Systems development: quality and safety of organic livestock products

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Edited by
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SAFO Sustaining Animal Health and Food Safety in Organic Farming
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Sustaining Animal Health and Food Safety in Organic Farming (SAFO)

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Foreword

Sustaining Animal Health and Food Safety in Organic Farming (SAFO) is a European Commission funded project, with the objective to contribute to improved animal health and food safety in organic livestock production systems in existing and candidate member countries of the European Union. This volume, with the contributions from the 4th SAFO Workshop at the Research Institute for Organic Farming in Frick, Switzerland in March 2005, is one in a series of five proceedings published during the lifetime of the project (2003-2006). Electronic versions of the proceedings are available at the SAFO web-site at http://www.safonetwork.org/.

The fourth Workshop in Switzerland carried on from the 3rd Workshop in Poland: defining and discussing the concept of quality in organic livestock production. The collection of the presented papers reflected the complexity of the issues involved, ranging from the problems with zoonotic agents to the composition of milk and carcase quality of pigs. The emphasis on local breeds and local food traditions in the new member states in relation to organic livestock production was, once again, highlighted.

The use of veterinary medicines and their role in organic systems was addressed in one session. The presentations covered issues from the environmental impact of conventional veterinary medicines to veterinary attitudes to disease and health management in organic systems.

This was the second last of the SAFO Workshops, and further activities of the network will focus on dissemination of the results. The SAFO participants and workshop delegates were, therefore, invited to share and discuss, in an interactive workshop, the most important messages that they will take-home from SAFO. The results from this workshop are also published here, making interesting reading and highlighting the importance of networking.

Soon after the workshop in Frick, we received the sad news of the passing of Dr. Jan Zastawny, one of the SAFO partners and the organiser of the previous workshop in Poland. We publish here a paper by him and his colleagues at the Institute for Land Reclamation and Grassland Farming at Falenty. We regret that Jan is not with us any more and wish his colleagues all the best with the work he initiated with organic livestock production in Poland.

Malla Hovi, Michael Walkenhorst and Susanne Padel

Reading, July 2005

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Acknowledgements

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Our special thanks goes to the farmers Andreas Ott, Angelika Grossgasteiger, Albert und Elisabeth Hess-Wittwer, Urs und Joan Brändli and Christophe and Brigitte Pally who welcomed us on their farms during the field trip. Also, the Swiss retailer COOP sponsored organic lunch packets for the field trip.

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In Memoriam:
Jan Zastawny

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The analysis of forage quality and grasslands utilization for livestock production on organic farms

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Introduction

Grasslands with legumes, as the basic source of nitrogen, should play an essential part in organic agriculture systems. The proportion of grasslands of the total area of all types of organic croplands in Poland in 2002 highlights its importance (>45% of the total 41 thousand ha) (Zastawny *et al.*, 2003).

Grasslands are the obvious basis of organic livestock production. They provide cheap but valuable roughage that can serve as the only forage for ruminants in the summer period. They also allow access to range and natural grazing behaviour for stock, as an essential element of organic agriculture (Jankowska-Huflejt *et al.*, 2004). The condition of grasslands and the quality of produced forages have a major influence on animal health, their condition, welfare and the quality of animal products. Conversely, the management on grasslands is stimulated by livestock production.

In 2004, the Institute of Land Reclamation and Grasslands Farming in Falenty initiated a major study into organic livestock production. Research into grassland management was to be a large part of the study. The study is supported by the Ministry of Agriculture and Development of Rural Areas of Poland.

Methods of study

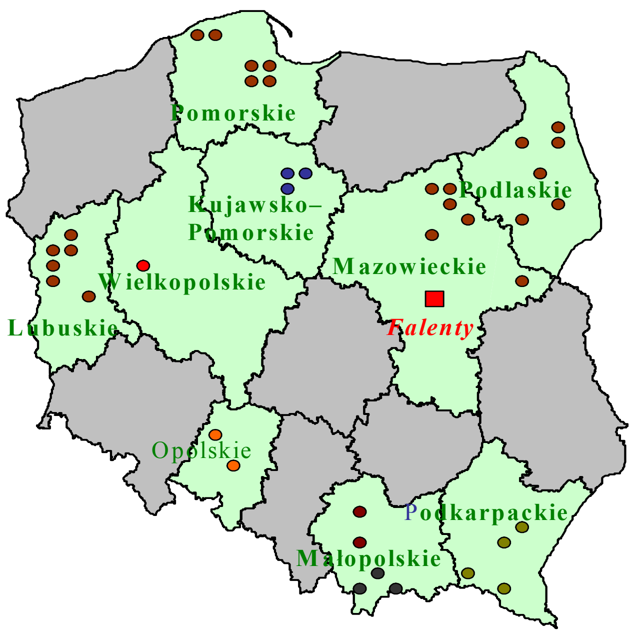
A total 39 organic farms with livestock production were chosen for the study. The farms are located in different geographic conditions in eight of the Polish provinces (Figure 1). The total area of the farms is 1,502 ha, and the area of permanent grasslands is 665 ha (43.6 % of the area). The size of the farms ranges 3.13 ha (Little Poland province) to 312 ha (Pomorskie province). The farms were grouped into four groups by size: 1-10 ha; 11-20 ha; 21-50 ha and >50 has (Table 1). The biggest group is the 21-50 ha farms.

Table 1 The share of grasslands and livestock density in each group of the study farms.

Area group of farms [ha]	Number of farms	Share of grasslands in area of agriculture lands of farm [%]		Livestock density	
		mean	range from – to	LU/ha	heads
1-10	6	50.3	28.1-85.7	0.93	0.83
11-20	15	36.3	10.3-73.4	0.72	0.74
21-50	12	63.3	7.4-94.9	0.61	0.58
above 50	6	39.6	13.6-92.3	0.70	0.66
Total/Mean	39	47.3	-	0.74	0.70

The quality of forages from grasslands of each farm was evaluated by botanical composition of sward, the useful value of sward (Lwu) (Filipek, 1973), the content of nutritive components, i.e. crude protein, crude fibre, crude fat, crude ash, and nitrogen free extract (NFE) in relation to dry matter (DM).

Figure 1 The location of examined organic farms.



Results and discussion

Grasslands and structure of agriculture lands on the farms

The farms were characterised with a large proportion of grassland (average 47.3%). This figure is twice as high as the mean of country (Table. 1). The grasslands, with multi species community of meadow sward and with high content of legumes (up to 50%), were typical of these organic farms. Only three of the 39 farms had no arable land, apart from the grassland, and, on two farms, the arable area was very small (0.15 and 0.69 ha). The highest proportion of permanent grassland (>50%) was found on the smallest farms (<10 ha) and on farms with 21-50 ha, with considerable variation between farms. The proportion of forage production from grassland varied according to farm size as follows:

- on farms with 1-10 ha – 66.3%;
- on farms with 11-20 ha – 67.0%;
- on farms with 21-50 ha – 90.1%; and
- on farms with > 50 ha – 63.4%.

The proportion of permanent grassland was high (40.7% mean), but ranged from 23% in Lubuskie province to 66% in Pomorskie. These figures suggest that the organic farms in the study were following good grassland management practices, in compliance with the principle that the large proportion of pastures in grasslands warrants their better utilisation and higher quality of green forage (Moraczewski *et al.*, 2001). The average area of pastures in investigated provinces was 8.5 ha. In a situation were farm-sizes are diminishing in Poland, it appears to be a large area. However, the area of pastures in each farm ranged from 0 to 77 ha.

The biggest avearage area of pastures was found in Pomorskie province (25.6 ha), and the smallest in Opolskie province (1.2 ha).

Livestock production and feeding

The dominant livestock on the farms was cattle, but also sheep and goats and, on one farm, horses (for meat prodution) were kept. On three of the farms, goose production on grasslands was carried out. The cattle were mainly milk breeds. On 14 of the farms, the cattle were Polish Black and White, on five farms Red Polish, on four farms Simmentals, on three farms Red and White, on another three farms Holsteins and on the remaining 14 farms there was a mixture of breeds.

Livestock density (Table 1) varied on farms from 0.33 to 1.73 head/ha. The highest densities were observed on the smallest farms (average 0.93 LU/ha), and lowest on the medium sized farms (group 21-50 ha; average 0.61 LU/ha). While there were considerable differences between farms, the average livestock density on the organic farms was high, i.e. 2-2.5 times higher than the mean in Poland (Table 2).

Table 2 Comparison of grasslands area (in ha) per head of cattle in examined organic farms and the means for conventional farms in each province (GUS, 2003) and per 1 LU all animals.

Province	N (farms)	Grasslands (ha)	Cattle (heads)	Area of grasslands per 1 head on farm			
				organic			conventional
				LU all animals	LU cattle	Heads of cattle	Heads of cattle
Wielkopolskie	1	2.10	-	1.21	-	-	2.53
Lubuskie	6	121.58	21	0.18	7.24	5.79	6.58
Podkarpackie	4	111.99	36	2.10	3.89	3.11	4.05
Pomorskie	6	201.57	353	0.64	0.71	0.57	4.33
Kujawsko-Pomorskie	3	28.41	79	0.41	0.45	0.36	2.66
Podlaskie	6	81.97	95	0.65	1.08	0.86	1.67
Mazowieckie	6	42.60	73	0.69	0.73	0.58	2.18
Opolskie	2	5.39	21	0.29	0.32	0.25	4.12
Małopolskie	5	68.38	21	1.80	4.07	3.26	2.73
Total	39	663.99	699	0.49	1.19	0.95	3.43

Cattle feeding was based on bulk feeds and concentrates, usually made on the farm (in compliance with principles of the organic farming). The share of concentrates bought outside the farm was small. The basis of summer feeding of cattle was mainly green forage from grasslands or arable lands at 50-60kg/head/day. Additionally, animals were given hay (26% farms), silage (10% farms), root crops (18% farms) and concentrates (51% farms). The basis of winter feeding was hay (18% farms), silage from arable lands (51% farms), partly root crops (51% farms), concentrates and the addition of the straw from cereals or cereal-leguminous straw.

On most of the investigated organic farms (~70%), grassland was well utilised for livestock production, considerably better than in remaining conventional farms, and almost in all provinces of Poland. On the remaining farms, there were reserves of fodder, with more than 2 ha of permanent grasslands per 1 LU. This was particularly the case on one of the farms in Małopolskie province, where there was 3.9 ha of permanent grassland/1 LU, and in Pomorskie province, where there was 4.5 ha/1 LU. These farms did not have adequate numbers of livestock to fully utilise the grassland area on the farm.

Quality of feeds from grasslands

The basis of summer feeding for cattle was grazing of pastures and meadows, mostly after the harvest of first or second cut. Among 39 farms, 9 (30%) had no pastures, but did have livestock production. On these farms, the grazing of animals took place on meadows, similarly, after first and second cuts.

The mean area of pastures on investigated farms was 8.5 ha and ranged from 0 to 77 ha. Pastures were situated close to the farmsteads (in 75% of cases within 500m), and pastured animals had a permanent access to water (except two farms) and, in most cases, to salt-licks.

Yields of green herbage (23.6 $t \cdot ha^{-1}$) were good and in general higher than the average yields in the country on conventional farms (15-17 $t \cdot ha^{-1}$) (Table 3).

Table 3 Yields of herbage from pastures, its botanical composition and the useful value of sward (Lwu) acc. to Filipek (1973).

Province	Green mass yield (t/ha)	Botanical composition (groups of plants - %) grasses	legumes	herbs and weeds	sedges, rushes and horsetails	Useful value of sward (Lwu)
Kujawsko-Pomorskie	17.7	50	16	30	4	6.9
Lubuskie	25.6	62	1	27	10	5.8
Małopolskie	26.2	57	25	18	-	-
Mazowieckie	18.4	67	19	14	-	-
Podkarpackie	26.0	77	15	6	2	7.0
Podlaskie	23.8	86	5	9	-	8.0
Pomorskie	22.2	54	30	14	-	8.0
Opolskie	29.0	47	50	3	2	8.1
Wielkopolskie[x/]	-	-	-	-	-	-
Mean	23.6	63	20	15	2	7.6

[x/] in examined farm there is not any pasture and not any livestock

The yield from investigated pastures was created mostly by grasses (average 63%), legumes (average 20%, in some cases even 60%), herbs and weeds (15%) and sedges, rushes or horsetails (2%). The quality of herbage was evaluated according to the useful value of sward Lwu by Filipek (1973). The quality of plant species present in the sward was good, and even close to very good (the average useful value of sward Lwu=7.6, while very good Lwu is 8.1-10.0). The most common grasses were:: *Poa pratensis L., Lolium perenne L., Lolium multiflorum L., Festuca rubra L.s.s., Festuca pratensis L., Dactylis glomerata L., Agropyron repens (L.) Beauv*.

There was a high share of legumes on all pastures. Dominant species were *Trifolium repens* (L) and *Trifolium pratense* (L.). The share of herbs and weeds was not high. On some farms, the share of herbs was higher, up to 30%, with *Taraxacum officinale* F.H.Wigg., *Achillea millefolium* L., *Rumex acetosa* L., as the dominant species.

The crude protein content (Table 4) in investigated green forages from pastures ranged between farms from 13.5 to 23.1% (average 17.8%). On most farms, the levels were adequate even for high performing dairy cows. The green forage was not too old, but grazed at appropriate height and in appropriate phase of growth for good protein composition. This was particularly the case on the smaller (1-10 ha) and the medium sized farms (11-20 ha), indicating good grassland management culture on these farms, where knowledge-based decision about yields and profits are more important than on big farms, that profit from the scale of production. The energy value of evaluated green forages from pasture was also comparatively high (Table 4).

Table 4 Nutritive value of feeds from grasslands on examined organic farms.

Type of forage	Content of nutritive components, % of DM					Energetic value [MJ]	
	crude protein	crude fibre	crude fat	crude ash	NFE	1 kg of DM	1 kg of feed
Green forage	17.76	24.36	3.62	8.97	45.29	5.8	1.15
Hay	13.92	29.41	3.31	7.08	46.28	4.95	4.26
Silage	16.06	27.73	3.26	14.07	38.88	5.10	2.43

Meadow forages
A prevailing technology of harvest and conservation of the meadow sward on investigated organic farms was hay production (Table 5), especially on smaller farms (100% farms from the group 1-10 ha). Usually, the sward from first cut (82.0 % farms) and second cut (61.5% farms) was intended for hay. The green forage from third cut was dried for hay only on 12% of the farms. On remaining farms, it was consumed directly by animals. Ensilaging of meadow sward is still not popular among organic farmers. Unfortunately, only few of them (15% in I cut, 10% in II cut and 2.6% in III cut) used the technology of harvest and conservation of meadow sward. It had the influence on the quality and nutritive value of obtained feeds. Hay drying on the surface of meadow causes a significant loss of nutritive components.

Table 5 Technologies of harvest and conservation of meadow grass on examined 39 organic farms.

Farm area	Number of examined farms	Hay production (% of farms)			Silage production (% of farms)		
		I cut	II cut	III cut	I cut	II cut	III cut
1-10 ha	6	100,0	83,3	0,0	16. 7	0.0	0.0
11-20 ha	11	72,7	63,6	18,2	9.1	0.0	9.1
21-50 ha	16	81.3	68.8	18.8	25.0	25.0	0.0
Above 50 ha	6	83.3	16. 7	0.0	0	0.0	0.0
%	100	82	61.5	12.8	15.4	10.3	2.6

The content of crude protein in investigated fodders for cattle was higher than the mean given for this type of fodder. In hay, the crude protein content ranged from 10.2% to 19.6% (average 13.9% - Table 4). The content of crude fibre correlated with the content of protein and was on average 29.4%. The percentage content of ash in investigated hay samples was not too high, i.e. ab. 7% on average. The fat content ranged from 3% to 4%. The results were similar to the results from conventional farms (Zastawny and Paluch, 1996) and to the contents of the nutritive components in the hay dried traditionally on the surface of meadow.

Table 6 Content of mineral components in hay and silage samples from organic farms

Farm area	Content in % of DM				
	P_2O_5	K_2O	CaO	Na_2O	MgO
hay					
1-10 ha	0.96	3.29	2.09	0.94	0.87
11-20 ha	1.12	2.94	1.87	1.22	0.98
21-50 ha	1.06	2.79	1.80	1.16	1.04
Above 50 ha	1.01	2.59	1.52	1.07	0.86
Mean	1.04	2.90	1.82	1.10	0.94
silage					
1-10 ha	1.79	1.60	3.09	1.07	1.07
11-20 ha	1.48	3.10	3.15	0.54	0.35
21-50 ha	1.36	3.12	1.96	0.29	0.69
Above 50 ha	-	-	-	-	-
Mean	1.54	2.61	2.73	0.63	0.70

Six samples of silage from meadow swards were analysed. The content of crude protein in DM ranged from 12.8 to 17.4% (average 16.1%), and fibre from 20.8 to 35.5% (average 27.7%). This suggests that the silage was prepared from different material to the hay. The high (35.5%) content of fibre in one silage sample testified about too late cutting. Generally, the content of basic nutritive components was comparable with results of the chemical evaluation of hay.

According to literature, 1 kg DM of silage should have from 14 to 17 % of crude protein, and the NEL should be 6.0-6.5 MJ/kg DM (Zastawny *et al.,* 2000). The nutritive value of evaluated silage samples was lower than this. It suggests that losses of nutritive components during the process of harvest and conservation took place. The nutritive value of 1 kg DM of hay was 4.95 MJ/kg, while the nutritive value of 1 kg of DM of silage was 5.1 MJ.

In seven samples of fodder from meadow sward, excessive quantities of ash were found (>12.6%). It is the result of impurities in the fodder with sand, and disqualifies it as fodder. The high content ash decreases the digestibility and has the influence on the decrease of NFE content and, consequently, on the fodder value. However, in spite of the lack of the mineral fertilization, the fodder from the meadows contained more protein and energy than is required in feeding standards.

The P_2O_5 content in hay was about 1 % (Table 6). It is the optimum content of this component in the meadow sward. In the case of silage, the content of this component was even higher (1.5%). The K_2O content was more diverse and ranged from 1.6% (in silage - which is too little for this type of fodder) to over 3% (the average for hay and the most of silage samples – this ia an optimum value). In case of remaining mineral components ie, calcium, magnesium and sodium, the content in investigated samples of the fodder was too high. For magnesium and calcium, the quantities were twice, and for the sodium three times higher than norms.

Conclusions

A prevailing direction in the most farms was livestock production, mostly cattle for milk production. The mean livestock density of cattle in examined farms was 2-2.5 times higher than the mean for the country. This is seen as a consequence of the importance of grassland in organic farming.

The basis of summer feeding of animals was grazing of pastures or meadows, usually after the harvest of the first or the second cut. In the winter, the animals were fed with hay and silage from arable lands, partly roots crops and concentrates with the addition of straw. Such feeding is influenced by organic form of agricultural utilisation of permanent grasslands.

There was a high proportion of pastures in agricultural land, suggesting the correct direction of the utilization of the land area on these farms. The average surface of pastures on investigated farms was 8.5 has. The grassland yield was created usually by grasses, legumes, herbs and weeds. The quality of pasture herbage was good or very good and higher than on conventional farms in Poland.

