Organic livestock production systems and appropriate development in relation to public expectations

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Introduction

There has been a tremendous growth in numbers of organic farms in EU over the latest years – from below 20,000 farms in year 1992 to more than 120,000 farms in 1999 (Padel, 2001). Worldwide-certified organic production takes place in 130 countries, half of which are developing countries (ITC, 1999). The market share in EU, however, on total is still quite low ranging from less than 0.5% in nine out of 18 countries some countries to 5-9% in other countries for some major product groups (Michelsen et al., 1999).

Livestock production and especially ruminant livestock production forms an integral part of many organic farms due to its role in nutrient recycling on farms. Out of 16 European countries, livestock products were within the top five organic products in 14 countries (Michelsen et al., 1999). The market share of livestock products, however, is very different from product to product. In Austria, Denmark, Switzerland and Finland milk products are the most important organic products. Pork and poultry only play a minor role whereas eggs in some countries are quite important.

The recent development of organic farming in Europe is not only a matter of (marginal) agricultural change (Michelsen, 2001). It also represents an implantation of important aspects of recent major changes in society at large into agriculture. Essential vehicles in the development of the concept of organic farming are values expressing a general criticism of mainstream European agriculture and more general doubts about the interplay between man and nature as reflected in modern technology. In society at large these doubts have manifested themselves in growing political and public concern for the environment, increasing doubt regarding the importance of science in solving social problems, and increasing doubts about how society should be governed.

The actual development can be attributed to an increased consumer interest in organic products throughout Europe while, at the same time, farmers are interested in converting to organic production methods – often stimulated by governmental support or subsidies.

The main actors mentioned, however, do not necessarily have the same expectation to organic farming and the future development in organic farming in general as well as the individual livestock systems in particular may depend on to what degrees common expectations can be fulfilled.

The aim of this paper is to highlight some expectations from main actors and to discuss the importance of this for the appropriate development of different livestock systems.

Regulation for organic livestock farming in EU

In the European countries, the EEC-Regulation No 1804/1999, supplementing regulation No 2092/91 on organic production, has been passed and become law in August 2000. As shortly described in Sundrum (2001), Jakobsen & Hermansen (2001) and Padel et al. (2001), the EEC-Regulation provides a standard that involves the right to label food as organic. It includes specifications for housing conditions, animal nutrition and animal breeding, as well as animal care, disease prevention and veterinary treatment, and will create a framework for organic livestock production and labelling products in all European countries on an equal legal base. An important key principle is to rely mainly on the management of internal farm resources rather than on external input and, in relation to health management, to rely on prevention measures rather than on treatment.

As regards feed, this intends to ensure quality production rather than to maximize production, while meeting the nutritional requirements of the livestock at various stages of their development. Livestock must be fed on organically produced feeding stuffs, preferably from the farm itself. A limited proportion of conventional feeding stuffs is permitted within a transitional period expiring on 24 August 2005. The feeding of young mammals must be based on natural milk, preferably maternal milk for a minimum period depending on the species. Rearing systems for herbivores are to be based on maximum use of pasturage according to the availability of pastures in the different periods of the year. At least 60% of

the dry matter in daily rations is to consist of roughage, fresh or dried fodder, or silage.

The minimal standards in relation to animal welfare are primarily focussed on locomotion areas, floor characteristics and husbandry practices. Dry litter as well as group penning is prescribed for all farm animals. Tethering farm animals is not acceptable. The indoor area is supplemented by an outdoor area that must be at least 75% of the indoor area.

The above mentioned regulation is formed partly on the basis of the guidelines formulated by the International Federation of Organic Agriculture Movements (IFOAM, 1996; IFOAM, 2000). However, it is important to realize that the EU-legislation is an administrative interpretation of the ideas of organic farming, which in their scope have wider goals, mainly originally identified and developed in individual countries.

Different actors' expectation to organic farming and possible dilemmas

Three main actors of importance for the development of organic livestock farming are considered in the following – the organic movement of which organic farmers are most important, consumers of organic foods and the governmental/EU-agricultural policy and the attached regulation of agriculture.

Organic movement/organic farmers

The ideological basis for organic farming has developed from earlier attempts to develop radical alternatives to mainstream agriculture.

Biodynamic agriculture is one important source of alternative thinking.