A prevailing technology of harvest and conservation of meadow sward on the examined organic farms was hay production. The hay usually was prepared from the herbage of the first and the second cut, not always in accordance with the principles of good hay making. Ensilaging of herbage is still not popular.

The content of nutritive components in hay and similarly silage samples from organic farms was rather low. It suggests that the knowledge of available technologies by farmers is limited. However, the utilisation of grasslands for livestock production was better on the studied organic farms than on conventional farms in Poland.

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Part A:
Quality concept and organic livestock products

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Quality of organic livestock products

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European consumers have become increasingly more aware of food safety issues, as a consequence of a number of food ‘scandals’. Most of these ‘scandals’ have been related to livestock products. However, most consumers still believe that it is possible to produce ‘safe’ food at low prices, while a small group of consumers is willing to pay a price surplus for special quality. The individual definition of such “special quality” is diverse and includes both product and process quality. This paper attempts to describe this diversity for livestock products and to create a connection between aspects of quality and the organic standards.

“Intrinsic” or “product” quality is directly measurable in the product itself and includes physical, chemical and microbiological parameters. Nutrient content, taste, texture, smell and appearance are food characteristics that can benefit the consumer. Residues, toxins and pathogens are potential risks. Food safety measures should decrease these risks.

Aspects that are not detectable directly in the product are part of the “extrinsic” or “process” quality. Certification aims at ensuring these aspects that could be divided into three areas:

1. ethical (responsibility towards human beings and animals);
2. ecological (responsibility towards different parts of the ecosystem, including the whole world); and
3. cultural aspects of quality.

Arable organic production is regulated in more detail and more consistently in the EU organic standards than organic livestock production. In spite of the implementation of the livestock standards in 1999 and their obvious positive aspects (low stocking densities, free-range systems, organic feed, preventive health measures, minimisation of veterinary medicines etc.), many critical points remain: tethering of dairy cows is still allowed, non-organic feed is still allowed in ration, ruminants are still fed on high concentrate diets and the use of conventional veterinary medicines is still common. Approach to longevity and killing of organically reared animals does not differ from the approaches in the conventional systems. There is little difference in the consumption of fossil energy between organic and conventional livestock systems, and organic food often accumulates even more ‘food miles’ than conventional food. And last but not least, organic livestock are still fed high quality protein feeds that are suitable for human consumption, such as feeding Brazilian soy to European organic livestock.

Organic standards, especially for livestock products, have very few definitions of process quality, and even fewer of these definitions that influence product quality. As most consumers of organic livestock products expect high process and product quality, the organic movement has to address this issue. It is suggested that a two-way approach is taken:

1. Consumer education and information on the importance of process quality; and
2. Definition and development of organic product qualities that are measurably better than those of the conventional products (e.g. lower somatic cell counts in milk, lower pathogen contamination of carcases, etc.)

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Consumer expectations of the quality of organic livestock products: how can premiums be justified?

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Consumers have a right to transpareny, clear and understandable information, opportunity to compare and choose, protection against unfair competition and the right to benefit from competition. They have the right to have safe and healthy food and other goods. The Swiss Foundation for Consumer Protection (SKS) has set itself guidelines for its activities and interventions. The SKS works for healthy, ethical and ecologically responsible food.

In relation to organic food, the consumers have the right to food products that are safer, more natural and more welfare friendly than conventional ones. They also have high expectations, in terms of choice. Consumers are willing to pay a fair but competitive price that is not isolated from comparison.

With highly priced organic products, the tolerance of consumer of false promises is much reduced.

If the consumer expectations are fulfilled, and the additional value of organic food products is clearly communicated, the higher prices become justified and plausible, and consumers are willing to pay a premium.

Clear communication, based on images and on the emotional value, is one, if not the most important factor, for successful placement of the food products of Swiss organic farming in future markets.

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Producer expectations of quality of organic livestock products

R. Fuhrer
BIO SUISSE CH

BIO SUISSE is the umbrella federation of 35 organic farming organizations in Switzerland. BIO SUISSE was established by Swiss orgnaic farmers and their wives in 1981. They agreed on a common standard of high ecological standing and introduced a common label, the Bud. The members of BIO SUISSE are the organic farmers of Switzerland. Approximately 6,500 agriculture enterprises (11 per cent of all Swiss farmers) follow the standards of BIO SUISSE.

Improvement of soil fertility, soil cultivation and crops were the most important issues at the start of the BIO SUISSE activities. In the past few years, also the animal husbandry standards of BIO SUISSE have been developed. All animals on BIOSUISSE farms benefit of the welfare friendly guidelines: low stocking densities in housing, type of stable, grazing and regular outdoor access are a matter of course. Great emphasis is also placed on welfare friendly feeding, including high roughage proportion in ruminant diets (maximum of 10% concentrates). BIO SUISSE farmers recognise that respect for livestock and quality of products provides both pride and self confidence to the producer.

Since its initiation, BIO SUISSE has also been engaged in the processing of organic food. The organisation sets guidelines for Bud-products from cultivation to the supermarket shelf. The consumers rightfully expect from organic products that they are carefully processed, if possible, without additives. The raw materials should be unique and maintain their distinct quality throughout the processing. For BIO SUISSE-labelled food, the most preserving processing method is used in each case, without artificial flavouring and colouring: the taste of fruit in the yogurt comes from “Bud” fruits and nothing else.

BIO SUISSE is an active federation that does not rest on past successes or ignores social change. Therefore, convenience products have become and important topic for us recently. People take less time for cooking, but nevertheless want to have healthy food. Therefore, for example ready made pizza or canned tomatos are also available in “Bud” quality today. We hope to meet similar challenges in the future and are confident that, with organic farming, we can offer credibility and additional value for the consumers.

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Posters:

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Organic production and nutrimarketing strategy of 'Hungaricums' of animal origin

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Introduction

During the past decade, the general attitude of the population towards health, nutrition, quality and environment has remarkably changed. Consequently, organic farming is increasing, especially in economically developed countries. Due to the growing demand, government subsidies and other economic advantages, the cropping area has increased.

In Hungary, organic farming principally means organic crop production. Livestock with organic certification has existed in Hungary only for some years, with organic animal husbandry usually located in the areas of national parks. For this reason, farmers primarily keep breeds that are suitable for rough grazing, e.g. indigenous, traditional breeds. Table 1 shows the total number of animals in animal unit and the numbers of the two chosen species from 2001.

Table 1 Organic livestock production in numbers of livestock units and farms in Hungary in years 2001-2003.

	2001	2002	2003	2004
Total (in animal unit)	8,388	11,855	11,210	12,254
Organic cattle	6,181	8,862	7,503	8,419
Organic pigs	225	327	446	704
Number of farms	72	83	137	160

Source: Biokontroll Hungária Kht., 2001-2005.

In the present study, two animal breeds are presented. Their numbers are increasing year on year, with demand for the products increasing. Between these traditional Hungarian breeds, the Hungarian Grey cattle amounts to 80% of the domestic, certified organic cattle stock, while the organic pig stock consists of about 90% of the Mangalitsa pigs.

The Hungarian Grey Cattle and the Mangalitsa Pig

Historical sources, of which the earliest are from the 15th century, confirm the development and origin of the animal breeds belonging to the Hungarian nation living in the Carpathian Basin. In recent times, these breeds have been determined as 'hungaricums'. This term shows their indigenous origin and Hungarian production, helping the marketing of the products. The main characteristics of 'hungaricums' have been described by several experts. From these definitions we highlight the following, in order to help the interpretation of the study:

> *"**Hungaricums** are animals, plants and food industry products made from them which are related to the Hungarian production traditions developed through generations, and which are recognized by the population of Hungary or a smaller region to be*

typical of Hungary, and foreign countries also accept them as Hungarian specialities" (Andrásfalvy, 2003).

The Hungarian Grey Cattle

The Hungarian Grey cattle can be characterized as tough and undemanding animals. Fat depositing begins early. However, the fat builds in the abdominal cavity and the subcutaneous connective tissue instead of between the muscle-fibres (Holló, 2003). This makes the valuable beef parts dry and low in cholesterol. The meat is suitable for people on special diets, and has a taste similar to game (Kovács, 2002). Due to its extensive character, the Hungarian Grey cattle require large pasture areas (5 to 10 hectares per animal unit, depending on the quality of the herbage). There is no need for housing; the stock's living-space can be designated by natural boundaries and cattle-grids. At the beginning of 2004, approximately 8,000 Hungarian Grey cattle were counted in the agricultural census, owned by 194 farmers. It is remarkable that about 75% of the Grey cattle stock is kept on organic farms.

Mangalitsa pig

The Mangalitsa is the only remaining indigenous Hungarian pig breed. Since the middle of the 20th century, the Mangalitsa pig began to lose ground on the Hungarian market, due to the flooding of the market with intensively reared pork and increasing use of vegetable oils for cooking. It should be noted that the Mangalitsa is the fattiest pig breed in the world, with an ability to produce over 70% of its body weight in fat (Magyar Mezőgazdaság, 2002).

The production indices of the ancient Hungarian Mangalitsa are low. The slow gain in muscles is accompanied with the increased infiltration of fat. Therefore, Mangalitsa pig counts among the so-called heavy fat pigs with a recommended slaughter weight of 150-180 kg (Holló *et al*, 2003). Similarly to the Grey cattle, lot of Mangalitsa pigs can be found in national parks. The total number of Mangalitsa pig is currently nearly 30,000. However, only a small part, approximately 5% of them, is reared organically.

SWOT analysis for marketing Grey Cattle and Mangalitsa Pig products

Considering the production and the nutritional benefits of the two above-mentioned organic products, a SWOT analysis was prepared summarizing the strengths, weaknesses, opportunities and threats for marketing of the products (see Table 2).

The special features of both products are high quality, low water content (contrary to PSE meats) and good cooking quality. The high intramuscular fat content and the fine, even fat distribution of Mangalitsa pork is beneficial from the viewpoint of taste, friability and enjoyment value, and it can also be advantageous for the production of steak-like meats and special products (ham, chop). Breeds with similar capabilities cannot be found elsewhere. The Hungarian Grey cattle and the Mangalitsa pig utilize the local conditions well, they are resistant and undemanding which makes their feeding simple. Consumer confidence in organic production is increasing, making a premium price more acceptable. The slaughter yield of Grey cattle and Mangalitsa pig is lower than that of the modern breeds. This is an obvious weakness. The slower weight gain, the lower slaughter weight, the early fat deposition and the considerable fat deposition reduce the profitability of meat production, too. The market opportunities for the products are favourable; the top quality of the products is well-recognized by demanding consumers. The value added may be further enhanced by increasing the processing degree and keeping animals in organic production. Slow increase of product quantity can be initially a threat to the marketing of these products. Special import products and good quality imitated products, which are already present on the market, also threaten the Hungarian products. Lack of common marketing is a general problem among almost all traditional and regional products.

Table 2 SWOT analysis of marketing organic meat products from Hungarian Grey Cattle and the Mangalitsa pigs.

STRENGTHS	**WEAKNESSES**
Excellent taste, structure Distinctive and unique quality Bioactive healing and preventive effects Undemanding keeping and high resistant	Weak natural index Something high strict costs
OPPORTUNITIES	**THREATS**
High standard product for highbrow people Unsatisfied market, high market potential, niche market Distinctive in the environment-and landscape protection Further product development	Limited quantity of goods High price because of demand Failure of collective marketing and market research Fierce import competition

Marketing-strategy of Hungarian Grey Cattle and Mangalitsa Pig products

Today the consumption of organic meat and meat products (made from Hungarian grey cattle and Mangalitsa pig) is low. In order to change this, a radical change of the consumers' view is needed, which can only be realized by target group oriented, detailed marketing programmes.

Target markets and positioning

The market of these organic products can be characterized with high demand which favours the pricing of farmers and processors. Organic products made from Grey cattle beef and Mangalica pork are primarily demanded by people in high income categories; consequently, niche-marketing should dominate the strategy. In positioning*, organic production, nutritional benefits, health-protecting function and the Hungarian origin* should be emphasized by marketing communication. Further product advantages materialize in top quality, good taste, speciality and distinguishability form another species and from products from other countries. These processed organic meat products, with a great added value, can expect a sound market, even when both 'hungaricums' are combined in one product (for example in sausages and salamis).

Marketing mix

The central element of the product strategy is quality*,* which is to be used from two different aspects. The first viewpoint is the traditionality and naturalness of the products derived from the keeping and feeding of animals (organic farming) which is also reflected in the processing. The second aspect is the correspondence to the nutritional demands by the outstanding ripening and frying characteristics, low cholesterol and high mineral levels, and the excellent taste of organic meat products. Considering the of top quality position of Mangalica and Grey cattle products, the direction of pricing can only be the prestige price, as well on domestic as on foreign markets. The basis of the price is the value recognized by the consumers. The products should appear in stores regularly visited by wealthy customers including smaller special shops (bio- and health stores), retail chains, and larger self-service supermarkets and hypermarkets, exclusive restaurants and health spas.

In addition to increasing of quantity, future competitiveness can only be achieved by intensified advertising activity and extending the role of common marketing which was mentioned among threats in the SWOT analysis. In the communication, the nutritional benefits, special taste, processing quality and Hungarian origin of Grey cattle and Mangalica pig products are to be accentuated. The role of Grey cattle and Mangalica pig in the tourism cannot be neglected, either.

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Working Group Reports:

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Working Group Report

Differences in quality and safety expectations between stakeholders: how these be addressed

Rapporteurs: C. Atkinson and V. Ferrante

Intorduction
The group identified that there were a range of expectations held by different stakeholders and agreed that these were often not compatible or harmonious. The main areas of incompatibility, in relation to livestock products and production systems, were felt to lie between the expectations of consumers and producers.

Process quality
Consumer expectations might not be fulfilled. For instance, the range of permitted inputs might not be aligned with consumer perceptions e.g. permitted disinfectants and cleaning materials. Also, expectations of environmental diversity might not be met in specialised production systems that require large scale production to achieve technical performance – especially pig and poultry production systems. Indeed, these might have a negative impact on environmental performance.

Product quality
Consumers expect all aspects of the production system to be ‘pure’ and based on ‘natural’ inputs and aids. But this could be a difficult area. How should we balance the use of chemically synthesised cleaners, sanitizers and medicines against the risk of product and environmental pollution and contamination? Rather than relying on inputs we must ensure that all applicable aspects of management are in place to prevent problems arising in the first place.

Suggestions on ways forward
A tool is needed to quantify risks associated with areas of conflict with expectations, so that they can be resolved by the most acceptable method without the risk to product quality or safety becoming unacceptable.

The Regulation (2092/91) lacks clarity. Both from the point of view of the producers - who find it difficult to understand what is expected of them, and of the consumers - who are unclear about what it is legitimate to expect. The Regulation carries great expectations for product quality, but it is currently unclear as to how it ensures that this will always be delivered. Perhaps this indicates that the legislators are not always clear what their expectations are or how these should be achieved.

Process quality is a much more complex message – it requires an attention span from consumers that it is not very easy to obtain. This makes complex messages about system attributes difficult to communicate. An example might be the area of animal welfare. *The group recommends that animal based outcomes are used as a key indicator of process quality as these can demonstrate to producers how they are doing and show consumers what is being achieved.*

In regard to processing – minimal processing should be preferred.

It should be noted that in some countries the organic certification system currently gives a better control over quality and safety than for conventional products and this remains a valuable role.

Where it is suggested that some food safety issues are potentially more of an issue in organic products, there should be proper surveillance and monitoring to investigate these claims, e.g. mycotoxins.

Working Group Report

Report of the working group discussion on the draft IFOAM principles in relation to animals

Rapporteurs: S. Padel and H. Alroe

The group began with a discussion of the group members' understanding of what aspects, in relation to animals, are important to them and should be addressed in principles in relation to organic farming.

During a first brainstorming the following points were raised.

- Naturalness (right to express natural behaviour)
- Respect for the animals integrity (including the 'pigishness' of the pig)
- Adequate feeding (in line with the physiological needs of each animal species)
- Animal welfare with the three dimension of ethology, functionality (including animal health) and the animal's feelings
- Sufficient space
- Respect for herd/flock ranking order and social behaviour
- Right to express natural behaviour
- The five freedoms (We had some discussion about how well they represent all issues important to us):
    - *Freedom from Thirst, Hunger and Malnutrition* by having access to fresh water and a healthy diet;
    - *Freedom from Discomfort* by having a suitable environment, shelter and a resting place;
    - *Freedom from Pain, Injury and Disease* by prevention of cruelty and illness by care and rapid treatment;
    - *Freedom to express Normal Behaviour* by providing space, facilities and company of the animal's own kind;
    - *Freedom from Fear and Distress* by ensuring conditions which avoid stress and mental suffering
- The human animal relation ship
- Domestication and the differences between farm and wild animals

Three key concepts were seen to emerge from the above:

a) Naturalness (respecting the natural behaviour and the nature of the animal)
b) Integrity (respect for physiology and health)
c) Human animal relationship and domestication

The group further discussed a number of questions that could be used to test principles, for example, whether organic rules should include rules for the collection of products from wild animals, should include species that are not historically domesticated and whether organic principles should also apply to pet animals (dogs, cats, horses etc). No conclusive answers on these topics were reached.

The next step was to compare the three key concepts with the proposed four principles.

Principle of health

- The group liked the fact that animal and human health are describe as one and indivisible, because this gives emphasis to a point that has been discussed in many SAFO meeting: that only healthy animals will provide the basis for a healthy diet.
- However, we felt that respect for the physiology of animals should be mentioned explicitly in the explanations of this principle, as this is pre-requisite for the animal health.

Ecological principle

At the end of the first paragraph of the explanation text should read: "; for *farm* animals this is the farm", as this statement clearly can only relate to the domesticated and not wild animals.

- The group felt that this principle appears to be quite radical in relation to current practice of organic animal husbandry.
- However, the group was aware of many examples where the current practise would not correspond with this principles and where production cycles in relation to animal could currently not be closed (e.g. sales of animals into the non-organic sector; use of concentrate feeds from other farms, other countries, bedding straw in area without grain production etc).

Principle of fairness

- The groups questioned whether the four terms mentioned in the first paragraph of the explanation of the term fairness (equity, respect, justice and stewardship) fully capture the relationship of humans and farm animals. Equity and justice seem to relate to humans; stewardship to the environment; leaving respect to be the term that would relate to the human animal relationship.
- The group liked the fact that animal physiology, innate behaviour and well-being were especially mentioned in the 3rd paragraph of the explanation.

Principle of care

- The group felt strongly that animals should be included in the text of the main principles alongside future generations and the environment.
- This principles would be the right place to include the concept of "due diligence" in relation to food safety in the organic principles, which is particularly relevant to zoonotic diseases (that animals may carry without becoming ill themselves) and in relation to microbial contamination of food.

Finally the groups discussed parts of the question 7 of the IFOAM consultation:
Do the proposed principles and explanations address 'soil,' 'animal welfare' and 'biodiversity' in a satisfying way? Do 'soil' and / or 'animal welfare' deserve a separate principle? If you think so, please suggest some motivation, formulation and explanation of the new principle.

The group felt that a separate principles would be desirable for the following reasons:

1) The dimension of the "feelings" of the animals that is included in common understanding of animal welfare would not be included in any of the above principles.
2) In the development of the organic movement and standards, animals have, by and large, been considered as an afterthought and often in less detail than soils and cropping and the animals have some catching up to do,

3) The current state of animal health and welfare on organic farms is very similar to conventional systems, and organic standards, as they stand at the moment, do not seem to improve the health and welfare situation of the animals considerably. A separate principle an animal welfare would give this area more prominence in relation to further development of organic standards and production practises.

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Part B:
Quality and safety of organic livestock products

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Organic milk

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Studies comparing the composition of milk produced on organic and conventional dairy farms in the UK

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Introduction

Organic milk production in the UK increased from 16 million litres in 1997/98 to 218 million litres in 2001/02 (MDC, 2002). Consumers often cite health benefits of organic food as a reason for purchase (Hill and Lynchehaun, 2002; MDC, 2002). To date, only minor differences in composition between organic and conventional milk have been identified (Lund, 1991; Jahreis, *et al*, 1996; Toledo, *et al*, 2002), with little information available about organic milk from the UK. However, differences in farm management and cow nutrition in the organic system may potentially affect milk composition and milk hygiene. The aim of this project was to compare the composition (including fatty acids and vitamins), hygiene and persistent organic pollutant (POP) content of milk from UK organic and conventional farm-gate and processed milk. Additionally, farm management data were collected to identify factors affecting milk composition.

Materials and methods

A pilot study was carried out to determine whether differences in POP, conjugated linoleic acid (CLA), mycotoxin and hygiene parameters existed between organic and conventionally produced milk. Data were then used to design a longitudinal study over 12-months.

Pilot study

Dairy farms (7 organic and 5 conventional) and processed milk sources (7 organic and 5 conventional) were recruited within Scotland, Wales and England. Milk from each farm or processed source was sampled monthly during April–June 2002. Farm production data were collected by personal interview. All samples were analysed using high performance liquid chromatography (HPLC) for contamination with the mycotoxin Ochratoxin A (OA) and for *cis*-9 *trans*-11 octadecadienoic acid (CLA) content. Individual farm-gate milk samples taken in April were submitted to the DEFRA Central Science Laboratory (York, UK), for analysis of persistent organic pollutants (POPs) by gas chromatography-mass spectrometry. The POP compounds analysed were ortho PCBs, non-ortho PCBs, dioxins, and PBDEs. Two processed samples pooled from organic and conventional milk collected in April were also submitted for POP analysis. Data were analysed using 2-sample t-tests and Mann-Whitney tests for simple comparisons, where significance was defined as $p<0.05$. The CLA data were analysed using a generalised linear mixed model (GLMM), with significance defined as $p<0.05$.

Main longitudinal study

Nineteen conventional and 18 organic farms were recruited in the north-west of England and were visited monthly between May 2003 and April 2004. A bulk-tank milk sample was collected from each farm at each visit. Farm production and management data were collected each month by personal interview. Additionally, three separate sources of processed organic and conventional milk were sampled monthly. All milk samples were analysed for the fatty acid content by gas chromatography at the Institute of Grassland Research, (IGER, Aberystwyth, Wales). Samples from every second month of the 12-month period were analysed for the vitamin A, vitamin E and beta-carotene content by HPLC. Multivariable analyses were conducted on both the fatty acid and vitamin data including effects of the production and management factors.

A subset of 28 farms (14 organic and 14 conventional; approximately matched for herd size) were recruited for assessment of cow hygiene scores and were visited during January 2004 when all milking cows were housed. Cow cleanliness was assessed using a modified scoring method based on previous studies (Hughes, 2001; Bowell *et al*, 2003) and an overall whole-cow score based on summation of scores from four sites was determined. Faecal pat consistency was assessed by means of a scoring system based on that of Hughes (2001). Pat samples were also visually analysed by a modification of the faecal sieving technique (Hall, 1999), paying attention to the fibre length and the presence or absence of undigested foodstuffs. Additionally, the number of clinical mastitis cases reported by the farm each month was recorded. Data were analysed using proportional odds logistic regression (POLR) with significance defined as $p<0.05$.

Results

Pilot study

The median annual milk yield in organic herds was 5,500 litres/cow/lactation, while in conventional herds was 6,600 ($p>0.05$). On average, the organic farms turned cows out to pasture 13 days earlier than conventional farms and held a more diverse range of dairy breeds. The average 3-month geometric mean bulk tank somatic cell count (BTSCC) was higher on organic farms than on conventional farms ($p<0.05$) (Table 1). There was no significant difference in the Bactoscan count, or percentage of butterfat or protein between organic and conventional farm-gate samples (Table 1). Ochratoxin A was not detected in any farm-gate or processed milk samples (limit of detection 0.01ng/ml). During the study period, the milk fat CLA concentration increased over time in both farm-gate and processed milk ($p<0.01$), but did not differ between management systems (Figure 1). Despite considerable individual farm variation with respect to the POP content, there was no difference in total ortho PCB, non-ortho PCB, dioxin, PBDE or WHO-Toxic Equivalent (TEQ) content between organic and conventional farm-gate milk (Table 2).

Table 1 Summary of farm production data from pilot study

Parameter	***Average parameter value in each farming system for 3-month period***			
	organic n=7		***conventional n=5***	
	Mean (SD)	***Median***	***Mean (SD)***	***Median***
BTSCC ('000s)/ml♦	293 (202)	255[a]	109 (17)	111[b]
Bactoscan ('000s)/ml♦	29 (16)*	26*	64 (45)**	56**
% BF	4.32 (0.60)	4.12	3.98 (0.12)	4.00
% TP	3.32 (0.15)	3.29	3.28 (0.08)	3.26
Herd size (no. cows)	90 (27)	100	132 (79)	110
Av. yield/cow/lactation (L)	5,526 (989)	5,500	6,471 (741)	6,600

[ab] Different superscript indicates significant difference where $p<0.05$

* n=6, **n=4, ♦average of three month geometric means for BTSCC and BS

Figure 1 Change in CLA concentration in organic and conventional farm-gate milk over duration of pilot study

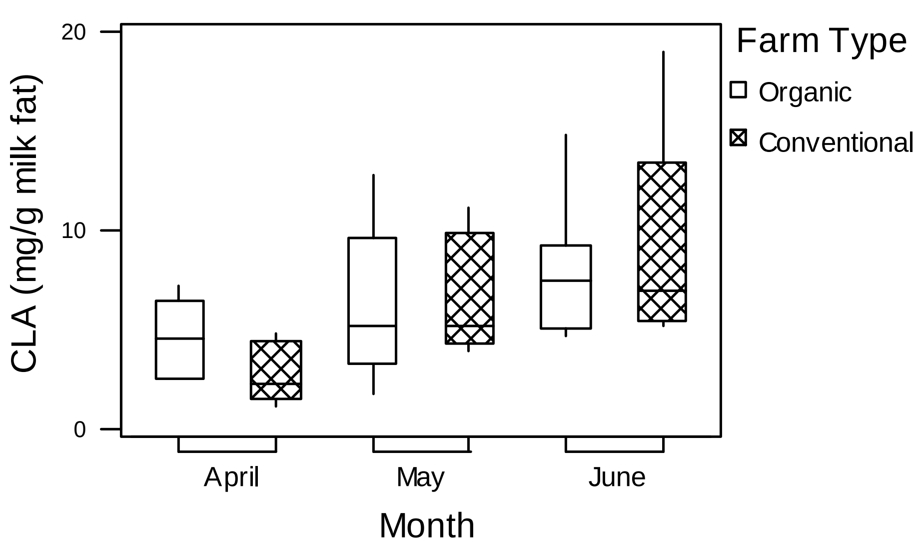

Table 2 Summary of pollutant content in pilot study April milk samples

Variable	Farm-gate *mean (SD)*		Processed †	
	Organic	**Conventional**	**Organic**	**Conventional**
Ortho PCBs (ug/kg fat)	8.22 (10.29)	5.06 (7.01)	4.04	21.45
Non-ortho PCBs (ng/kg fat)	6.45 (3.62)	8.06 (6.00)	8.69	12.13
Dioxins (ng/kg fat)	2.60 (0.91)	9.88 (12.57)	3.77	2.32
PBDEs (ug/kg fat)	1.09 (0.21)	0.91 (0.51)	1.83	1.80
TEQs (ng/kg fat)	0.88 (0.21)	0.91 (0.52)	1.44	1.05

PCBs=polychlorinated biphenyls, Dioxins=polychlorinated dibenzo–*p*-dioxins and polychlorinated dibenzo furans, PBDEs=polybrominated diphenyl ethers, TEQs=WHO-Toxic Equivalents
† one pooled sample of each milk type

Main study

Milk composition

Only data on selected milk fatty acids have so far been comprehensively analysed. Data were obtained on 60 fatty acids present in bovine milk. Both season and farm type (organic or conventional) affected the proportions of fatty acids present in milk collected over 12-months. Proportions of saturated fatty acids (SFA) decreased during the summer months and mono-unsaturated fatty acids (MUFA) and poly-unsaturated fatty acids (PUFA) increased in the summer. The proportion of MUFA was higher in conventional farm-gate milk ($p<0.01$) and the proportion of PUFA was higher in organic farm-gate and processed milk ($p<0.01$). Processed milk samples were generally similar to the farm-gate milks with respect to all fatty acid data. Organic milk had a higher proportion of C18:3 (linolenic acid), which is the main omega-3 fatty acid in bovine milk, when compared to conventional milk at both the farm-gate and the processed milk level at all times during the sampling period ($p<0.01$). Conventional farm-gate milk had a higher proportion of C18:1 (oleic acid) compared to organic milk ($p<0.01$). There was no difference between organic and conventional milk with respect to CLA content. Multivariable data analyses for all fatty acids are continuing. Other factors affected the fatty acid profile of the milk, including: herd average yield level, the breed of cows in the milking herd, whether or not a total mixed ration (TMR) was fed, the access to fresh pasture, silage type fed and level of in-parlour concentrate top-up feeding.

Cow hygiene results

Univariate POLR analysis showed that cow cleanliness was influenced by a wide range of factors. Cows that were in organic systems had a higher odds ratio (OR) of being cleaner than conventionally managed cows. When compared to lactating cows of all yield levels that were all housed together, separately housed dry-cows had a higher OR of being cleaner. Faecal pat consistency and degree of digestion affected cow cleanliness, where increasing fluidity of pats and poorer digestion score was associated with dirtier cows. Multivariable analysis is continuing including association with the herd BTSCC and Bactoscan data for this time period.

Summary and conclusions

Our data have shown that nutritional and management factors critically affect both the composition of the milk and cow hygiene. Farming system (organic or conventional) affects milk composition, independent of nutritional and management factors included in our study. Thus, further work needs to be directed to determining the 'organic' or 'conventional' effects, particularly sward types or concentrate feed composition may have to be taken into account in analyses. Additionally, our data will provide the basis for advice to farmers on management and feeding practices that will improve the milk quality.

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The influence of the grazing season on polyunsaturated fatty acids content in cow milk fat from Bieszczady Region of Poland

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Introduction

There is a growing interest in the fatty acids composition in animal products, especially in cow milk. Several studies have demonstrated that polyunsaturated fatty acids (PUFA) have a positive impact on human health. Especially conjugated linoleic acid (CLA) is suggested to have an immunomodulating, anticarcinogenic and antiartheriosclerosois properties (Pastuschenko *et al.*, 2000, Whigham *et al.*, 2000). The beneficial effects of n-3 fatty acids have been shown in the prevention of coronary heart disease, hypertension, type 2 diabetes, rheumatoid arthritis and some other diseases (Simopoulos, 1999).

Milk produced in low input systems, where feeding is based mainly on grass and legumes, is potentially of higher biological value than milk produced under intensive, grain-based feeding regimes, as indicated both by experimental and field studies. Increased CLA concentration was found in the milk of cattle fed with fibre-rich diets (Dhiman *et al*,. 1999). According to Bergamo *et al.* (2003), an organic livestock diet, containing at least 60 % of the dry matter of roughage, fresh or dried fodder, recommended by Council Regulation EC 1804/99 and Council Regulation no. 2092/91, may well improve concentrations of these fatty acids.

Beneficial properties of milk produced in organic and low-input production systems could be an important argument to maintain extensive milk production in many regions in Europe, where local conditions do not allow for intensive milk production.

The aim of the work described here was to study variation of fatty acid composition in cow milk from low-input mountain farms, namely:

- effect of pasture season and production level; and
- possibilities to develop production system for biologically valuable milk, with elevated level of beneficial fatty acids.

Materials and methods

Data collection: the farms

Milk samples were collected in 2003/2004 at 19 sites in Bieszczady Region. The region is situated in the south-east Poland, on the border between Central and Eastern Carpathians. Landscape is hilly, with mountains up to 1,300 m above sea level. Due to natural conditions, the agriculture production is not intensive, with cattle and sheep as the main livestock enterprises. Most farms do not exceed 30 ha of land. Agricultural land is dominated by pastures and meadows. Use of artificial fertilisers and other chemicals for crop production is limited. Low intensity of feeding and high content of forages in cow diets was typical for observed dairy herds. During pasture season, cows were grazed on natural pastures. Grazing was sometimes supplemented with hay or straw. Silage was fed during pasture season only occasionally. Indoor (winter) diet was based on grass silage and hay or straw. Corn silage was used only on two farms, together with grass silage. Other feeds, such as beet pulp and brewer's or distiler's grains, were fed on some farms in limited quantities. In both seasons, roughage was supplemented with concentrates, but amount of grain was generally low and did not exceed 4 kg per cow per day. As a consequence, mean milk yield was low, between 3,500 and 5,500 kg of milk per cow per year.

Milk samples were collected directly from milk tanks on nine farms and ten milk delivery centres operated by Co-operative Milk Plant in Sanok. Samples were taken at every site in August, October and December 2003 and in March and May 2004. According to the verified beginning and end of grazing in studied herds, samples were assigned to pasture or indoor season. In most cases, indoor season comprised samples taken in December and March, while rest of the samples were from the pasture season. Total number of samples was 45 for those collected on farms and 40 for those collected in milk delivery centres.

Chemical analyses
Collected samples were analysed for content of fat and protein with Milcoscan 104 A/B (Foss Electric, Denmark). Lyophilised for 48 hours, milk samples were then extracted using chloroform-methanol and water mixtures (4:2:1,v/v) and derivatisation reaction was carried out (Czauderna and Kowalczyk, 2001, Czauderna *et al.,* 2001). The derivatizated samples were filtered through a 0.2 μm membrane filter (Whatman). The resulting solutions were injected onto chromatographic columns on Spheri–5 RP–18, 5 μm, 220x4.6 mm columns (Perkin Elmer, USA).

Dibromoacetophenacyl esters of fatty acids were identified on a HPLC system Series 200 Perkin Elmer USA. The development of the gradient elution system, collection and data integration were performed with Turbochrom Workstation Ver. 6.1.2 software. All solvents were degassed under vacuum and then maintained flushed with helium (99.996%, Praxair, Warsaw, Poland). The column temperature was maintained at 35^{O}C and the eluted dibromoacetophenylacyl esters of fatty acids were detected at 242 nm. Elution was performed using a concentration of a methanol (MeOH) and acetonitryl-water (ACN-H_2O, 40-60, v/v) mixture. The elution of dibromoacetophenacyl ester of 3:0 –20:5 fatty acids was completed within 40 min at a flow-rate of 2.6 ml/min.

List of identified fatty acids, with their systematic names, is given in Table 1. It should be noted that conjugated linoleic acid (CLA), labelled as C18:2c in the Table, was a mixture of cis- and trans isomers of 9,11 and 10,12 octadecadienoic fatty acid.

As seen in Table 2, differences in both milk yield and composition were observed between seasons. One can argue that at least part of differences in milk fat composition is due to yield change, not due to feeding regime. The aim of Model 2 analysis was to delineate between these effects. Results shown in Table 4 indicate that a part of the variation in milk fat composition is attributable directly to milk yield, but the effect of yield on fatty acids content in milk fat was significant only for few of analysed fatty acids. Positive correlation found in our study between C18:1c9 and milk yield is contradictory for results summarised by Chilliard *et al.* (2001) showing negative correlation between C18:1 response and milk fat response in several studies.

Table 1 Fatty acids analysed in milk samples (n=95)

Symbol	Systematic name	Mean (g/100g fat)	SD (g/100g fat)
C4	Butyric	3.36	2.27
C6	Hexanoic	2.41	1.55
C8	Octanoic	1.59	0.49
C10	Decanoic	1.76	0.39
C10:1	Decanedioic	0.088	0.023
C12	Dodecanoic	1.35	0.31
C12:1	cis-5-dodecenoic	0.32	0.13
C14	Tetradecanoic	6.40	3.63
C14:1	cis-9-tetradecenoic	0.63	0.19
C15	Pentadecanoic	1.41	0.90
C16	Hexadecanoic	20.09	3.50
C16:1c9	cis-9-hexadecanoic	2.81	0.87
C17	Heptadecanoic	0.40	0.11
C18	Octadecanoic	12.39	2.94
C18:1c9	cis-9-octadecenoic	0.34	0.19
C18:1t9	trans-9-octadecenoic	12.08	2.50
C18:2c9,12	cis-9-cis12-octadecadienoic	1.11	0.61
C18:2(C)	octadecadienoic, conjugated	0.70	0.31
C18:3 c9,12,15	9,12,15-octadecatrienoic	0.61	0.27
C20:3c5,8,11	cis-5,8,11-eicosatrienoic	0.065	0.060
C20:3c8,11,14	cis-8,11,14-eicosatrienoic	0.017	0.008
C20:4c5,8,11,14	cis-5,8,11,14-eicosatetraenoic	0.102	0.034
C20:5c5,8,11,14,17	cis-5,8,11,14,17-eicosapentaenoic	0.032	0.033

Statistical analyses

In order to evaluate the effect of pasture season on milk composition and fatty acids content in milk fat, data were analysed with following model (Model 1):

$$y_{ijk} = P_i + Pmonth_{j(i)} + l_k + e_{ijk},$$

where:

y_{ijk} – considered trait,
P_i – fixed effect of feeding season (pasture, indoor),
$Pmonth_{j(i)}$ – fixed effect of j-th month nested within i-th season,
l_k – random effect of k-th location (herd/centre),
e_{ijk} - random residual.

Effect of average milk yield in a herd on fatty acid composition in bulk samples was evaluated with another model (Model 2):

$y_{ijk} = P_i + b_i(\text{milk}) + l_k + e_{ik},$

where:

y_{ijk} – considered trait,
P_i – fixed effect of feeding season (pasture, indoor),
b_i(milk) – fixed regression of considered trait on average milk yield in a herd, specific for i-th season,
l_k – random effect of k-th location (herd/centre),
e_{ijk} - random residual.

Procedure MIXED from SAS package (SAS Institute Inc.,1999) was used for computations. The F test was applied, in order to test significance of effects of variables included in described models on dependent variables.

Results

Milk yield in the observed herds was significantly higher in pasture season, while both fat and protein content was significantly lower (Table 2). Month of observation has clearly significant effect on milk yield and composition, within both seasons, indicating that feeding regime did differ both between and within feeding seasons. During pasture season milk fat contained less medium chain fatty acids and more PUFA compared to indoor season (Table 2).

Table 2 Effect of pasture season on milk yield, milk composition and pools of fatty acids in milk fat. Results from analyses with Model 1.