Main aspects of criticism of the mainstream agriculture has been the increasing use of chemical substrates, especially mineral fertilizers and pesticides, and the reduced way of thinking in relation to the production process. In contrast to convention agriculture, the organic farm is considered a farm organism where the integrative and holistic aspects are placed into the fore (Köpke, 1993). In addition, responsibilities for the interaction of the farming practice with the surroundings (nature, society) are considered. Organic livestock farming is defined by basic guidelines. These guidelines have been formulated and – as part of a development process in the movement – are being further developed by the International Federation of Organic Agriculture Movements (IFOAM). This is an umbrella organization acting worldwide coordinating the international network of the organic organizations.

However, it is important to realize that in the eyes of organic farming the organic movement is based on fundamental values regarding nature, environment, food production, farming and society. The basic guidelines, or standards, are thus attempts to find means that may help realize these values. Therefore, the standards are not being seen as ends themselves, but as temporary attempts to realize the values. So, it is logical that guidelines may change over the years when new knowledge, insight or a

technology may support the fulfilling of the basic ideas or values in a better way. Therefore, it is very important to acknowledge the values of organic farming.

The principle aim of organic production as defined by IFOAM is given in Figure 1.

Livestock often plays an important role – besides supporting income the farmers – in obtaining some of the principle aims in organic farming. In the detailed practice for organic farming, however, some main conflicts may appear in how and to what degree the different aims can be obtained. In relation to livestock, conflicts may appear in the most appropriate keeping practice related to consideration of the basic aspects of their innate behaviour on one hand, the risk of pollution from the production on the other and, in addition, the aim of producing in sufficient quantities. These possible conflicts are reflected in the compromises set in national or EU regulations. These, however, often develop after an intensive debate where, sometimes, you may get the impression that livestock production may be acceptable but not desirable in organic farming, at least for some species.

In the long term, it therefore seems important that different sorts of livestock production contribute directly to a steadily increasing fulfilling of the organic ideals on a national scale or at farm level. This point of view has until now scarcely been elaborated.

Andreasen (2000) puts words to the idea saying that the view on livestock should be changed from considering them as being passive (receivers) to

active parts of the sustainable development of production systems. More focus should be put on the (various) capabilities of the animals and less on the "requirements" of the animals. The challenge is then to give conditions so that the livestock can optimize the value of their various capabilities rather than to control the animal in the environment. The emphasis on animal performance then shifts from mere feed conversion to functional efficiency in the farming system. This leads to new parameters for evaluation.

Several examples of interaction/synergism can be given. First of all, there is the well-known and accepted role of ruminants when converting fibrous

The Principle Aims of Organic Production and Processing

Organic Production and Processing is based on a number of principles and ideas. They are all important and are not necessarily listed here in here in order of importance.

- To produce food of high quality in sufficient
- To interact in a constructive and life-enhancing way with natural systems and cycles.
- To consider the wider social and ecological impact of the organic production and processing system.
- To encourage and enhance biological cycles within the farming system, involving micro-organisms, soil flora and fauna, plants and animals.
- To develop a valuable and sustainable aquatic ecosystem.
- To maintain and increase long term fertility of soils.
- To maintain the genetic diversity of the production system and its surroundings, including the protection of plant and wildlife habitats.
- To promote the healthy and proper care of water, water resources and all life therein.
- To use, as far as possible, renewable resources in locally organised production systems.
- To create a harmonious balance between crop production and animal husbandry.
- To give all livestock conditions of life with due consideration for the basic aspects of their innate behaviour.
- To minimise all forms of pollution.
- To process organic production using renewable resources.
- To produce fully biodegradable organic products.
- To produce textiles which are long-lasting and of good quality.
- To allow everyone involved in organic production and processing a quality of life which meets their basic needs and allows an adequate return and satisfaction from their work, including a safe working environment.
- To progress towards an entire production, processing and distribution chain which both socially just and ecologically responsible.

It may be considered important for the further development of organic livestock production that the systems, as a whole, benefit from the inclusion of livestock, so that livestock contribute to fulfilling the organic aims or that at least possible dilemmas in the organic aims are diminished.