Item	Season (pasture versus indoor)	month (within sezon)	LSM	
			pasture season	indoor season
Milk (kg/day)	*	***	18.5	14.6
Fat (%)	***	***	3.96	4.22
Protein (%)	*	***	3.32	3.42
SFA (g/100 g fat)	n	***	50.38	51.5
MUFA	n	***	15.8	16.6
PUFA	*	ns	2.86	2.56
Short	ns	***	8.65	9.50
Medium	**	***	31.4	34.2
Long	ns	***	26.2	27.0

LSM – least square mean
ns, *, **, *** – effect not significant or significant at $p<0.05$, $p<0.01$, $p<0.001$ respectively
Short – sum of C4 to C10 fatty acids
Medium – sum of C11 to C15 fatty acids
Long – sum of C17 to C20 fatty acids
SFA – sum of saturated fatty acids
MUFA- sum of monounsaturated fatty acids
PUFA – sum of polyunsaturated fatty acids.

The effect of season on separate fatty acid content in milk fat was significant for most of analysed acids. In many cases, the effect was pronounced, with difference between seasons being more then 40% of the level in season with lover value (Table 3). Nevertheless, the effect of month remains significant for most of analysed fatty acids.

Table 3 Effect of pasture season on milk yield, milk composition and pools of fatty acids in milk fat. Results from analyses with Model 1.

Fatty acid	Season (pasture versus indoor)	Month (within season)	LSM (g/100g fat)	
			pasture season	indoor season
C4	Ns	***	3.54	3.15
C6	***	ns	1.76	2.78
C8	Ns	***	1.64	1.58
C10	***	***	1.61	1.89
C10:1	**	***	0.084	0.093
C12	***	***	1.17	1.48
C12:1	**	***	0.28	0.35
C14	**	ns	7.61	5.32
C14:1	***	***	0.57	0.69
C15	***	*	1.06	1.68
C16	***	**	18.4	21.4
C16:1	***	***	2.27	3.21
C17	*	***	0.42	0.38
C18	**	**	13.2	11.8
C18:1c9	***	**	0.48	0.25
C18:1t9	Ns	***	12.1	12.0
C18:2c9,12	***	ns	0.65	1.37
C18:2(C)	***	***	1.00	0.49
C18:3c9,12,15	***	ns	1.01	0.47
C20:3c5,8,11	Ns	***	0.070	0.062
C20:3c8,11,14	***	ns	0.021	0.015
C20:4c5,8,11,14	***	**	0.083	0.115
C20:5c5,8,11,14,17	*	ns	0.040	0.027

Table 4 Effect of mean herd yield on concentration of fatty acids in milk fat from analysed farms. Results from analyses with Model 2.

Item	Regression coefficient[1)]	
	pasture	non-pasture
Long	0.95	0.47*
C15	-0,23**	-0,29
C18	0.046	0.34**
C18:1c9	0,020	0.019*
C20:3c5,8,11	-0.002	0.008**

[1]) - regression coefficient of fatty acid content in milk fat on milk yield in analysed herd, calculated separately for both seasons

*) – regression coefficient significantly (p<0.05) different from zero

**) - regression coefficient highly significantly (p<0.05) different from zero

Considering fact that expected differences in (mean) daily milk yield between herds are likely to be several kilograms per cow, possible effect of yield on level of fatty acids listed in Table 4 could be considerable. It is obvious that feeding regime have an impact both on milk yield and milk composition, including composition of milk fatty acids. It would be interesting to delineate between an impact of lower yield (caused by lower energy intake) from the effect of changes in diet composition. With data we had it was not possible, thus presented results should be considered with caution.

Discussion and conclusions

In our study the content of C18;2c and C18:3 in milk fat was on average two fold higher during pasture feeding compared to season of indoor feeding. This appears particularly important, as both kinds of fatty acids are know for their beneficial role in human nutrition (Parodi, 1999; Simopulos, 1999; Kritchevsky, 2000). For the same reason, significant increase of C20:5 content in milk fat during pasture feeding can be viewed as a positive effect. Observed effects are in good agreement with results already published (Chilliard *et al*., 2001), where effect of pasture based and grass silage based diets on fatty acids composition were compared.

Bergamo *et al.* (2003) analyzed the content of CLA in several dairy products from organic and conventional production system: buffalo milk and buffalo mozzarella cheese, cow pasteurized milk, cow UHT milk, butter and 5 kinds of typically Italian dairy products (parmigiano, mozzarella, ricotta, crescenza and fontina). They found significantly more CLA in all investigated products from the organic production systems, and the ratio CLA/LA (linoleic acid) was regularly higher. Organic milk fat has higher levels omega 3 essential fatty acids, according to new research released in January 2005 at the Soil Association's annual conference, held in conjunction with the University of Newcastle's Quality Low Impact Food (QLIF) Congress in Newcastle. Organically reared cows, which eat high levels of fresh grass, clover pasture and grass clover silage, produced milk with higher levels of omega 3 essential fatty acids, confirming earlier research into raised omega 3 levels by the University of Aberdeen and the Institute of Grassland and Environmental Research (results only published at http://www.organicfqhresearch.org).

In conclusion, the results obtained in this study are in agreement with most studies comparing the levels of CLA in milk from different feeding regimes. Probably the most important factor of CLA level is connected with the feeding regime of cows and not so much with the organic methods of fertilization of the grasslands. A recent study conducted by Nielsen *et al.* 2004 (http://www.darcof.dk) indicated that the level of conjugated linoleic acids (CLA) was similar in organic and conventional milk, while the level of vitamin E and carotenoids was significantly higher in organic milk. The authors considered different feeding regimes: the large amount of maize silage used in conventional system and considerable amount of grass and leguminous plants used in organic system.

The main conclusions from this study are:

- Differences in fatty acids composition between pasture and indoor seasons and between months within season were significant;
- Higher concentration of polyunsaturated fatty acids in general, including some of them known for their beneficial impact for human health (like CLA), indicated that milk produced during pasture season was biologically more valuable;

- Effect of yield on fatty acids concentration was shown to be significant only for few fatty acids and mostly during non-pasture feeding. As season has significant impact both on milk yield and fatty acids composition, data structure do not allow to fully delineate effect of season from the effect of increasing milk yield;
- Pasture feeding had beneficial effect on milk fat composition in the studied region. In order to maintain this value throughout indoor season, changes in winter diets are needed; and
- Organic rearing standards require regular pasture grazing and, therefore, may foster a feeding regime of cows, leading to better nutritive value of the produced milk.

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Minimal processing of dairy products

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Introduction

Consumer's attitudes towards food products in societies of abundance are changing. Hygiene and microbiological safety are presupposed. Consumers' interests focus on the history of the product, with emphasis on origin, farming system and applied processes. Retailers claim longer shelf life for the distribution and selling period, with a significant effect on the technology to be applied and an effect on the quality of the product. Milk from organic production systems, therefore, should lead into high quality milk products that are safe and minimally processed.

Raw milk quality

Good raw milk quality is a prerequisite to produce certified milk. Bacterial growth is decisive for raw milk quality. Growth can be limited by cooling and can be stopped by heating and inactivation. The aim is to limit bacterial growth by cooling and by short storage times of the raw milk. Raw milk should not be older than 48 hours, unless the biologic activities have been stopped by means of a thermisation process. The total count should never exceed 500,000 colony forming units (cfu) per ml, otherwise flavour alterations in the end product cannot be excluded.

Developments in heating technology

New developments in heat treatment and food preservation technology are driven by food safety concerns. Raw milk has to be treated before consumption, to guarantee the absence of pathogens. This is usually done by heating. In order to ensure longer shelf life, micro-organisms and enzymes that cause spoiling have to be inactivated, and the technique most often used to accomplish this is heating. Longer shelf life and safety are clearly attractive to consumers, but they also want to consume food products that are as fresh as possible and of good taste.

Developments of the technologies are also driven by heat load indicators and minimal processing. Beside the traditional thermal procedures, alternatives, such as cold procedures and electro heating technologies, are discussed. Food irradiation for example is a process of exposing food to a controlled source of ionizing radiation for the purposes of reduction of microbial load, destruction of pathogens, extension of product shelf life and disinfection of products.

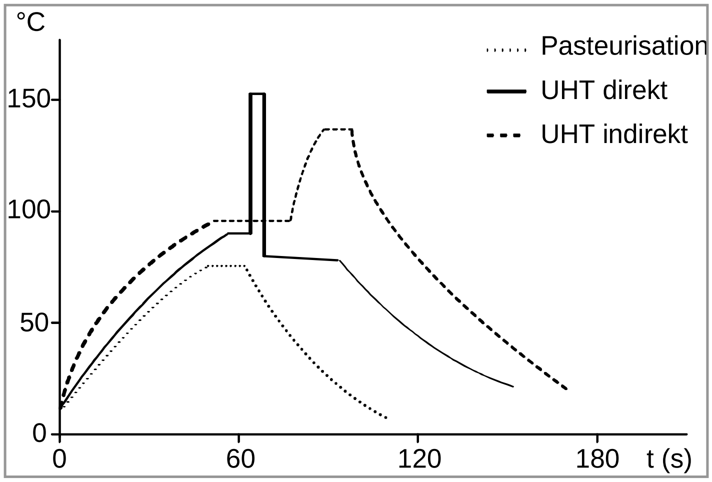
With the application of pulsed electric fields (PEF), a product undergoes a number of very short electric pulses, which cause damage to the cell wall of the bacteria. The cells that survive this process multiply less quickly than cells that survive a thermal treatment. The most important disadvantage of PEF is that spores are not, or only marginally, inactivated and that the energy costs are relatively high. Various groups are carrying out research into combining PEF with other technologies in order to increase the effectiveness of the technique. Thus, the alternative methods have the potential to inactivate micro-organisms with a good retention of the freshness characteristics of the product. But until now it has appeared impossible to achieve sufficient inactivation of bacterial spores in milk. However, alternative procedures are not generally accepted yet, either for reasons of safety or sensory quality or costs.

Shelf life, storage options and taste

The key parameters for the difference in quality of pasteurised and ultra heat treatment (UHT) treated milk are shelf life, storage options and taste. Pasteurisation at 72°C during 15 seconds, followed by refrigeration (<5 °C), is the most careful heating procedure. Shelf-life of pasteurized milk is approximately ten days in cold storage. More than 90% of the micro-organisms are destroyed. Without any recontamination and under optimized storage conditions below 6°C, it is possible to reach a shelf life of more than 12 days for pasteurized milk.

The UHT procedure was introduced about 50 years ago. UHT milk is heated up at temperatures between 135 and 150°C for a few seconds. With UHT-processing, there a two procedures, the direct and indirect one, to be differentiated. The time-temperature diagrams of direct and indirect procedures are totally different (Figure 1). With the direct procedure, steam can either be injected into milk directly or milk can be infused into saturated steam. After a short preservation time, the added quantity of water will be removed under vacuum. The residence time over 100°C is shorter with direct heating. The time-temperature diagram of indirect UHT procedure is similar to the diagram of pasteurisation, but it is on a higher level: 138°C instead of 72 °C. Indirect heating is done by heat exchangers (plates or tubes). With the same bacteriological effect, the direct procedure is more careful regarding chemical and sensory changes, but it is more expensive because of energy consumption. Shelf-life of UHT milk, light- and gas-protected, is more than two months, with storage at room-temperature.

Figure 1 Time-temperature diagrams for pasteurisation and direct and indirect UHT processing.



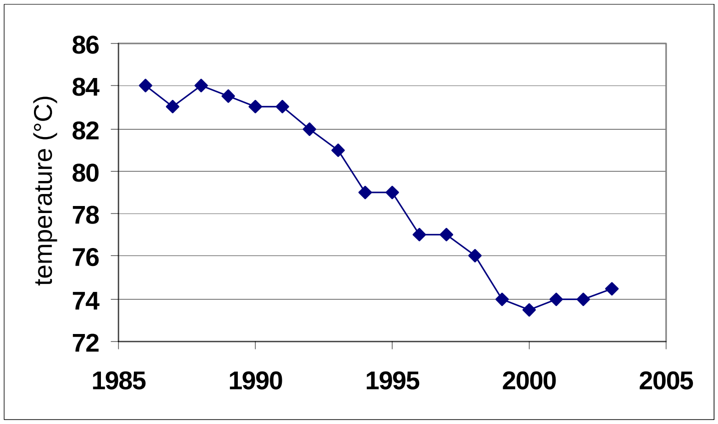
The extended shelf life (ESL) milk is a compromise in shelf-life between pasteurized and UHT milk. There are different processing procedures, as High Temperature Pasteurisation, Micro-filtration and Bactofugation both together with a heat treatment. Shelf-life and heat-load indicators of ESL-milk depend on the selected processing procedures. The self-life is about 15-40 days with cold storage. ESL milk is a compromise between freshness and convenience with the heat load and sensory quality being between pasteurised and UHT milk. There are international differences in the acceptance of ESL milk. In the United States, high temperature pasteurized ESL milk is widespread, whereas in Switzerland it is only little accepted.

For safety reasons, additional pasteurisation of the milk and high heating of the cream is required when processed by micro-filtration. Actually, direct high heating (125-130°C) seems to be of current interest. Disadvantages of ESL milk are combination of unit operations and legal status. ESL-milk also has to be stored in the refrigerator. The great advantage of ESL-milk lies in the means of distribution. This benefit is primarily money economised in logistics and convenience for trade and consumers and finally a taste similar to the taste of pasteurised milk.

Assessment of heat load indicators

Knowledge of kinetics of heat-induced changes is a prerequisite for technologists to be able to optimise a process, such that the desired result is achieved and undesirable changes are restricted to a minimum. An optimisation of processing conditions by Agroscope Liebefeld-Posieux (ALP) allowed to decrease pasteurisation temperature (Figure 2). Today, pasteurised milk in Switzerland has a better taste and even a longer shelf life than in the past.

Figure 2 Decrease of pasteurisation temperature in the past 20 years.



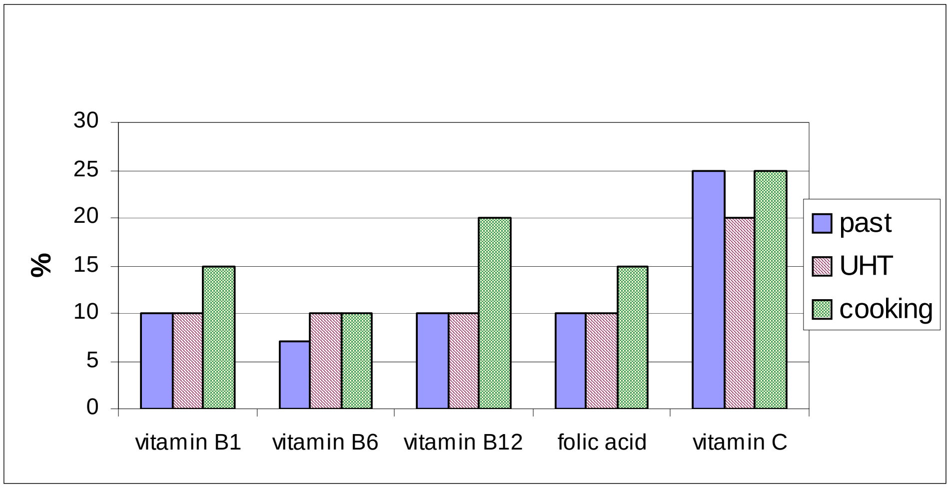
Considerable scientific progress was made in the last decade by developing new methods for measuring heat load of milk and milk products. The most important parameters that quantitatively assess heat treatment of milk are listed in Table 1.

Table 1 Heat load indicators for milk

	Raw	Thermised	Past	High past	UHT direct	UHT indirect
Temperature [°C]	< 40	< 65	72	127	150	138
Phosphatase	+	+	-	-	-	-
Peroxidase	+	+	+	-	-	-
native β-LG [mg/L]	3,600	3,400	3,000	1,800	800	200
Lactulose [mg/kg]	< 10	< 10	< 10	< 100	< 200	> 200
Furosine [mg/kg protein]	< 20	< 20	35	< 200	< 500	> 700

An inactivated phosphatase is a proof of sufficient heating, the presence of peroxidase, however, shows that the milk was heated up carefully. Heat denaturation of whey proteins, loss of native β-lactoglobulin, and the formation of reaction products, such as lactulose and furosine, are further heat load indicators. Based on such indicators, it is possible to suggest the best fitting process type coping with the needs of preservation of the natural aspect. As Table 1 shows, with increasing heat load, native β-lactoglobulin decreases and lactulose and furosine resulting from Maillard reaction, increase. The degradation of β-lactoglobulin and the formation of lactulose are valuable heat load indicators to distinguish between direct and indirect UHT treatment. Vitamin losses are nearly the same either in pasteurized or UHT milk, losses of vitamins by cooking raw milk are much higher (Figure 3).

Figure 3 Loss of vitamins in heat treated milk



UHT milk and organic Cultures "Bud"

The "Bud" is the registered trade mark of BioSuisse, an association of Swiss organizations of organic farming. In the evaluation procedure of BioSuisse, to accept UHT milk with the label "Bud" or not, the comparison of different heat treatments concerning the heat load indicators played a decisive role. For the Swiss organic label "Bud" the UHT-process in general is banned but direct steam injection UHT-process is allowed, due to very limited heat-load similar to pasteurized milk. Avoiding over-processing in this context means the application of no more heat load than absolutely necessary for food safety requirements.

ALP produces organic cultures labeled "Bud". These cultures are free of genetic manipulation and antibiotic resistance. They are cultivated without any additives on organic milk. The strains are of dairy origin, out of a collection of more than 15,000 strains, mostly isolated several decades ago. "Bud" cultures are widely used in cheese-making in Switzerland. Avoiding over-processing in that context means the application of no unnecessary additives.

Conclusions

For a holistic evaluation of processes and products, there are different criteria, which have to be taken into account. In addition to quality, innovative character, naturalness and freshness, a product must meet consumers' acceptance. It is finally the market that decides whether a new organic product will gain acceptance or not. The aim of an all natural food-process is to preserve the quality, to preserve genuine properties and bio-active substances and, finally, to preserve the emotional value of the product. The process should be in accordance with the history of the raw materials and has to be driven by food-safety. New production strategies and minimal processing are important for both, traditional and novel technologies.

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Posters:

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Afflatoxins in organic and biodynamic milk marketed in Florence area

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Introduction

It is believed that risks linked to aflatoxins (AFM_1) contamination are higher in organic milk production than in conventional. In a previous study (Lorenzini *et al.*, 2004), we demonstrated that the AFM_1 is not only a problem for organic agriculture, but also for conventional agriculture. Therefore, adopting preventive measures, it is possible to produce safe milk for human consumption, also in Mediterranean areas, where the warmer climate increases the risk of AFM_1 contamination in the maize.

The aim of this work has been to establish what is the actual risk linked to AFM_1 contamination of milk in the organic Italian market.

Methodology

The study was initiated with a literature review, in order to evaluate the problem of the AFM_1 in the milk marketed in the Florence area. Dairy Centre of Florence, Pistoia and Livorno (Mukki Latte) carried out the laboratory analyses on organic and biodynamic milk (Table 1), using the official methodology (HPLC). The analyses were carried out for three times, every ten days, on samples bought in the supermarkets of Florence, throughout February 2005.

Table 1 Milk samples collected in the Florence area in February 2005 from retail outlets and analysed for AFM_1

	Organic				Biodynamic	
	Pasteurized		UHT		UHT	
	Entire	Partially skimmed	Entire	Partially skimmed	Entire	Partially skimmed
N° of samples	4	2	3	1	1	1

Amongst the methodologies used for the analysis of AFM_1, the liquid chromatography was the most efficient. This methodology has a high sensitivity and specificity and with this it is possible to resolve 5ppt (ng/kg) of AFM_1 in milk. In comparison to the HPLC method, the ELISA (Enzyme-Linked Immunosorbent Assay) methodology shows the following advantages: high specificity, relatively simple and short assay time (4 hours).
The data obtained from the analyses were reported on tables underlining the legal limits.

Results

Literature review

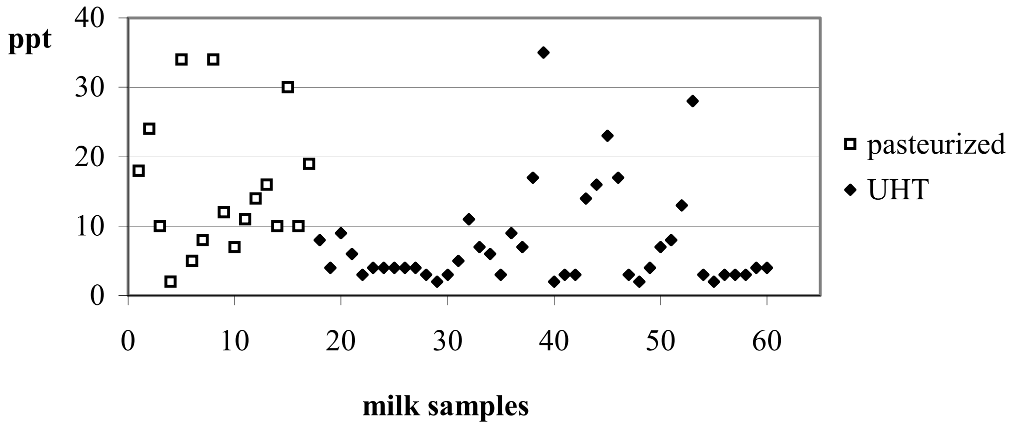
A study, carried out in 2002 to evaluate the occurrence of AFM_1 in milk and dairy products (Capei and Neri, 2002) (Table 2 and Figure 1), analysed a 60 samples of commercial milk, collected in supermarkets in Florence and checked for AFM_1 by using direct competitive enzyme-linked immunosorbent assay (ELISA). The incidence of AFM_1 contamination in samples analysed was high (91-94% of positive samples). It was found, above detection limit (d.l.) of 3 ppt, in 55 (91.6%) of the milk samples in amounts ranging from 3 to 35 ppt with a mean concentration of 9.3 ppt. None of milk samples exceeded the European and Italian legal limit of 50 ppt. The results showed a diffuse microcontamination of AFM_1 in samples analysed, which does not appear to be a serious risk to public health.

Table 2 Occurrence and levels of AFM_1 in milk in Florence area in 2002 (Capei and Neri, 2002).

	Number of samples Pasteurized milk N. (%)	UHT milk N. (%)
< d.l.	1 (6)	4 (9)
> d.l.	16 (94)	39 (91)
Total	17	43
Range (ppt)	N. (%)	N. (%)
3 - 10	6 (38)	30 (77)
11 – 20	6 (38)	6 (15)
21 – 30	2 (13)	2 (5)
31 – 40	2 (13)	1 (3)
41 – 50	0	0
media ± S.D.	15,5 ± 9,8	7.5 ± 7,2

d.l. = detection limit (3 ppt)

Figure 1 AFM$_1$ dispersion in milk samples.



Analyses performed by Mukki Latte

Mukki Latte carried out analyses on milk samples of this study, using the official methodology HPLC. The results are presented in Table 3.

Table 3 AFM$_1$ in organic and biodynamic milk collected in the Florence retail outlets in February 2005.

	Organic				Biodynamic	
	Pasteurized		UHT		UHT	
	Entire	Partially skimmed	Entire	Partially skimmed	Entire	Partially skimmed
1st analysis						
< d.l.	2	1	3	1	1	*
> d.l.	2 (7 and 24 ppt)	1 (13 ppt)	0	0	0	*
2nd analysis						
< d.l.	0	1	2	1	1	1
> d.l.	2 (7 ppt both)	1 (14 ppt)	1 (14 ppt)	0	*	0
3rd analysis						
< d.l.	1	0	2	1	*	*
> d.l.	2 (5 and 11 ppt)	2 (2 and 6 ppt)	1 (12 ppt)	0	*	*

d.l. = detection limit (5 ppt)

It was not possible to find all the types of milk for all three analyses, as some milk labels were not available in the supermarkets at the time of sample collection. Biodynamic milk samples were all free of AFM_1. 40% of the organic samples (pasteurized and UHT) showed positive results for AFM_1, but all were under the EU legal limit of 50 ppt.

Conclusions

Comparing these results with the previous study of conventional milk by Capei and Neri (2002) (91,6% positive samples), it appears that the levels of contamination with AFM_1 in organic milk is not higher. However, comparative samples would have to be taken in the same year to give a true picture of the levels of AFM_1 in milk, as maize levels of aflatoxins vary every year and are dependent on the climatic conditions.

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The comparison of intensive and extensive pasture feeding for dairy cows on a Bohemian farm

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Introduction

The nutritive value of forages for ruminants highly depends on the ratio between cell content and cell walls and on the ability of the rumen microorganisms to degrade the plant cell walls (Waldo, 1986). The primary function of the NDF fraction in ruminant diets is to provide energy for microbial synthesis of the short chain fatty acids produced during fermentation, but also to secure rumen function and animal health by adding structural value to the diet (Mertens, 1994). The utilization of the fibre fraction in ruminant diets varies highly within and between forage types and is highly influenced by associated effects (Stensig and Robinson, 1997). Analysis of the content of fibre in ruminant feeds is based on the NDF analysis (Van Soest *et al.,* 1991). The detergent system is a rapid procedure for determining the insoluble cell wall matrix and estimating its major subcomponents, as hemicellulose, cellulose and lignin can be determined from NDF, ADF and ADL analysis (Van Soest, 1994).

While extensive grassland will still continue to be the most important form of management in the world, intensive grassland will continue to evolve with improved forage quality and yield of other forage crops, making a greater contribution to such systems. Moreover, treatment and breeding of cereal and protein crop straws will increase their feeding value, so that they will possibly contribute more to nutrient supply from grassland systems in the future.

Within grassland systems, research in forage quality has recently focused on the measurement of forage quality and the need to describe the attributes of forages, measured chemically or biologically, to meet the objectives of the system (Čermák *et al.*, 2004a,b).

Materials and methods

On a farm of the West Bohemian District of the Czech Republic, the characteristics of pasture content of clover/grass/other plants was observed during three summer seasons. The farm had 65 Holstein-Freesien (11 im figure.1) and 78 Czech Red Peed (70 im figure 1) cows, with a total pasture area of 32 ha. Samples of pasture were taken and the percentage of clover, grass and other plants was evaluated. Milk samples were analysed for the content of protein, fat, lactose, urine and somatic cells, using standards analytical methods.

Twenty-five samples of pasture forages, of which 13 were from intensive (fertilised 80 kg AMOPHOS/ha, second year of utilisation) pasture and 12 from extensive (withaut fertiliser, five year of utilisation) pasture, were selected from a bank of samples, previously examined at our laboratory for dry matter (DM) nylon bag degradability. The chemical analyses were with the standard method for the protein, fat, fibre and ash content. The NDF, ADF and ADL analyses were caried out with the methode described by Van Soest in Koukolova *et al*. (2004). Samples were selected to cover as large a variation as possible in DM degradability after 24 and 48 h rumen incubation, assuming that this selection would give a similar variation in degradability. Samples had been freeze dried and milled through a 1.5 mm screen before the previous examinations, and since then stored in a deep freezer. Nylon bag degradability (pore size 37 µm) was measured after 24, 48, h incubation according to Hvelplund and Weisbjerg (2000). Measurements were repeated in three dry Holstein cows fitted with a rumen cannula. The cows were fed twice daily, and had free access to drinking water. The feed ration was composed of grass hay (5.4 kg/day) and concentrate mixture (2.6 kg/day). Composition of concentrate mixture (g/kg of mixture) was soyabean meal (100), barley (420), oat (420), rapeseed meal (30) and sugar beet molasses (30). Furthermore, cows were fed granulated minerals (200 g/day) and vitamin mixture (150 g per week).NDF analyses were performed on Fibertec analyser (Fibertec System M), according to the standard procedure mentioned above, but without the pre-treatment with α-amylase. Data were statistically analysed with the STAT ANOVA package.

Results

In many parts of the world, there will be a continuing need to develop simple methods for describing forage quality, which do not rely on sophisticated equipment, but utilise the experience and knowledge of local grassland managers. The content of average results of pasture analysis is presented in Table 1, with the range of dry mater degradation.

Table 1 The average pasture characteristic on the farm.

%	Clover part	grass part	Plants oth.	% of rumen degradability	DM
Intensive	16-22	65-77	11-19	24h..	67-71,5
				48h	76-82,6
Extensive	0-5	45-55	45-50	24h	53-57
				48h	68,5-70,5

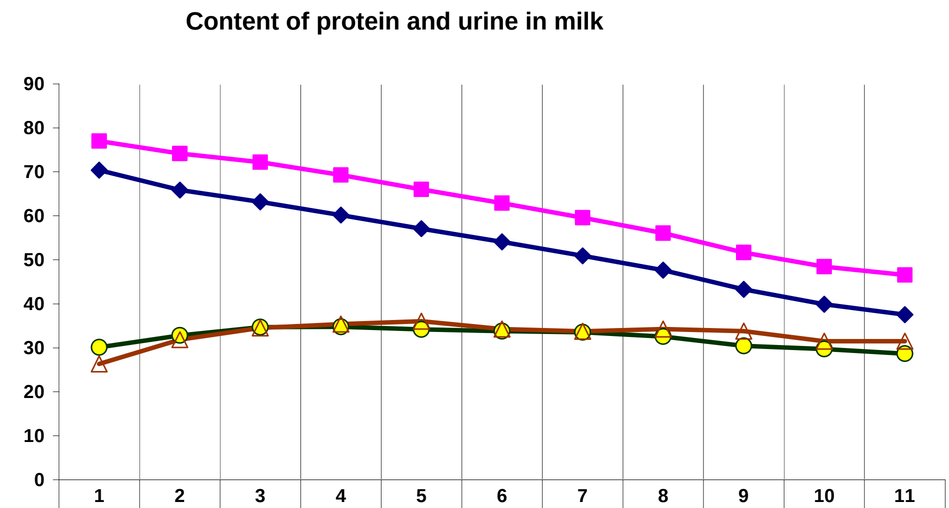
The average content of Nutrients in g of 100% DM

	C.protein	C.fat	C.fibre	NFE	Ash	NDF	ADF	ADL
Intensive	175	26.5	220	493.9	85.6	387	212	26.2
Min.	169	22.2	165	462.1	71.7	321	189	20.1
Max	224	31.5	265	386.9	92.6	485	269	31.6
Extensive	106.3	21.2	265	486.7	61.8	575	349	49.6
Min.	82.8	18.7	245	477.3	56.2	450.8	281	31.8
Max.	146.5	31.6	320	412.4	89.5	591.8	361.9	57.8

These results of some nutrients (fibre, ADF and ADL) were depended for decreasing of clover part and increasing of the other plants. The some results Koukolova *et al* (2004) and Cermak *et.al* (2004)a,b presents (in comparison of pasture intensity utilisation and altitude are depend). By the old pasture withaut fertilise the % of other plants increased.

The urine and protein content of the milk differed in the different pasture seasons, increasing in the early pasture season (Figure 1).

Figure 1 Seasonal changes in milk urine and protein content.



	1	2	3	4	5	6	7	8	9	10	11
breeds 11 prot.tot.	70.4029	65.8472	63.1991	60.1709	57.0947	54.0664	50.9055	47.6674	43.2729	39.877	37.5253
breeds 70 prot.tot.	76.9824	74.1702	72.2275	69.2686	66.0319	62.8987	59.5812	56.0925	51.6498	48.4343	46.5468
breeds 11 urine	30.1213	32.8342	34.6932	34.7655	34.1744	33.7817	33.528	32.5507	30.4556	29.7422	28.6924
breeds 70 urine	26.3399	31.86	34.497	35.4227	36.0359	34.2755	33.7493	34.2754	33.799	31.5075	31.4899

month of control

Note: Holstein-Freesien(11), Czech Red Peed(70), total- protein content in dry matter

The same tendences could be seen when comparing the results from dairy farm data with the average milk company firms analyse data. The some tendency cold see in grafic part of presentation (Cermak *et.al* 2004a). The diference in higher protein content (by 70-Czech Red Peed) are genetic fixed, the milk yield and its componets between the breeds and the season has the some tendency. The casein content of milk by Czech Peed cows averaged at 2,71% (of 3,56 % milk protein), while it was 2,48 % for the Holstein-Feesian cows (3,26 % milk protein respectively).

Conclusions

The present study showed that common laboratory analyses could be used for prediction of both potential degradability of DM for pasture forages, as an addition to chemical and biological method of evaluation. The quality of old pasture decreased with the increasing of other plants then grass and clover parts. There were no statisticaly significant differences in the milk protein values between the breed groups. In the early pasture season the protein content in the milk increased.

Acknowledgements

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Selecting dairy cows for organic farming

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Introduction

Selective breeding could make an important contribution to the development of a healthy and safe organic food production chain. When animals are selected so that they are optimally adapted to the organic farming environment, these animals could be expected to function better under organic conditions. This might be reflected by a reduced disease incidence and a reduction of treatments and medication. The question is whether dairy cattle need to be selected specifically for organic farming conditions and, if so, how selection should be organized.

At present most organic dairy farmers in the Netherlands use breeding stock of the Holstein breed, originating from conventional breeding programmes (Nauta *et al*., 2001). However, the farmers indicated that they have problems keeping their cows in good condition due to the genetic drive for high milk production in these cows (Nauta *et al*., 2001). A poor body condition may result in problems with health and fertility (Berry *et al.*, 2000) which, in return, will have a negative effect on organic farming.

It seems that the farmers did not select the optimal breeding bulls. The selection of these bulls is based on the performance of offspring under conventional circumstances. These circumstances, however, differ substantially from organic farming conditions. This can cause an important effect of genotype environment (GxE) interaction (Falconer and Mackay, 1996). Due to the GxE, it is expected that bulls, with offspring which excel under conventional circumstances, are not necessary the same as those who produce superior offspring for organic farming conditions.

Subsequently, to select bulls that produce animals that are expected to perform optimally under organic farming conditions, farmers need information (estimated breeding values) that apply to the specific organic conditions. For this, information on GxE interactions will be necessary. The importance of GxE interactions can be quantified by estimating the genetic correlation between the same trait measured in different environments (Calus, 2002). A high correlation (0.90 to 1) indicates that a trait measured in different environments is from a genetic point of view the same trait and, therefore, will not result in re-ranking of bulls based on their breeding values. However, low correlations (say lower than 0.9) are expected to result in selecting different bulls, depending upon the production environment. At present, no information on GxE interactions between conventional and organic farming is available.

In this paper we show the first estimates of genetic correlations between conventional and organic dairy production for milk production and somatic cell score (SCS).

Materials and methods

Predicted 305-day lactation records and pedigree information from dairy cattle from converted farms were obtained from the Dutch Herd Book and milk recording organization (NRS). The data was from calvings between January 1990 and March 2004 and a total of 17,389 305-day lactation records of first parity Holstein-Friesian cows could be selected. Records were from before, during and after conversion of 159 organic farms. Data for somatic cell counts was transformed to a somatic cell score (SCS) by a $\log_{10}$ transformation and added to the production records. Not all production records did have a SCS record.

Genetic correlations between milk production traits and somatic cell scores in three environments were estimated:

(1) pre-organic; with data from lactations belonging to calving dates from at least 9 months before conversion to organic,

(2) converting to organic; with data from calvings between 9 months before the conversion till two years after the conversion date and

(3) organic; with data from two years after conversion and onwards.

Summary statistics for the data are presented in Table 1.

Table 1 Summary statistics of milk recording and somatic cell score (SCS) data from 17,389 lactations in 159 dairy herds during pre-organic, conversion and organic phase.

	Pre-organic	converting	organic
Milk yield (kg)			
Number of records	6063	3337	2782
Mean (kg)	6910	6580	6383
SD	927	904	846
SCS			
Number of records	5316	3265	2750
Mean	1.761	1.805	1.862
SD	0.669	0.775	0.764

Correlations were estimated by using ASREML (Gilmour, 1998). Correlations were analysed using the following model:

$$Y_{ijkl} = mu + HYS_j + \beta_1 AFC_{ijkl} + \beta_2 (AFC_{ijkl})^2 + \beta_3 DO_{ijkl} + \beta_4 (DO_{ijkl})^2 + Animal_l + e_{ijkl}$$

(HYS=herd-year-seison, AFC= age at first calving, DO= days open, Animal= the random genetic effect)

Genetic correlations were estimated using multivariate analyses.

Results and discussion

Genetic correlations between the same trait under different environmental conditions and the standard error of the estimates are presented in Table 2.

Table 2 Estimated genetic correlations between milk yield or SCS under different environmental conditions (standard error between brackets).

	Genetic correlations between environments		
	Pre-organic and converting	Pre-organic and organic	converting and organic
Milk yield	0.93	0.86	0.89
	(0.04)	(0.08)	(0.06)
SCS	0.77	0.76	0.98
	(0.01)	(0.11)	(0.06)

The genetic correlations between pre-organic and organic were 0.86 for milk yield and 0.76 for SCS. This suggests that genotype by environment interaction is of importance, and that re-ranking of animals based on their EBV may occur. Especially for the SCS, the correlation is relatively low, and this is already the case right after conversion, between the pre-organic and converting stage, while the correlations for milk production show a more continuous decrease over the different periods. This might be due to the strong effect of the restrictions on the use of antibiotics against mastitis (EU, 1999), which already immediately after the date a farmer has to produce organic milk.

The preliminary results suggest that, especially for udder health, the EBVs derived in conventional environments, may not be entirely reliable. However, standard errors of the estimates were high. Mulder and Bijma (2005) estimated that a correlation of 0.80 between two environments results in 20% less genetic gain for a trait when breeding stock is selected in another environment.

Based on these preliminary results, it is concluded that using breeding bulls from conventional breeding programmes in organic farming might put more pressure on udder health and probably also on other health issues. More research is required to find solutions for selection of cattle and other farm animals for organic farming conditions.

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Organic pork

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Carcass yield and meat quality in organic pig production

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Introduction

According to the Council Regulation (EEC-No 2092/91), organic livestock production is intended to ensure quality production rather than maximising production. Livestock must be reared by using feed from the unit or feed from other units subject to the provisions of the regulation. By way of derogation, for a transitional period expiring on 24 August 2005, the use of a limited proportion of conventional feedstuffs is authorised. The restrictions concerning the import of non-organic feedstuffs have clear consequences for the availability of nutrients, especially in the case of essential amino acids in the nutrition of monogastric animals.