The above statement relies on the assumption that organic farmers related to the organic movement need to be a driving force in the development of organic farming. This of course can be questioned. Several authors have observed a difference in farmers' motivations for converting to agriculture between farmers of "older" organic farms and newly established, organic farms; the ones who are actually going to expand the organic sector. The farmers have been characterized as "pioneers" as opposed to "boom-time organics" (Moder, 2000), or "idealists" as opposed to "pragmatics" (Morgan & Murdoch, 2000; Schoon & Grotenhurs, 2000) (cited from Jensen et al., 2001).

In a detailed series of questionnaires among Danish organic farmers who were certified before 1991 or in 1995-1997, the farmers' attitudes and motives were investigated (Michelsen, 2001). The earlier organic farmers put considerably more weight to the concern for the environment, disagreement with development in conventional farming and better agricultural procedure than the newly established organic farmers, who, on their part, put more weight to the professional challenge, that organic farming seems to be the future and an expectedly better farm economy. However, the investigation showed that also the new-comers were quite committed to the goals of organic farming, and Michelsen (2001)

concluded that no major differences existed in their motivation. A main difference according to Noe (2001) seems to be that the new-comers were less affiliated to the organic network, a fact which probably weakened their role in developing the organic ideas.

It is also interesting to note that in Austria, where recently a larger group of farmers got the opportunity to reconvert without breaking the subsidy contract, only 12% planned to reconvert, and they were mainly farmers with small, intensively managed farms, who did not participate in organic organizations or networks (Eder et al., 2000).

Based on these results, it seems most likely that the organic livestock production, also in future, will be carried out by farmers who are committed to the organic ideals. Therefore, it is important that the livestock production as such supports the fulfilment of these ideals, and systems should be developed accordingly.

Consumers and their interaction with retailers

Since trade with organic products is predominantly market driven, the attitudes and expectation of the consumers are very important. Several investigations conclude that the potential market is far bigger than the present market share. In a recent literature review the international results on the consumer's attitude and buying behaviour is summarized (Jensen et al. 2001).

As regards the consumer interest in Denmark, it has been shown that the proportion of consumers who never buy organic products was reduced from 70% in the beginning of 1990 to 13% in 1999. This shows one the

picture of the potential. The (higher) price on organic food is a major constraint for the consumption. However, in several investigations it has been found that consumers are willing to pay extra for organic products. In two earlier papers from Holland and Great Britain (Hack, 1993; Beharrell & MacFie, 1991) it was estimated that a premium price of 25-30% would allow 25-35% of the consumption to be organic for several organic products. A similar range of price elasticity was also found for organic pork in a recent Danish investigation (Andersen, 1999). So, the potential for "organic" consumption is obvious even if a (limited) premium price has to be paid and several quote an expected total market share of 30% - highest for the more well-educated part of the population, but - according to most investigations - independently of the actual income level of the family.

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 of which is concern for animal welfare. So, there is no doubt that a large proportion of consumers relate organic production with healthier food, less detriment to the environment and a better animal welfare.

Looking at different consumer groups, the following distinctions have been made. Older consumers put most weight on own health, whereas younger consumers put most weight on environmental issues (Thompson, 1998; Bugge & Wandel, 1995). "Heavy users" put most weight on environmental issues whereas occasional users put most weight on own

health (Schifferstein & Oude Ophuis, 1998). In general, it seems as if the health aspect has become more important during the 1990s (Wier & Calverly, 1999).

Looking at the health aspect, it is important to realize that the consumers are not primarily focussing on the "traditional" nutritive value of the foods, but on risk for pesticide contamination, medicine residues and factors influenced by the use of mineral fertilizer (Infood, 1997).

Expectations of a better animal welfare in organic production systems are also a motivation for organic buyers although less important than environment and consumer health. In an open questionnaire, 25% of the consumers mentioned animal welfare as a motive, whereas, when put the question directly, more than 60% mentioned animal welfare as a motive (Jensen et al., 2001). Also Swedish consumers believe that organic livestock experience a better welfare than animals in conventional farming (Lund, 2000). Only few consumers relate the preference for organic products to taste etc. and it has been put that way that the consumers expect that the organic products have at least the same eating quality as conventional food (Infood, 1997).