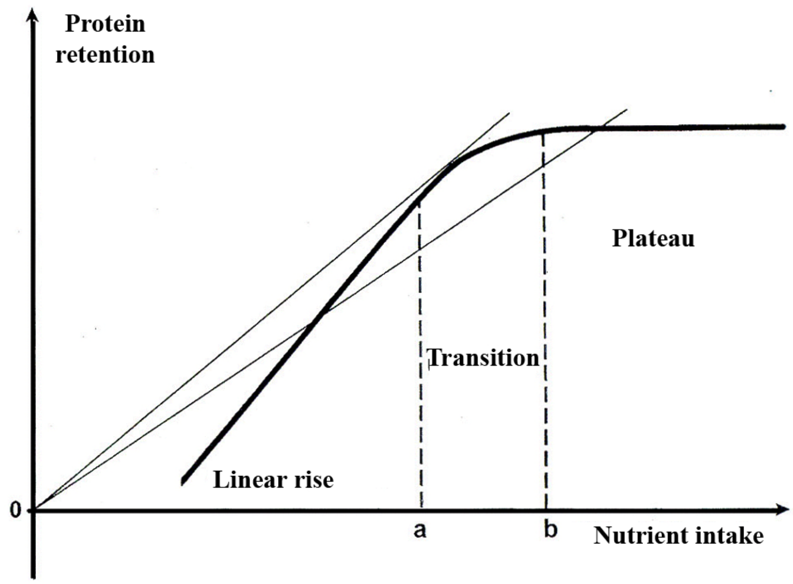
As consumer interest in organically produced meat is growing, there is need to understand the consequences for meat quality of producing pigs to organic standards and to discuss the main factors likely to have an impact on pork quality (Guy and Edwards, 2002). With regard to the expiring of the transitional period, it is of special interest whether the restriction in the use of non-organic feedstuffs is detrimental to the objective of producing organic pork of high quality and whether organic pig farming requires specific management practices to ensure quality production. In this paper, the potential implications of a limited availability of protein sources are described and discussed in relation to carcass yield and traits of meat quality in organic pork production.

Carcass yield

Amino acids are the most important monomers for muscle growth. During the growing period, protein accretion increases as the supply of limited amino acids increases (Heger *et al*., 2002). All amino acids, needed for protein biosynthesis, have to be available in synthesis compatible fashion. Equally, a sufficient energy provision is necessary. If one of the essential amino acids is missing, the protein synthesis comes to a standstill. The extent of protein accretion is thus dependent on a balanced protein and energy provision via feed.

The dose-effect ratio, illustrated in Figure 1, can be subdivided into the nutrition-dependent phase, which is substantially linear, and the plateau phase, which is independent of nutrient supply, and the maximum of which depends on features of the animal, primarily characterised by the genotype (Susenbeth, 2002).

Figure 1 Representation of nutritional effects on the protein retention (Susenbeth, 2002).



The quality of the feed protein in the pigs` diet is a reflection of the amount and the availability of essential amino acids. High quality protein contains all of the essential amino acids at acceptable levels. Poor quality protein is deficient in one or more of the amino acids. Where there is a deficiency of essential amino acids in the diet, the metabolic functions of the pig are compromised, leading to biological inefficiency (Muirhead and Alexander, 1997). If the diet is deficient in one or more of the essential amino acids (lysine is the most likely, followed by methionine), protein synthesis will only continue to the level associated with the first limiting amino acid. The amounts of each amino acid required in the diet are expressed generally as a percentage of the total lysine requirement.

The supply with limited amino acids is not only important for the protein accretion but provides also several side effects on other traits of performance. The relationship between protein accretion and performance traits of fattening pigs is demonstrated in Table 1. According to Susenbeth (2002), already a moderate difference in protein accretion (130 to 150 g/day) goes along with a clear increase in daily live-weight gain, feed expenditure for the increase in live weight (feed conversion) and on muscle growth, while, simultaneously, the fat content decreases only slightly.

Table 1 Relationship between protein accretion and selected performance traits in fattening pigs.

Protein accretion (g/d)	Fat content(g/d)	Daily weight gain (g/d)	Feed conversion (kg/kg)	Muscle growth (g/d)
130	250	840	2,61	330
150	240	920	2,39	380

Body weight: 60 kg; Feed intake: 2.20 kg/d: 13.0 MJ ME/kg; MEm = 0,475 MJ/kg BW ^{0,75}; kpf = 0.7022 % cp in dFFS; 56 % of total body protein in muscle; 1 g CP corr. 2.55 g muscle growth

Source: Susenbeth, 2002

Based on the close relationship between protein accretion and production traits, it is understandable that farmers intend to maximise protein accretion for at least two reasons. A high lean meat content of the carcass is not only honoured by the market but also reduces production costs by a higher feed conversion and a shorter fattening period. In practice, the aim of a high protein accretion is implemented by using genotypes with a high capacity for protein accretion and by increasing the supply of limited amino acids by the way of increasing their concentration in the feed ration.

In organic pig production the use of non-organic high quality protein feedstuffs is limited, limiting the possibilities to increase the concentration of essential amino acids in the feed ration. This is a primary limiting factor to the protein accretion in organic fattening pigs.

Availability of protein sources

In conventional pig production, soybean meal is used world wide as the most important protein source for monogastric animals. It contains a high portion of essential amino acids that are easily digestible. In addition to other high value proteins from the food industry, such as brewers yeast and potato protein, the use of synthetic amino acids plays an important role in the nutrition of conventional fattening pigs.

Under the organic conditions, both conventional soybean meal and synthetic amino acids are banned. Consequently the primary home-grown amino acid source in organic farming is provided by grain legumes (faba beans, peas and lupins). In comparison to soybean meal, the proportion of essential amino acids in home-grown grain legumes is low, especially methionine in lupines, peas and faba beans. The proportion of limiting amino acids of grain legumes and by-products in comparison to soybean are presented in Table 2. Peas are among the poorest in protein, and lupins are the richest of the grain legumes. Faba beans and peas have a relatively high lysine content, but the content of methionine is low as is the digestibility.

Table 2 Crude protein, lysine and methionine content and prececal digestibility of lysine and methionine in different grain legumes and by-products (g/kg, 88 % DM).

Feedstuffs	Crude Protein	Lysine	Prececal digest. Lysine	Methionine	Prececal digest. Methionine
Soybean	352	22.2	18.4* (83)*	5.3	4.3 (82)
Lupin	318	14.7	12.9 (88)	2.2	1.8 (82)
Faba bean	254	16.3	13.4 (82)	2.0	1.3 (66)
Peas	209	15.0	12.2 (81)	2.1	1.6 (74)
Potato Protein	738	58.3	52.5 (90)	16.8	15.3 (91)
Rape-cake	348	19.5	14.4 (74)	7.1	5.8 (81)

* Digestibility in %

Source: Degussa AminoDat 2.0 (2002)

Apart from the crude protein content and the amino acid availability, the maximum inclusion rate of home grown protein sources is influenced by the content of metabolisable energy and fibre, the digestibility and the quantity of anti-nutritive factors (ANF's). There are several varieties of grain legumes with distinct nutrient content. The crude protein content can vary to a high degree, according to variety and conditions of location. This is especially so in the case of lupins. The variation in the crude nutrient content of lupins is shown in Table 3. The yellow sweet lupin has a clear higher crude protein (approx. 439 g/kg DM) than the white (344 g/kg DM) and blue lupin (339 g/kg DM). The lysine content of sweet lupins is high, while the methionine and cystine content is moderate. The huge variation in the nutrient content highlights the inadequacy of information derived from standard feed tables and stresses the need for direct analysis of feed ingredients.

The feed value of sweet lupins, as a feed ingredient, is variable. Lupins, especially the white lupins, have a higher fat content than beans or peas, which have to be considered when a feed ration is formulated. However, the maximum inclusion rate of home grown protein sources is primarily determined by the quantity of ANF's, which can be estimated by taking into account the official variety list, provided that the variety is known. This, in practice, often is not the case. Due to the high variation of the crude nutrient content between varieties and origins of grain legumes, it is of particular importance to analyse their composition before mixing, in order to optimise the feed ration.

Table 3 Crude nutrient content of blue, yellow and white lupins (Mean, Min. and Max.).

		Crude Protein (g/kg DM)	**Crude fat** (g/kg DM)	**Crude fibre** (g/kg DM)	**Stark** (g/kg DM)	**Sugar** (g/kg DM)
Blue Lupins	**Mean**	**339**	**71**	**157**	**78**	**55**
(n = 50)	Min.	277	53	137	52	43
	Max.	399	95	174	111	72
Yellow Lupins	**Mean**	**439**	**70**	**147**	**36**	**70**
(n = 50)	Min.	318	54	122	14	28
	Max.	491	86	191	58	98
White Lupins	**Mean**	**344**	**110**	**139**	**84**	**86**
(n = 50)	Min.	300	86	107	41	70
	Max.	422	153	167	93	117

Source: Sundrum et al., 2005a

With the expiry of the transitional period for purchase of non-organic feedstuffs, the replacement of conventional feed by organically produced commercial feed becomes inevitable. Various cakes (oil produce where the fat has been removed through physical pressure) and milk products are among the currently available organically produced feedstuffs. Ingredients of several protein-rich feedstuffs are presented in Table 4.

Table 4 Contents and digestibility estimates for pigs of protein supplement feedstuffs in relation to conventional soybean meal.

	Soybean meal	Soya full-beans	Soya cake	Rape cake	Sun-flower cake	Flax cake	Non-fat milk powder	Whey powder (de-sugared)
DM	880	880	880	910	910	900	960	960
g CP	451	356	424	300	431	337	350	229
g EE	12	177	68	79	107	89	4	12
MJ ME	13.0	15.5	14.4	12.3	14.0	11.4	15.2	13.4
g Lys	26.8	21.8	25.9	17.0	11.0	11.9	25.9	16.7
g M+C	12.6	10.6	12	13.5	12.4	10.6	11.4	8.2

MJ ME = Mega Joule metabolizable energy, CP = Crude protein, EE = Crude fat, Lys = Lysine, M+C = Methionine + Cystine,

Source: Jeroch et al., 1993; Degussa AminoDat 2.0 (2002)

With regard to the feed value, the contents of digestible lysine and methionine are particularly decisive. There are high contents of lysine and methionine, especially in soya expeller (toasted) and non-fat milk powder. Individual feedstuffs vary in respect of essential amino acids, fat, and energy content. Every feedstuff shows specific advantages and disadvantages, which should be taken adequately into account in formulating the feed ration.

Soya products show a favourable amino acid pattern, which explains its success in conventional feedstuffs. It is expected to provide an increasing use also in organic agriculture. However, soya products have to be toasted before feeding, due to their high ANF content. The soya full bean, in comparison with extracted soybean meal, shows a very high fat content, which limits its possible use. Also, with regard to cake, special attention has to be paid to the fat content. Sunflower cake is a suitable alternative protein source. Although it is deficient in lysine, it is rich in sulphur containing amino acids. This is the case also for rape cake.

Non-fat milk and whey powder are characterized by their high digestibility, which makes them a valuable component, especially in the diet of young stock. With sweet whey powder, there is the risk that the high lactose content may cause problems with regard to storage and will not be properly digested in the small intestine. On the other hand, partially de-sugared whey powder is still useful. However, the possible uses of feedstuffs are not determined exclusively by the value-giving and anti-nutritional contents or taste. Other determining factors are the price and the general availability. Although it may be assumed that increasing demand of protein supplement feedstuffs will lead to sustainable increase in cultivation and processing of corresponding protein sources, there is reason to believe that protein accretion in fattening pigs will be more expensive in organic systems than in conventional ones, due to the higher price for organic feedstuffs of high protein quality.

Sensory quality of pork

Introduction

The trade value of carcasses is principally determined by the muscle meat proportion, slaughter weight and cuts composition on the basis of price labels. Increasing demand for lean pork over the last twenty years in many European countries has produced a situation where the back fat thickness has been reduced by over 50% and the proportion of muscle meat has risen correspondingly (Andresen, 2000). These major changes are the result of a combination of improved genetics and improved nutrient supply.

However, with the increase in the proportion of lean meat in the carcass, the risks for meat quality deficiencies have increased. In a survey of Doedt (1997), pigs with a high lean meat content significantly produced more 'PSE-meat' (pale, soft and exudative) than pigs with lower lean meat content. A total of 22% of the animals, whose proportion of lean meat was above 58%, were categorized as 'PSE-suspect' or 'PSE-meat'. In contrast, the proportion of 'PSE-meat' in pigs with a lean meat content between 50% and 52% was 13.5%. Additionally, the high estimated ham formation in variety assessment was negatively correlated with the appearance of 'PSE- meat' as a consequence of the related muscle hypertrophy.

With the increase of lean meat content in the carcass, the proportion of intramuscular fat (IMF) decreases (Schwörer *et al*., 1994; Kirchheim *et al*., 1996). While the taste of meat is largely determined by criteria of tenderness, juiciness and flavour, intramuscular fat content is decisive for all three criteria (Kallweit & Baulain, 1995; Claus, 1996). In particular, the genus criterion 'flavour' is linked to fat, because this serves partly as a carrier for fat-solvent flavour materials. The full flavour emerges only in the preparation as a result of chemical reactions between fatty acids and other meat components, while low-fat muscle meat is almost taste-neutral. Only the finely distributed fat in the muscle, recognizable in higher contents as marbling, makes a taste differentiation between animal varieties possible. The IMF content, optimal for taste in the *M. longissimus* (muscle part with the lowest IMF content), should range between 2.5 % and 3.0 % (Bejerholm & Barton-Gade; 1986; Fernandez *et al*., 1999). Modern slaughter pigs show an average IMF content of only 1% (Doedt, 1997; Köhler *et al*., 1999). The development in the carcass composition over the last decades demonstrates a clear property antagonism between quantity traits and taste value of pork (Kallweit & Baulain, 1995; Köhler *et al.,* 1999).

Approach to improve sensorial quality

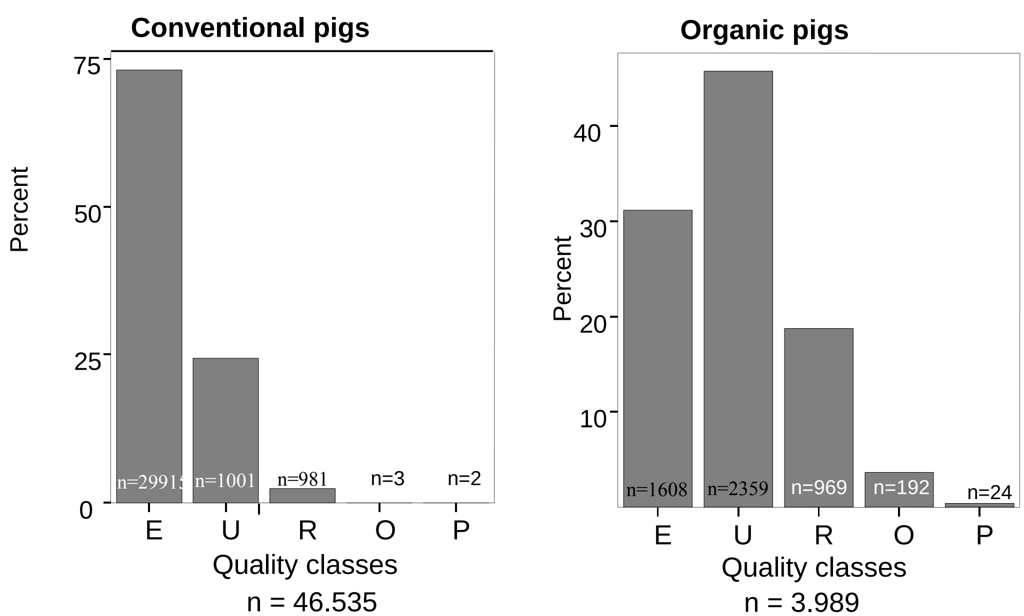
In order to estimate the possibilities to improve the quality of organic pork by different feeding strategies, several feeding trials have been carried out. Results from a first trial in 1999 showed that diets based on organic cereals and home grown grain legumes (faba beans, peas and lupines) have the potential to produce pork with a high intramuscular fat content (IMF); this being a relevant but not the only factor effecting the sensorial quality of pork (Sundrum et al., 2000a). Pork derived from different feeding treatments and characterised by a high IMF content (> 2,9%) was preferred by an expert panel compared to pork with a low IMF content (Fischer, 2000). The results of further investigations confirmed that specific diets have the potential to increase the IMF content of pork without increasing the back-fat thickness of the carcass (Sundrum et al., 2005b). These results give suggest that an unbalanced relation between essential and non limited amino acids could provoke the de-novo-synthesis of fatty acids in the muscle cell, while the fat is stored within the muscle cell.

However, the production of meat with a high intramuscular fat content has its price. Negative correlations between IMF content and lean meat percentage, muscle area as well as live-weight gain highlight the antagonistic relationship between quantity and quality. The previous results do not necessarily lead to a simple solution as to how to increase carcass quality (Sundrum et al., 2000b). In addition to the IMF content, there are various other aspects that have to be taken into account.

On-farm situation in organic pork production

Currently, there are only few studies available on the carcass yield and pigmeat quality under in organic livestock production (Danielson et al., 1999; Jonsäll et al, 2002). In Germany, an investigation was carried out in 2003/04 on 21 organic pig farms (Sundrum & Ebke, 2004). The results of the assessment of carcass yield derived from organic and conventional farms and rated with the EUROP-System are presented in Figure 2.

Figure 2 Distribution of quality classes of carcass from organic and conventional fattened pigs in Germany (Sundrum & Ebke, 2004).



A total of 30% of the assessed carcasses of organic pigs were classified as ‘E’, 46 % as ‘U’, 19 % as ‘R’, 4 % as ‘O’ and 1 % as ‘P’. In comparison, nearly 68 % of the conventional reared pigs slaughtered at the same abattoir were categorized in class ‘E’. The variation in lean meat percentage was significantly higher in organic production than in conventionally fattened pigs. The average intramuscular fat content of organic carcass was at 1.53 %, with a variation between 0.77 % and 2.73, as mean values of the farms. Nearly all organic carcasses (95.4 %) reached a pH_1 in the muscle tissue of over 6.0.

The results indicate that most of the assessed carcasses of organic pigs did not meet the high demands in relation to carcass yield and meat quality and in relation to the intramuscular fat content. Especially the huge variation of quality traits between the farms are a challenge for the organic market. The results are similar to those published by Jonsäll *et al.* (2002), who found organic pork quality to be inferior compared to conventionally reared pork. Pork loins were found to be less juicy and gave higher scores for crumbliness when tested by a trained taste panel, although no explanation was given for the cause of these differences.

Conclusions

Currently, there are only few data available on the specific implications of organicrearing of pigs on carcass yield and meat quality. From the existing data, however, it can be concluded that organic rearing conditions do not appear to have a distinct impact on pork quality, but reconcile a huge diversity concerning genotypes, feeding strategies and environmental conditions within countries or regions and even between farms in the same region. Due to the prominent impact of interactions between genotype and feeding strategies on carcass yield and quality of pork and with regard to the huge variation of interactions within organic pig production, market and consumer expectations of high and uniform quality traits of organic pork do not appear to be met. Insufficient feedback from the market and missing quality control schemes are jointly responsible for existing deficits and offer options to improve the current situation.