It can be argued that the health concern of the consumers related to their preference of organic food is related to food safety and to confidence (or the opposite) in the way food is produced and handled throughout the market chains, rather than to documented health benefit or risks. There seems to be a general preference in many countries for locally produced food because of a lack of confidence in foreign products for which less is

known on production conditions etc. This point has also been part of the motives for buying organic food.

In the early phase of organic farming the direct distribution from producer to consumer was the dominant one. This has changed a lot in several countries, and part of the market increase in organic consumption is assigned to the active involvement of supermarkets. This holds at least for countries such as Denmark, Sweden, Austria, Switzerland and Great Britain (ITC, 1999). In Denmark, where organic food amounted to 2.5% of the total sale of food, the supermarket shares amounted to 70%, and in Switzerland and Austria with total organic shares of the food market of 2.0% the supermarkets' shares were 60-65%. In contrast, the shares of supermarkets in Holland and Germany were much smaller (20-25%). In Germany and France the direct distribution is estimated to be as high as 20% and 30%, respectively (ITC, 1999). In some countries it seems as if the supermarkets have been able to give the consumers confidence in the organic produce, whereas in other countries this seems not to be the case.

However, it might be expected that, if the organic sector is to be able to expand considerably, the marketing and distribution will in future to a high degree be carried out by the established system, which also handles conventional food. Therefore, the consumers are probably very often going to decide whether to buy organic or conventional food. So, it can be foreseen that the organic sale will be vulnerable to continuous information and occurring crises related to organic production methods and product safety. For instance, a public debate on an animal welfare issue – even

discussed in a very narrow perspective – can be expected to influence consumer behaviour considerably. I cannot be expected that consumers have a very sophisticated and "well-balanced" view of the overall organic goals and the diverse role of the livestock in the system. Probably, the expectations of the consumers are related to relatively few major/global topics such as food safety, environmental issues and animal welfare in the way in which these topics are considered in daily life. As regards the latter, "natural" keeping of livestock will probably be a good guideline for consumers' way of relating to the topic. Therefore, it seems crucial for the further support from consumers as a driving force in the development of organic livestock production that the farmers constantly work on being in accordance with these concerns.

The EU and national governments

In European countries and the EU the support of organic farming is justified as an element in stimulating/regulation the agricultural sector to be more supportive for rural development, for a diversification of the production, and for a reduction in the environmental load of agriculture. The emphasis on the individual elements differs from country to country. For instance in Spain, organic livestock production is seen as an opportunity for the recuperation of economic and social activities in mountain areas. In the EU the environmental aspect has been dominant and so it has in Denmark. (MAF, 1999).

In Denmark it is directly being considered to "use" organic farming as an environmental-political instrument to improve the environment. The increase in organic farming is seen as a tool to improve biodiversity in the open land. As quoted in the "Aktionsplan II": "The environmental advantages of organic farming is a part of the background for the public subsidies for conversion and maintaining organic production Denmark. The society hereby pays for an environmental service" (MAF,1999).

These agri-political considerations are obviously not taken in order to fulfil the goals of the organic movement, but in order to take advantage of the features of organic farming in the overall planning of the agricultural production. Therefore, it is reasonable to believe that a continued awareness from the (subsidy-) authorities will depend on if the organic production also in reality can deliver the expected services in the form of low environmental impact and improved biodiversity.

Different perspectives of the actors

Although there is no direct conflict in the expectations of the role of organic farming and livestock production between the main actors (producers, consumers and authorities), there is a different framework in their views. Simplified, this could be described as

- organic farmers/the organic movement who consider the farm as an "organization" and who – though life-long education and reflection – decide on how to carry out the production in a way that fulfils the overall idea,

- consumers who buy organic products for the sake of their own health and/or from their wish to stimulate a more environmentally sound or animal friendly livestock production,
- the authorities who expect a direct service for the community in the form of low environmental load of the production and/or better support for rural development.

These are major elements to which organic livestock producers and the research related to/connected with its development have to relate.

Matters of concern in organic livestock production systems

Without attempting to be complete some matters of concern for different livestock production are highlighted below.

Dairy production

Two concerns can be considered

- The milk yield of the cows
- The handling of bull calves born in dairy herds.

The organic milk production is generally based on high yielding dairy cows not differing in genetic setup from conventional breeds. E.g. the average milk production of 500 organic herds (herd size 87 cows) in Denmark was $\approx 7,500$ kg energy corrected milk, which is approximately 10% less than that of conventional farms (Kristensen & Mogensen, 2000).

On the basis of studies in various European countries, Padel (2000) reports a range of 80-105% of conventional milk yield levels in organic herds.

High yielding dairy cows are susceptible to their nutritional stage in relation to maintaining health (avoid metabolic disorders and probably also mastitis). Therefore, several investigations have addressed the health of dairy cows in organic and conventional farms from the underlying hypotheses that the health of the organic cows might be impaired because of a poorer plane of nutrition as affected by the restrictions in feeds to be used in organic dairy production. As summarized by Sundrum (2001), no major differences in health aspects in general have been identified.

However, until now the organically produced feeds have often been supplemented with conventional foodstuffs including vitamins. In future, the dairy cows have to rely entirely on organically produced feed. This is a logical development, also in the eyes of the consumers, and in Denmark the largest milk co-op only sells organic milk from cows entirely fed on organic feed. But this may impair the farmers' possibilities to supply the cows with sufficient nutrients to maintain a good health and product quality, and this "conflict" may steadily increase as the genetic merit of the cows for milk yield is improved. There is a need to consider the genetic setup for organic cows compared to the ones used in conventional farming. At least, there is a need for establishing new methods for nutrient supply of organic dairy cows as discussed by Jakobsen & Hermansen (2001).

Another crucial thing to consider is the fate of bull calves born in organic dairy herds. In several countries, Denmark included, where the organic milk production are carried out quite intensively, bull calves are often sold at an early stage of life to be raised conventionally or, in some cases, killed as new-born (Nielsen & Thamsborg, 2001). The reason is that it is difficult to comply with the organic regulations in a way that makes the rearing of the bull calves profitable for the farmers. However, this practice neither fits the organic ideals nor the public expectations of how organic production is carried out. Therefore, there is a need to develop new profitable production systems, where the beef production, also in intensively managed areas, is based on roughage. Cooperation between organic dairy farmers and arable farmers may be one way forward.

Beef and sheep production

In many ways the extensive rearing of beef cattle and sheep fits well within the organic ideas and expectations, where the livestock are kept under "natural" conditions and the offspring are staying with their mothers and raised through access to their mothers' milk.

Maybe there is one matter of concern, however, which cannot be ignored.

Helmith infection in young stock is the most common health problem in organic livestock as discussed in Younie & Hermansen (2000). Since prophylactic medical treatments are not used, preventive management has to be implemented. Preventive measures in relation to grassland management do exist: moving stocks to uninfected areas and/or using

diluting strategies by alternating or mixing species (cattle and sheep) on the grassland. These management strategies are not always simple to apply and there is, consequently, a considerable risk that such livestock in reality will suffer from illness. This is both an ethical and an economic problem. There is a need to develop other approaches to controlling parasites including breeding for resistance in the animal and implementation of "new" grassland species, which may affect the animals' resistance, e.g. *Lotus pedunculatus*, which has a high content of condensed tannins.

Pig production

Although many organic farms are rearing pigs, the size of the pork production is still very limited. In Denmark, where pig production in general is a major business, there are only approximately 4,000 organic sows, and approximately 70,000 porkers are estimated to be produced in 2001. This is less than 0.5% of the total pork production. The production, however, is increasing these years and the following comments are mainly addressed to Danish conditions. The main approach here is to have sows kept on grassland and the porkers reared in barns where the pigs at the same time have access to an outdoor run often made out of concrete (Lauritzen et al., 2000). The sows are often given a nose-ring to prevent rooting and damaging the pastures which, among other things, are expected to increase N-losses from the grazing area. Male pigs are most often castrated to eliminate the risk of boar-taint in the products.