However, organic pig production conditions do not prevent high quality production. Organic diets, based on corn legumes, have the potential to produce pork with a high intramuscular fat content: a precondition of a high sensorial quality. The production of pork of high quality is a challenge to the farm management and requires high management skills. It is suggested that these are, in fact, a more important factor than the availability of high quality protein feedstuffs. The high variation in the availability of feed resources, in feed intake, in digestibility and utilization of amino acids between farms and the variation in protein accretion between genotypes highlight the need for the development of advisory tools and recommendations that are closely related to the specific situation of an individual farm.

Due to the higher production costs, and due to the conflict of aim between quantity and quality traits, there is need for the development of a specific organic premium line of production. The willingness of consumers to pay premium prices for organic products offers an opportunity to develop such a premium line, in combination with high process qualities in relation to animal welfare and environmentally friendly production. The most important requirement, however, is to remunerate the performance of the farmer, in order to guarantee the high quality standards offered to the consumer. In order to compensate for the lower productivity in organic compared to conventional pig production, quality production in organic agriculture is a *conditio sine qua none*. Following the principle that feed is intended to ensure quality production, rather than maximizing (EC Council-Regulation) the restricted availability of non-organic feedstuffs, fits to the objective of a high sensorial quality of pork, by preventing producers from focussing primarily on quantity traits and by provoking a more quality oriented production.

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Salmonella infection risk associated with outdoor organic pig production

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Introduction

Salmonella enterica bacteria are important causal agents of human enteritis throughout the world. The number of human cases in Denmark was 32 per 100,000 inhabitants in 2003, of which pork constitutes 10-13.7% (Anon. 2003). The host-adapted serotype *S. Choleraesuis* that causes systemic disease in pigs (salmonellosis) and may have severe economic consequences for pig producers has not been isolated from Danish pigs for several decades. Thus, *Salmonella* infections in Danish herds are predominantly subclinical, with the most frequent serotypes being *Salmonella* Typhimurium, *S.* Derby and *S.* Infantis (Popoff & Le Minor, 1997; Anon, 2003). However, clinical outbreaks occasionally occur.

There are nearly 300 registered organic pig herds in Denmark and the production of organic slaughter pigs is approximately 70,000 pigs per year. This constitutes a very small part of the total Danish production of ca. 22.5 millions pigs per year (Anon, 2003; Anon, 2004). An important difference between conventional and organic pig production is the requirement for access to outdoor areas. This implies an increased exposure to microbiological agents, such as *Salmonella* that may persist in the environment or is transmitted through wildlife. However, there are only limited data available on the *Salmonella* status in organic pig herds. As many of the organic pig farms produce less than 200 pigs per year, they are not included in the Danish national surveillance programme, which monitors the *Salmonella* seroprevalence in pigs (meat-juice) at slaughter **(**Nielsen *et al.* 1995; Mousing *et al.* 1997; Alban *et al.* 2002**)**.

A comparison of the *Salmonella*-seroprevalence in Danish organic, free-range, conventional and breeding pig herds (Wingstrand *et al*. 1999) showed that the risk of meat juice samples being seropositive was higher for organic and free-range than for conventional herds. The overall *Salmonella* prevalence in Danish slaughter-pig herds was 3.3% in 2003 (Anon, 2003). The difference to conventional herds was statistically significant for the free-range herds but, due to a limited number of samples, not significant for the organic ones. Similar results were obtained in a Dutch study where the *Salmonella* seroprevalence was statistically higher in free-range than in intensively housed finishers (Wolf *et al*. 2001).

The mainly subclinal *Salmonella* infections in pigs are probably of little significance for the welfare of pigs. However, the potential transfer of *Salmonella* to humans through the food chain implies a food safety risk and does not comply with the consumers' expectations of a better quality of organic products. Information about the time of *Salmonella* colonization, its duration and the level of infection in individual animals, would help to understand the infection dynamics in herds and, thus, the potential *Salmonella* contamination risk at the time of slaughter. Little is known about the effect of organic rearing with respect to infection susceptibility. The late weaning, the organic feed including roughage and the lower animal density may have beneficial effects on the degree of *Salmonella* infections in organic pigs.

The aim of the current study was to examine the *Salmonella* infection dynamics in organic pigs through an outdoor experimental set-up. Non-infected tracer pigs were grouped with artificially infected pigs to determine the transmission of *Salmonella* between animals. The establishment of a *Salmonella* contaminated pasture environment was studied, including its ability to infect new tracer pigs introduced into the pasture.

Methods

Experimental design

Six experimental outdoor pastures were set up on a three-year-old mixture of grass and clover, not previously grazed (research animal facility). The pastures (50 m^2 per pig) were enclosed with electric fence and placed 2 m apart to avoid direct contact between animals. In each pasture, the pigs had free access to an insulated house (straw bedding), drinking nipples for water, a wallowing area and a feed dispenser.

In three successive experiments, a total of 3×56 organic weaning pigs (*Salmonella*-free) with an average weight of 16.9 ±4.0 kg, 12.7 ±2.4 kg and 20.6 ±3.9 kg, respectively, were distributed into the six pastures. Four paddocks each with 10 pigs were used for *Salmonella* infection experiments and two paddocks each with 8 pigs served as *Salmonella*-negative control paddocks. Each of the three experimental periods lasted for six weeks and was carried out from late April to the beginning of September 2003. The pigs were fed *ad libitum* with pelleted organic feed and pea/barley silage as roughage.

Salmonella infection study

Three pigs in each pasture, except the negative controls, were artificially infected with a *Salmonella enterica* serotype Typhimurium DT12, rifampicin^{res} inoculum strain in a dose of either 7.4 x 10^7 (low dose, n=2) or 3.2 x 10^9 (high dose, n=2 first period, n=3 third period) cells (see Figure 1). The *Salmonella* inoculum strain applied in the third period was further selected for naldixic acid resistance to allow differentiation between *Salmonella* potentially surviving from the previous periods. Rectal fecal samples were collected once per week starting three days after inoculation and tested (5g) for *Salmonella* by bacteriological standard culturing methods. A semi-quantitative approach was applied with a 100-fold dilution of the samples (10^{-1}, 10^{-3}, 10^{-5}, 10^{-7}) to assess the *Salmonella* excretion levels in the pigs (Baggesen *et al.* 1999).

Survival of Salmonella in pasture environment

To study the non-host survival of *Salmonella* in the pasture environment, one water and six surface soil samples were colleted at seven different locations in each pasture once per week. The samples were tested (25g) for *Salmonella* by bacteriological (qualitative) culturing methods. Sampling of the pasture environment continued seven weeks after removal of the last pigs.

Figure 1 Experimental design; distribution of tracer pigs in six pastures (A-F) in three successive periods each of six weeks.

	Number of tracerpigs in pastures A-F						
Experiment	A[a]	B[a]	C	D	E	F	Time
Transmission of *Salmonella* from inoculated pigs	8	8	7[b]	7[b]	7[c]	7[c]	1st period (April-June)
Infectivity of *Salmonella*-contaminated environment?	8	8	10	10	10	10	2nd period (June-July)
Infectivity of *Salmonella*-contaminated environment?						8	3rd period (July-August)
Transmission of *Salmonella* from inoculated pigs	8	8	5[c]	6[c]	7[c]		

[a] *Salmonella*-negative control pigs
[b] Additionally 3 pigs inoculated with 10^7 *Salmonella* cells (low dose)
[c] Additionally 3 pigs inoculated with 10^9 cells (high dose)

Results and discussion

Transmission of Salmonella between pigs

In the current study, it was attempted to imitate *Salmonella* infections by artificial inoculation of one third of the pigs in each group with *Salmonella* Typhimurim, as described previously (Baggesen *et al.* 1999). This should allow a natural acquirement of *Salmonella* infection in the remaining non-infected tracer pigs and show the infection dynamics of outdoor pigs. Not all of the inoculated pigs were *Salmonella*-positive 3 days after sampling and three pigs remained *Salmonella*-negative throughout the study despite the challenge with *Salmonella* cells. However, this does not differ markedly from inoculation studies on conventional pigs (Nielsen *et al.* 1995; Baggesen *et al.* 1999). Furthermore, sub-clinically infected pigs can become latent carriers or intermittent shedders, which is indistinguishable from low-level shedding below the bacteriological detection level (Baggesen and Wegener, 1993).

In general, the organic pigs' susceptibility towards infection varied considerably in both inoculated and non-inoculated animals. There was no clear relation between the applied infection doses and the number of *Salmonella*-positive pigs. Both the frequency of *Salmonella*-positive animals and the number of times *Salmonella* was isolated from each pig during the 6 weeks varied between the seven inoculation experiments. The prevalence of *Salmonella*-positive tracer pigs increased over time, from approximately 20% within the first four weeks to 40% in the sixth week. Only a single tracer pig became *Salmonella*-positive in one of the inoculation experiments (high dose), whereas all seven tracer pigs were *Salmonella*-positive in another pasture (F) in the fifth and sixth week. This high infection rate coincided with a high level of *Salmonella* excretion in the inoculated pigs, including a pig that developed clinical symptoms of salmonellosis and was eliminated after four weeks.

Overall, *Salmonella* could be isolated at least once from 56% of the tracer pigs (n=46) placed together with the inoculated pigs, but *Salmonella* was isolated less than 3 times during the six weeks in 35% of the pigs. This low and intermittent excretion seemed similar to a Danish longitudinal study on conventional pigs (Kranker *et al.* 2003). Thus, the outdoor organic pigs were receptive to infection by *Salmonella*. Although, most pigs including the inoculated pigs only shed a low number of *Salmonella* cells (83% of samples <100 cells g^{-1}).

Potential benefits of reduced animal density and late weaning in organically reared pigs did not seem to prevent transmission of *Salmonella* to the *Salmonella*-free tracer pigs. This is not surprising, as the pigs still have close contacts e.g. in the hut and their rooting behavior implies a high risk of ingesting *Salmonella* from the contaminated environment (Fedorka-Gray *et al*. 2000). Another important factor for establishment of *Salmonella* infections could be the diet of the pigs. Studies of conventional pig production have shown that the diet strongly influences the development of a healthy bacterial community able to prevent proliferating of pathogens through antagonistic activities like competitive exclusion and colonization resistance (Hansen 2004; Jørgensen *et al.*¸1999; Mikkelsen *et al*. 2003; Naughton *et al.* 2001; Nisbet 2002; Pedersen *et al.* 2000).

Survival of Salmonella in the pasture environment

Salmonella was found widespread in the pasture environment after the artificial infection of pigs, as an average of 46% of the total number of soil/water samples (n=294) were positive over the six weeks. The samples were only assessed qualitatively, but the contamination level tended to be higher (more positive samples) when the high inoculum dose had been used.

This tendency was also seen in the second period where only few *Salmonella*-positive environmental samples were found in the two 'low dose' pastures, whereas a high number of *Salmonella*-positive samples were detected in the two 'high dose' pastures. Since no *Salmonella* cells were applied in the second period, the isolated *Salmonella* must have survived from the first period in the non-host environment or through re-ingestion into the new pigs. Furthermore, *Salmonella* was detected in soil samples for up to five weeks and for seven weeks in the huts after the removal of the last pigs in the autumn. This implies the requirement of good hygiene management practices to avoid persistent *Salmonella* contaminations. Since many of the normal measures to prevent and control *Salmonella* in indoor systems would not apply in outdoor organic systems, the prevention of *Salmonella* introduction in the first place seems preferable (Anon. 2000; Fedorka-Gray *et al*. 2000).

The frequent isolation of *Salmonella* in the environment indicated the ability of *Salmonella* to survive outside the host, which has been suggested to be an adaptation to ensure passage to the next host (Winfield &Groisman, 2003). However, the survival time may vary considerable under different physical and chemical conditions, including soil texture, pH, humidity, depth in soil column and exposure to UV-light and may range from a few days to years (Mitscherlich and Marth 1984; Baloda *et al.* 2001; Guo *et al.* 2002; Natvig *et al.* 2002; Placha *et al.* 2001; Purvis *et al.* 2002; Bicudo and Goyal 2003; Hutchinson *et al.* 2004; Nicholson *et al*. 2005).

Infectivity of the Salmonella contaminated pastures

The infectivity of the contaminated pastures was assessed by introduction of new *Salmonella*-free pigs in the second period. One of the pastures, with a low *Salmonella* contamination level, resulted in two *Salmonella*-positive pigs, while no *Salmonella*-positive pigs were found in one of the two pastures with a high contamination level, even though *Salmonella* could be isolated from almost half of all the environmental samples. These results probably reflect the pigs' variable susceptibility to *Salmonella* infections that is influenced by factors such as the general health status of the pig. In the other highly contaminated pasture, all pigs turned *Salmonella*-positive at least once and this coincided with the clinically infected (salmonellosis) pig in the first period. The high level of *Salmonella* excretion in this pig had probably led to a heavy contamination of its pasture environment.

A quantitative risk assessment of the *Salmonella* infection risk in outdoor organic pigs indicates that the mere presence of *Salmonella* may not pose a big infection risk, but that the level of contamination seems more important. This also indicates the importance of eliminating pigs with signs of *Salmonella* infections as soon as possible, as these animals probably contribute significantly to the persistence of infections. Furthermore, infected animals may serve as vehicles for spread to other animals or surroundings, and such reservoirs of *Salmonella* should be limited to reduce long-term persistence and potential recurrent *Salmonella* problems in the herd under some favourable but uncertain circumstances.

Several investigations have demonstrated that *Salmonella* infections on conventional pig farms are able to persist for several months or even years (Baggesen *et al.* 2000; Sandvang *et al.* 2000; Baloda *et* al. 2001; Davies & McLaren, 2001). Even though it is difficult to differentiate persistence in pigs caused by sub-clinically infected animals from infection by contaminated environment, isolations of *Salmonella* from soil, slurry, manure and equipment indicated that a contaminated environment might constitute a risk of infection.

When new *Salmonella*-free pigs were introduced into the highly infected pasture (F) in the third period, only two out of eight pigs were tested *Salmonella*-positive on three occasions, although *Salmonella* was still found in more than half of the examined environmental samples. A possible explanation is that, although *Salmonella* still were cultivable *in vitro,* the cells may have lost or attenuated their virulence factors important for their ability to infect pigs (Lesne *et al.* 2000; Mouslim *et al.* 2002).

Isolation of 'exotic' Salmonella serotypes

Besides the *Salmonella* Typhimurium DT12 Rifampicin/Naldixic acid^{res} inoculum strain, an unexpected high diversity of *Salmonella* serotypes was found, with a total of 14 different *Salmonella enterica* serotypes and 6 different definitive *S.* Typhimurium phage types (Jensen *et al.* 2004). The serotypes included *S.* Uganda and *S*. Goldcoast that are not normally isolated from pigs. The *Salmonella* serotypes were isolated from either the environment (n=40) or pigs (n=23) in all pastures including the *Salmonella*-negative control pastures, with exception of the pasture with the high infection rate (F).

Feedstuff has been pointed to as a potential source for the introduction of exotic *Salmonella* serotypes. However, in Denmark, the occurrence of *Salmonella* in compound pig feed is rare (Anon, 2002). *Salmonella* bacteria have a wide host-range that may imply an increased exposure of outdoor pigs to *Salmonella* from the surrounding environment. However, no *Salmonella* was found in a small-scale wildlife survey of 22 rats, mice and shrews and 22 birds, (Jensen *et al.* 2004). Thus, the source of these types was not readily identified and neither their significance, but indicated that the outdoor environment is harder to control with respect to pathogen occurrences. Since all *Salmonella* serotypes are potential pathogens, especially for immunodepressed individuals, their presence may play a potential role in food safety.

Conclusions

The experiments showed a possible transfer of *Salmonella* bacteria from artificially infected organic pigs to non-infected organic weaning pigs kept on outdoor pastures, but the shedding of bacteria was mainly low and intermittent. *Salmonella* was able to survive in the pasture environment and infect newly introduced pigs under certain circumstances. A high level of *Salmonella* contamination in the environment seemed to promote infections and it is recommended that infected pigs are eliminated early to minimize the spread and persistence of *Salmonella* infections in the herd.

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East Balkan Swine in Bulgaria – an option for organic production

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Introduction

One of the characteristics of organic farming is the conservation of domestic, endogenous livestock breeds and strains. For a successful development of the organic pig sector in Southern Europe, the animals must be well adapted domestic breeds, as they are exposed to extreme weather conditions in the free range systems required by the EC Regulation No 1804/1999 (CEC, 1999). Van Putten (2000) proposed the use of small coloured breeds with large snouts in organic pig production.

Old domestic breeds are also a part of the inheritance of a country, and should be considered valuable for this reason. Data from the Bulgarian Ministry of Environment and Waters show that, as a result of human activity in the last few decades, six aboriginal breeds of livestock in Bulgaria have disappeared. Such losses do not reflect sustainable development of livestock breeding and good management of genetic resources.

Traditionally reared, old Bulgarian breeds are well adapted to domestic conditions and are resistant to diseases. For this important reason, they are preferred in organic farming, in which the use of medicines is limited. In Bulgaria, the East-Balkan pig is well-adapted to climatic conditions of continental climate and uses the natural, local food resources effectively.

Characteristic and spread of the East Balkan Swine

The East Balkan Swine (EBS) is the only original Bulgarian pig breed that has preserved its genetic characteristics. It is well-adapted to extreme conditions, has a robust constitution and strong heard instinct, good longevity, disease resistance and produces meat of very high quality and taste. The breed has been formed mainly by natural selection, with very low intervention by man.

EBS was spread in the region of Western cost of Black sea more than 2,500 years ago. Now natural area of its spread is East Balkan mountain and Strandja Mountain. Hill areas, covered by oak and beech forests, characterize East Balkans. It is difficult to access these areas, the population is rear and there is no developed infrastructure. For years, EBS rearing has been part of the subsistence economy of the local people of these regions were annual rainfall is high, the climate is mild and the soils are poor, with weak water retention ability.

In both regions there are suitable conditions for all year round pasturing of livestock. Basic fodder source in Stranja region are natural meadows and pastures. There are 58,000 ha of common grazing and 87,200 ha of forest areas where grazing is allowed (Stoewa and Lindgorski, in press). Low nutrition value of the grasses from the natural pastures leads to prolonged fattening periods.

Existing data on performance

There is little information on the characteristic of EBS. First data for fattening and slaughter quality and quality of the meat were given by Chlebarov (1922), who reported on slaughter qualities of 2.5-3-year old pigs that produced carcasses with very high fat content. Georgiev *et al.* (1959) reported the following results: the starting weight of 60 kg to 81,3 kg; average daily gain of 341 g, from 81.3 till 95.5: 325 g, for the whole fattening period 333g. Slaughter output was 77.6%, meat with bones 57.3% and fat percentage of 42.7%. The authors concluded, that to feed the EBS with concentrates only would not be profitable.

Benkov (1962) and Georgiev and Benkov (1964a, 1964b) carried out crossing of EBS with boars from Manhgalica, Bulgarian White, Berkshire and Coloured German Swine. The crossings with Bulgarian White produced 38% higher average daily gain and 2.46% higher slaughter output than the pure breed.