Several challenges exist

- barns for finishers with an established outdoor run made of concrete are very expensive considering the requirements for area per pig given in the EU regulations, which puts a heavy burden on the producer. In addition, it may be questioned if pigs reared under such conditions comply with the consumers' expectations to organic farming,
- nose-ringing of sows is indeed questionable. Major organic actors in several countries (e.g. Soil Association in England and KRAV in Sweden) do not accept this, and there is an urgent need to develop keeping strategies for sows on pasture without a nose-ring. In this respect the risk of environmental load is important,
- despite regulations on stocking density on the grazed area, considerable N-losses are often seen on the grazing area. Danish investigations showed an N-surplus ranging from 300 to 600 kg N/ha on the areas used for sows on grass. It is estimated that this can lead to a leaching of 150 kg N/ha and of ammonia evaporation of 70 kg N/ha (Eriksen, 2000). Such an environmental load might easily be considered unacceptable by the authorities,
- until now, feeding has often included a supplement of conventional feed (up to 20% of DM), mainly for obtaining a good protein and vitamin supply. Several restrictions on that are implemented now and from year 2005 only organically produced feed is accepted. This puts a heavy pressure on finding the most appropriate source for protein and vitamin supply to ensure an efficient production,

- routinely castration of the male pig is also a matter of concern considering the integrity of the animal and the working conditions of the farmers – especially in the free range systems, where facilities often are poor. Very different views on that exists in the different countries, where, normally, UK will not castrate, whereas e.g. in Denmark and Germany castration is almost always done. In the long run, it appears that the organic production should avoid routinely castration.

It appears that many issues have to be considered in the organic commercial pig production. Probably, completely new systems need to be developed, where the pig production is fully integrated in the land use; e.g. the grass/pasture constitutes a considerable part of feed for sows and the rooting of the pigs are taken advantage of. In addition, systems may arise where the pig exerts a direct synergism with other livestock. In this respect, it has been shown that co-grazing sows and heifers reduces the parasite burden of the heifers and results in an overall better sward quality compared to grazing separately (Roepstorff et al., 2000; Sehested et al., 2000).

Poultry – layers

The organic egg production, where the hens are kept in flocks and have access to an outdoor area, can be carried out quite efficiently in terms of egg production and feed conversion compared to conventional egg production in cages, although the feed consumption often is higher. These results are valid, at least where the high yielding commercial lines or crosses are used. The high yielding hen has, through many generations,

been selected for high performance on the base of her production capacity measured in individual cages. Thus little attention has been paid to her genetically based ability to behave well in a larger flock of hens. The result of such breeding policy is a high yielding hen, but it seems that she has lost some of her ability to have social relation with many hens in large flocks (Sørensen & Kjær, 2000). In free-range systems with large flocks, including organic farming systems, too many cases have been observed in which hens have started to perform feather pecking that ended with an unacceptable high rate of cannibalism.

The total mortality is often recorded to at least 20% during a year. This figure covers not only cannibalism, but also deaths caused by predators and by an inappropriate behaviour of the birds, who sometimes suffocate because they tend to bunch together. This high mortality rate is a major problem, particularly in an animal welfare aspect and in the eyes of the consumers. There is a need to catch up improved lines that are still high yielding, but with less risk of performing unacceptable feather pecking.

There is also a need to develop new strategies for the birds' use of the outdoor area. Often only a small part of the birds actually use the outdoor area and it has been shown that there was a negative correlation between the birds' use of the outdoor area and the feather pecking as well as between "the quality" of the outdoor area and the feather pecking (Bestman, 2000). Maybe there is a need for a radically improved concept for the outdoor area. The load of N and P from an intensively used hen yard is very intensive, and with the increased awareness of such an

environmental load new solutions are needed. These may include mobile houses (Bassler et al., 2000), mixed grazing with other species or a direct integration in other cash crops, e.g. fruit gardens, where the birds reduce the contamination pressure of diseases on the fruits plants, or e.g. as weed fighters/cleaners in other tree crops. Due to lack of knowledge in relation to the handling of large flocks (needed by the farmer to have a profitable production), such a development will be very difficult to implement under such conditions. However, it seems that carrying out only small changes in the production system have too many drawbacks in relation to animal health and welfare.

The statements of Roderick et al. (2000) in the discussion report from the third NAHWOA workshop seem to be of particular interest in the poultry sector: "Perhaps the role of the researchers lies in developing systems and methods that go beyond the mere application of standard", and "animal welfare research should start from the perspective of the natural behaviour of animals and practical application on farms".

Conclusion

The organic livestock production systems have to comply with expectations of different kinds:

The livestock rearing should contribute to a more balanced overall production of the farm, the food safety (in a wide sense) should be enhanced and the animal welfare should be better compared to conventional production methods. Also, the environmental load should be low. The success of the expansion of organic systems will depend on to

what degree these different expectations can be fulfilled without resulting in too high premium prices of the products. Ruminant production methods need to be developed further to fulfil these goals, but probably the changes needed are moderate. Pig and poultry production methods need to be radically changed if especially the expectations of the consumers are to be fulfilled. Key issues will be animal welfare issues taking a starting point in the possibility of the livestock to perform a natural behaviour.

References

- Andersen, F. 1999. Økologisk svinekød har en fremtid [*Organic porc has a future*]. DS-nyt 11
- Andreasen, N. 2000. The foraging pig. Doctoral thesis. Swedish University of Agricultural Sciences Uppsala. Agrania 227. 40 pp.
- Bassler, A.; Cizuk, P. & Sjelín, K. 2000. Management of Laying Hens in Mobile Houses – A review of experiences. In: Ecological Animal Husbandry in the Nordic Countries. Proceedings from NJF-seminar No 303 16-17 September 1999. (Eds: J.E. Hermansen, V. Lund & Erling Thuen). DARCOF-report No 2: 45-50.
- Beharrel, B. & MacFie, J.H. 1999. Consumer attitudes to organic foods. Brit. Food. J. 93: 25-30.

- Bestman, M.W.P. 2000. The role of management and housing in the prevention of feather pecking in laying hens. Proceedings of the Third NAHWOA Workshop, Clermont-Ferrand.
- Bugge, A. & Wandel, M. 1995. Forbrukerholdninger til moderne matvareproduksjon. Landbruksøkonomisk Forum 1995. 12(1): 15-25.
- Burel, C.; Cizuk, P.; Brännäs, E.; Wiklund, B.-S.; Kiessling, A. & Liljedahl, L.-E. 2000. Study on the individual feed choice in a group of hens using an automatic registration system. In: Ecological Animal Husbandry in the Nordic Countries. Proceedings from NJF-seminar No 303 16-17 September 1999. (Eds: J.E. Hermansen, V. Lund & Erling Thuen). DARCOF-report No 2: 51-58,
- Eder, M.; Kirner, L. & Zollitsch, W. 2000. Animal husbandry in alpine organic farming - regional diversity and critical obstacles in Austria. Proceedings of the Second NHAWOA Workshop.
<http://www.veeru.reading.ac.uk/organic/proc/eder.htm>
- Hack, M.D. 1993. Organically grown products: perception, preferences and motives of Dutch consumers. Acta Hort. 340: 247-253.
- Hansen, L.L.; Larsen, A.E. & Hansen-Møller, J. 1995. Influence of keeping pigs heavily fouled with faeces and urine on skatole and indole concentration (boar taint) in subcutaneous fat. Acta Agric. Scand. Sect. A. Anim. 45: 178-185.

IFOAM. 2000. Basic standards for organic production and processing.

Decided by the International Federation of Organic Agricultural
Movement, General Assembly, Basel, September 2000.

Infod. Forbrugernotat: August 1997.

<http://ecoweb.dk/infod/not9808.htm> 15-11-1999. På nettet er det nr.
/not9708

ITC, 1999. Product and market development. Organic food and beverages:

World supply and major European markets. International Trade Center.

Jakobsen, K. & Hermansen, J.E. 2001. Organic farming – a challenge to
nutritionists. *J. Anim. and Feed Sci.* 10 supp.1: 29-42.

Jensen, K.O.; Larsen, H.N.; Mølgaard, J.P.; Andersen, J.-O.; Tingstad, A.;

Marckmann, P. & Astrup, A. 2001. Økologisk fødevarer og menneskets
sundhed. [*Organic foodstuffs and man's health*] Rapport fra vidensyntese
udført i regi af Forskningsinstitut for Human Ernæring, KVL [*Report
from a knowledge synthesis carried out within a framework of Research
Department of Human Nutrition, The Royal Veterinary and Agricultural
University*]. Arne Astrup & Peter Marckmann (eds). FØJO [DARCOF]-
report No 14.

Lund, V. 2000. Is there such thing as "organic" animal welfare?

Proceedings of the Second NAHWOA Workshop.

<http://www.veeru.reading.ac.uk/organic/proc/lund.htm>

Kristensen, T. & Mogensen, L. 2000: Danish organic dairy cattle

production systems – feeding and feed efficiency. In: Ecological Animal
Husbandry in the Nordic Countries. Proceedings from NJF-seminar No

- 303 16-17 September 1999. (Eds: J.E. Hermansen, V. Lund & Erling Thuen). DARCOF-report No 2: 35-40.
- MAF, 1999. Ministry of Food, Agriculture and Fisheries. Aktionsplan II – Økologi i udvikling [Action Plan II – Ecology in development]. Danish Directorate for Development, Ministry of Food, Agriculture and Fisheries.
- Maw, S.J.; Favler, V.R.; Hamilton, M. & Petchey, A.M. 2001. Effect of husbandry and housing of pigs on the organoleptic properties of bacon. *Livest. Prod. Sci.* 68: 119-130.
- Michelsen, J. 2001: Recent development and political acceptance of organic farming in Europe. *Sociologica Ruralis*. 41: 3-20.
- Michelsen, M.; Hamm, U.; Wyner, E. & Ruth, E. 1999. The European market for organic products: growth and development, Hohenheim, Germany. 199 pp.
- Nielsen, B. & Thamsborg, S.M. 2001. Organic beef production based on dairy breed bull calves: a questionnaire survey among farmers in Denmark. Submitted, *Livest. Prod. Sci.*
- Noe, E. 2001. Organic farming in Denmark: Enhancement N dissolution? A survey among organic farmers. Submitted for publication.
- Padel, S. 2000. Strategies of organic milk production. Proceedings of the Third NAHWOA Workshop, Clermont-Ferrand.

- Padel, S.; Smid, O. & Lund, V. 2000. Organic livestock standards.
Proceedings of the Second NAHWOA Workshop.
<http://www.veeru.reading.ac.uk/organic/proc/padel.htm>
- Roderick, S.; Henriksen, B.; Fossing, C. & Thamsborg, S. 2000. Proceedings
of the Third NAHWOA Workshop, Clermont-Ferrand.
- Roepstorff, A.; Monrad, J.; Sehested, J. & Nansen, P. 2000. Mixed grazing
with sows and heifers: Parasitological aspects. In: Ecological Animal
Husbandry in the Nordic Countries. Proceedings from NJF-seminar No
303 16-17 September 1999. (Eds: J.E. Hermansen, V. Lund & Erling
Thuen). DARCOF-report No 2: 41-44.
- Schifferstein, H.N.J. 1998. Oude Ophuis PAM. Health -related
determinants of organic food consumption in the Netherlands. Food
Quality and Preference 9(3): 119-133.
- Sehested, J.; Søgaard, K.; Danielsen, V. & Kristensen, V.F. 2000. Mixed
grazing with sows and heifers effects on animal performance and
pasture. In: Ecological Animal Husbandry in the Nordic Countries.
Proceedings from NJF-seminar No 303 16-17 September 1999. (Eds: J.E.
Hermansen, V. Lund & Erling Thuen). DARCOF-report No 2: 35-40.
- Sundrum, A. 2001. Organic livestock farming. A critical review. Livest.
Prod. Sci. 67: 207-216.
- Sørensen, P. & Kjær, J.B. 2000. Non-commercial hen breed tested in
organic system. In: Ecological Animal Husbandry in the Nordic
Countries. Proceedings from NJF-seminar No 303 16-17 September

1999. (Eds: J.E. Hermansen, V. Lund & Erling Thuen). DARCOF-report No 2: 59-63.
- Trujillo, R.G. 2000. Organic livestock production in Spain. Proceedings of the Second NAHWOA Workshop.
<http://www.veeru.reading.ac.uk/organic/proc/garcia.htm>
- van Putten, G. 2000. An ethological definition of animal welfare with special emphasis on pig behaviour. Proceedings of the Second NAHWOA Workshop.
<http://www.veeru.reading.ac.uk/organic/proc/vanP.htm>
- Wier, M. & Calverly, C. 1999. Forbrug af økologiske fødevarer. Del 1: Den økologiske forbruger [*Consumption of Organic foodstuffs. Part 1: The organic consumer*]. Professional report from DMU [*National Environmental Institute*].
- Younie, D. & Hermansen, J.E. 2000. The role of grassland in organic livestock farming. *Grassland Science in Europe* 5: 493-509.