Slanev et al., 1992, Slanev et al., 1993, Stefanova, 1993 and Stoykov, 1992 have shown that the highest average daily gain for the whole period of fattening was reached by EBS males (417 g), followed by mixed groups (380 g). The lowest average daily gain was recorded in females (371 g). The corresponding fattening periods were 170, 184 and 188 days. For the whole fattening period FCR for 1 kg of grain was 5.4 to 6.1 food units.

There are very limited current data on the meat quality from the EBS. It has been suggested that the EBS produces meat with differing dietetic values from the modern pig. There is, however, a need to carry out research to establish these values.

Organic farming of EBS

There are potentially good conditions for organic rearing of EBS in Bulgaria. These are:

- extensive grazing in the forests is still a common practice in Bulgaria;
- the breed is well-suited to these conditions;
- natural geographical and climatic conditions are very suitable for development of organic farming;
- there has been a very limited use of pesticides and fertilisers during last decade in Bulgaria;
- harmonisation of local regulations and labelling standards with those of the EU has established a level playing fields and clear goal posts for production;
- there are many farmers, who would like to produce meet with high quality under organic standards; and
- the low inputs required would suit the economic conditions of the regions.

General requirements of organic farming will be easily fulfilled in EBS rearing, as, e.g. the minimum weaning age of piglets for EBS is well above the organic requirement of 40 days. The feed will come virtually entirely from local natural meadows and pastures, and forest fruits, such as oak and beechnuts. Only in the end of fattening period maize is used. The condition of access to roughage or rooting material is maintained in the natural environment. Access to free range is virtually continuous, apart from the most cold winter months. Indoor housing is practiced only for ferrowing sows in the period of giving birth, in special sheltered wooden huts, provided with straw. Use of drugs is restricted, as the breed is disease resistant and low inputs are a characteristic of the system. Only one obligatory vaccine is used currently, but this will be phased out in 2005, as the region will prevent the contact with wild pigs. No tail docking and teeth clipping (or grinding) has been practiced in EBS rearing systems.

Conditions of success and possible obstacles

One of the basic conditions for successful organic rearing of the EBS is to register the existing animals, in order to establish the number of farms/herds and the number of breeding animals in each herd. While this may prove difficult due to the reluctance of many breeders to register for taxation reasons, there is a need to establish education and co-operation channels between the existing EBS breeders, in order to preserve the breed. There is an increasing public interest in this breed, as a possible source of organic pork. This interest should be harnessed to create better returns and increased marketing opportunities for the breeders. There is an on-going research programme (SAPARD, Measure 1.3. Organic breeding of EBS) that will potentially create new opportunities, including exports of organic EBS pork products.

A major obstacle for the development of organic breeding of the EBS is a lack of direct governmental support for the period of conversion from conventional to organic pig production, as well as for marketing and certification. Also, there is a lack of knowledge and know-how among farmers with regard to organic standards and techniques. Finally, there is a potentially a difficulty to establish local markets for EBS products in Bulgaria where local incomes are low and the consumers are unlikely to have a lot of interest in premium products. Therefore, western markets appear the main initial outlet for EBS products. However, in order to open up these markets, the certification bodies in different countries need to be aware of the potential from EBS production in Bulgaria.

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Organic poultry production

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Enhanced biodiversity and the perceived risk to food safety: *Campylobacter* and poultry

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Introduction

Organic farming is well documented (Hole *et al*., 2005), and accepted by the UK government, as having a beneficial impact on the environment (Costigan *et al*., 2003). It has been accepted by the most progressive organic farmers that biodiversity has benefits to the production system and that management of both should, as far as possible, be complementary. This holistic approach is regarded as one of the strengths of good organic farming.

This benefit, however, can be perceived to be combined with a risk to food safety. It is suggested that, as the biodiversity and biomass of wild animals and birds increase, the risk of these creatures introducing and transmitting food borne pathogens to farm animals, and then into the human food chain, is increased. Of particular concern are salmonellas, *E. coli* and *Campylobacter* species.

Campylobacter is the most common cause of gastroenteritis in the United States, (Altekruse *et al*., 1999, Bryan and Doyle, 1995), the UK (Anon, 2003, Frost, 2000) and worldwide, especially in developed countries (Bates *et al*., 2004, Charlett *et al*., 2003, Tam *et al*., 2003b, and Saleha *et al*., 1998). Its route of transmission to humans is varied, but it is most commonly cited as being through the ingestion of raw or undercooked poultry meat and milk, as it is found on poultry meat and in un-pasteurised milk. The infection can also be acquired through pets, wild animals, directly from farm animals and from water sources (Javid and Ahmed, 2002).

Campylobacter jejuni has been identified as the predominant cause of campylobacter related gastroenteritis (Tam *et al*., 2003a), but *C.coli* (Anon, 2003, Tam *et al*., 2003b). Other species and their sub-types, such as *C. lari* (Newell, 2000), *C. upsaliensis*, *C. fetus* and *C. hyointestinalis* (Javid and Ahmed, 2002) can also be responsible for human gastroenteritis. Alongside the risk to humans from gastroenteritis, *C. jejuni* infection can result in a Guillan-Barre syndrome: a rare but serious condition (Nachamkin *et al*., 1998, and Tam *et al*., 2003a).

It has been suggested that organic poultry are at particular risk from *Campylobacter* as they are more likely to pick up the pathogen from the environment, than flocks in conventional housing systems (Engvall, 2001, Heuer *et al*., 2001, and Humphrey 2002). Some research has suggested that free-range poultry products (Atterbury *et al*., 2003) are also more likely to harbor campylobacter than conventional or standard products. One study in particular suggests over 50% flock infection in conventional flocks and 80% flock infection in free-range broilers (Avrain *et al*., 2003). However it is currently far from clear whether increasing biodiversity, as occurs in organic farming, does in fact increase the risk or presence of campylobacter within these systems.

There have been proposals of how to overcome this perceived risk to food safety. In particular, it has been proposed that poultry flocks should be kept free of pathogens. To achieve this, poultry would have to be either kept permanently housed or isolated from sources of contamination, such as wild birds.

These proposals run counter to the principles of organic production and would prohibit the production of organic poultry. There are also animal health and welfare issues of raising poultry within fully housed systems. Such systems could also have a detrimental impact on the, currently positive, public perception of the interface between conservation, increasing biodiversity and organic farming. Currently there is little evidence as to risk to food safety and organic bio-diverse systems relative to other risk sources. There is, therefore, a strong case to "get a handle" on this issue and gather more information to evaluate the risk.

Aims and objectives of current study

The current study is aimed at carrying out a preliminary investigation to establish whether, and if so how, when and where, campylobacter enters the poultry system on organic farms and whether this can be associated with the increased biodiversity of the system.

Methodology

Location

A UK based organic farm was the site for this preliminary investigation. This farm has an active policy of biodiversity enhancement, including significant efforts to increase the wild bird population.

Test sites

The presence of campylobacter through the production cycle, in the birds themselves and their environment, and around the range was investigated. In addition to this, the general farm environment was investigated for the presence of campylobacter. This included various areas or 'sites' on the farm that could potentially transmit the campylobacter pathogen to the poultry. These were generally areas of the farm with different activities and levels of biodiversity, with particular attention to 'areas' close to or relevant to the poultry enterprise. Broadly, these areas covered poultry sites, biodiversity 'hotspots', other livestock, and aspects of poultry management, including vehicles used to service the poultry system and poultry stock team.

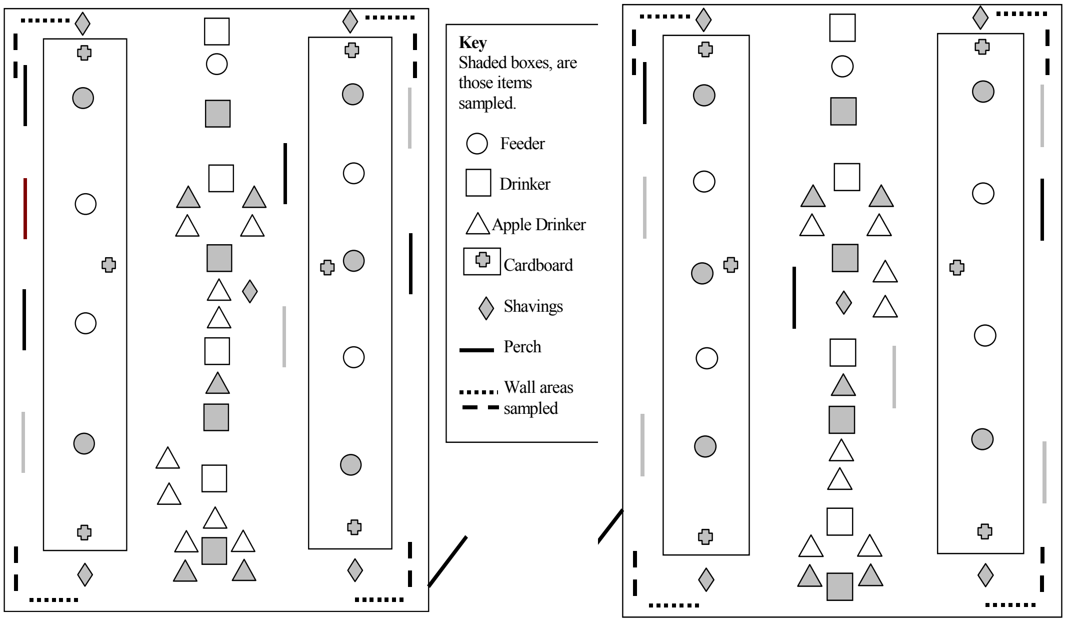
Production tests – batch of birds

One batch of birds was followed through its production cycle. This was planned to be for a ten-week period. However, after early positive campylobacter results, subsequent testing was viewed to be unnecessary. Samples taken for this batch of birds included both faecal from the birds themselves and samples from the shed environment.

Environmental swab samples were obtained from the prepared brooder sheds before the arrival of the day-old birds. These included, samples from the shed furniture (perches 1 swab, walls 2 swabs, shavings 1 swab, and cardboard 1 swab), and from the feeders and drinkers (feeders 1 swab, feed 1 swab, drinker 1 swab, apple drinker 1 swab). Shed furniture swabs for each brooder shed were combined and analysed on one plate; as were all feeder and drinker swabs (see Figures 1a and b, for brooder layout and sample sites). In addition, environmental swabs were obtained from chick crates in which the birds arrived.

Figure 1a. Brooder five set up and tests out

Figure 1b. Brooder six set up and tests carried

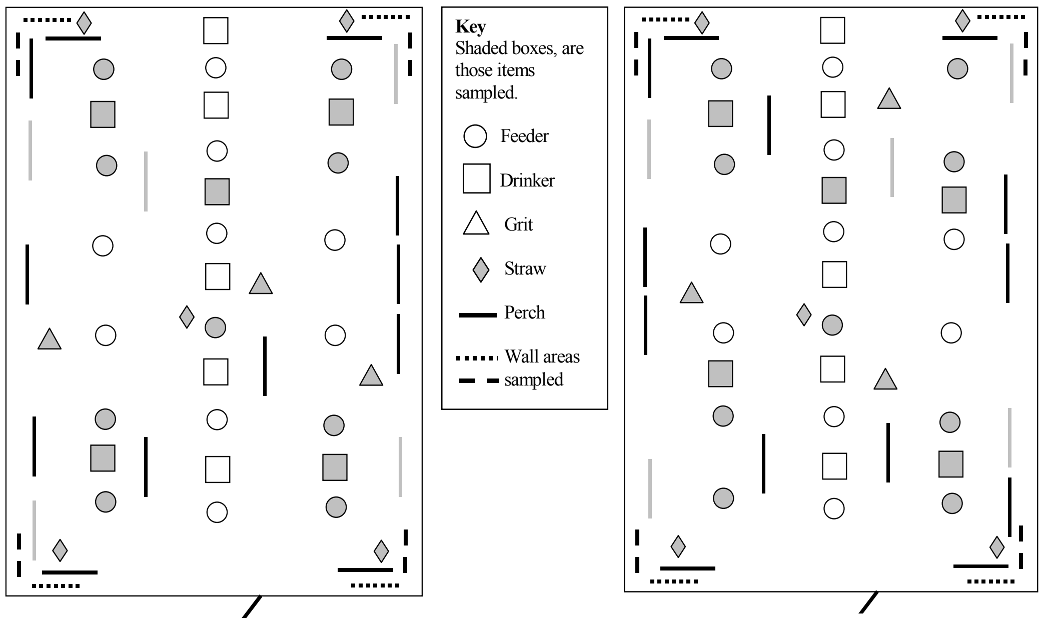


Faecal samples were obtained from a sample of birds from each brooder, and analysed on week one, day one and week two, day eight.

Environmental swab samples were obtained from the prepared field sheds before the transfer of the birds to the field environment. Once again these included samples from the shed furniture (perches 1 swab, walls 2 swabs, straw 1 swab, and dust bather – based outside 1 swab), and from the feeders and drinkers (feeders 1 swab, feed 1 swab, drinker 1 swab, grit 1 swab). Shed furniture swabs for each brooder shed were combined and analysed on one plate; as were all feeder and drinker swabs (see Figures 2a and b for field shed layout). In addition, environmental swabs were obtained from module crates in which the birds were transported.

Faecal samples were obtained from a sample of birds from each shed, and analysed on week four, (day 22/24) and week seven (day 44) (as part of the “all birds on site” sampling).

Figure 2a. Field shed one set up and tests **Figure 2b.** Field shed two set up and tests carried out



Production tests – all birds
Faecal samples were obtained from a sample of birds from all field sheds on site, on a selected day, to get a 'snapshot' of the campylobacter loading across the poultry system at any one time.

Environmental tests
Various sites around the farm were tested for campylobacter. These included environmental swabs on surfaces and faecal samples from wild animals and birds. These sites included biodiversity hotspots and some areas surrounding the poultry production areas. A full list of sites is displayed in Table 5.

Management and vehicles tests
Swabs were collected from stock team's boots, vehicles used for the poultry enterprise and other key areas. A full list of sites is displayed in Table 6.

Livestock tests
Faecal samples were taken from livestock located in geographically different locations on the farm and tested for campylobacter. A full list of sites is displayed in Table 7.

Multi-sites
Some of the sites in which either environmental or faecal samples were collected, are multi-sites, combining management, livestock and bio-diversity. These are sites that appear more than once across two of the results tables.

Equipment, sample collection methods and testing

Equipment

Sterile charcoal swabs were used to collect all the swab samples, and sterile faecal pots were used to collect faecal samples.

Sample collection

Faecal samples - Poultry

For birds aged week one through four, ten birds were randomly selected and placed in clean pet box to produce samples. For birds aged week five through seven, five birds were randomly selected and placed in clean pet box to produce samples. For birds aged week-eight through ten, a set of three birds and then two birds were randomly selected and placed in a clean pet box to produce samples. In addition, samples were obtained by collecting five freshly produced faeces from inside the shed. This approach was used to prevent stressing the birds through catching and handling at this later stage in the production cycle. All samples were placed in one faecal pot for dispatch and analysis.

Faecal samples – Wild animals and birds

As many fresh faecal samples as possible found in the immediate vicinity at each site were obtained for each species of wild animal or bird tested. In some cases this was not possible, as only limited amounts of faecal matter were found. For example, for the larger wild animals in most cases only one faecal deposit was present at each site.

Environmental samples

Samples were obtained by wiping the swab over the surface of the object in an X pattern, constantly turning the swab, for total coverage.

Sample testing

All samples were sent for testing using Royal Mail guaranteed next day delivery; to ensure samples were as fresh and viable as possible. They were tested at Wincanton Laboratories, Wincanton, Somerset.

Results

Production birds – batch of birds

Table 1 shows the results for the swabbing of the brooders prior to bird arrival, from the chick trays and week one faecal samples. The results from all of the analysis of these samples were campylobacter negative.

Table 2 shows the results for the faecal samples for the production batch of birds in week two. The results from the analysis of these samples were campylobacter negative

Table 1 Production batch, week one results, brooders, trays and faeces.

Week/ Day	Brooder	Sample Type	Further details (Plate group)		Result
Week 1 / Day 1	5	Environmental swabs	Feeders and drinkers	Feeders Feed Drinkers Apple Drinkers	Negative
	5	Environmental swabs	Shed and Furniture	Walls (short) Walls (long) Perches Shavings Cardboard	Negative
	5	Faecal			Negative
	6	Environmental swabs	Feeders and drinkers	Feeders Feed Drinkers Apple Drinkers	Negative
	6	Environmental swabs	Shed and Furniture	Walls (short) Walls (long) Perches Shavings Cardboard	Negative
	6	Faecal			Negative
	5 & 6	Environmental swabs	Chick trays	Trays for brooder five	Negative
				Trays for brooder six	Negative

Table 2 Production batch, week two results for faecal samples.

Week/Day	Brooder	Sample Type	Result
Wk 2 / Day 8	5	Faecal	Negative
	6	Faecal	Negative

Table 3 shows the results for the swabbing of the field sheds prior to the transition of the birds to the field, the module crates used to transfer the birds and week four faecal samples. At this stage the birds were analysed as campylobacter positive. In addition, the clean field shed and furniture was campylobacter positive, along with one module crate sample.

Table 3 Production batch, week four results, field shed, trays and faeces

Week/Day	Brooder / Field Shed	Sample Type	Further details (Plate group)		Campylobacter Result
Week 4 / Day 22	5 / 1	Environmental swabs	Feeders and drinkers	Feeders Feed Drinkers Grit & dispenser	Negative
	5 / 1	Environmental swabs	Shed and Furniture	Walls (short) Walls (long) Perches Straw Dust bather	Positive (2)
	5 / 1	Environmental swab	Module trays	Trays	Positive (2)
	5 / 1	Faecal			Positive
Week 4 / Day 24	6 / 2	Environmental swabs	Feeders and drinkers	Feeders Feed Drinkers Grit & dispenser	Negative
	6 / 2	Environmental swabs	Shed and Furniture	Walls (short) Walls (long) Perches Straw Dust bather	Positive (2)
	6 / 2	Environmental swab	Module trays	Trays	Negative
	6 / 2	Faecal			Positive

Key:
Positive Isolated direct from culture
Positive (2) Isolated from enrichment culture

Production results – all birds

The results for the faecal samples obtained from a sample of birds from each shed on site on one day are shown in table 4. There is a trend for a campylobacter positive result in the older birds on the site.

Table 4 Results for faecal samples for all birds on site.

Age (weeks /days)	Batch No.	Campylobacter Results Shed 1	Campylobacter Results Shed 2
1 / 1	4/260105	Negative	Negative
2 / 8	3/180105	Negative	Positive (3)
3 / 15	2/110105	Negative	Positive (4)
4 /22	1/040105	Negative	Positive (5)
5 / 30	53/281204	Positive	Positive
6 / 37	52/211204	Positive	Positive
7 / 22	51/141204	Positive	Positive
8 / 51	50/071204	Positive	Negative
9 / 58	49/301104	Positive	Positive
10 / 65	48/231104	Positive	Positive

Key:
Positive (3) Grew on initial culture but could not be isolated
Positive (4) Possible campylobacter, overgrown by another organism identification difficult
Positive (5) Possible campylobacter, not typical on gram plate

Environmental tests
Table 5 lists all the sites at which environmental sampling was undertaken, the individual samples obtained at the sites, their nature and the result when that sample was analysed. There is large amount of variability between the same kinds of sample obtained at different sites.

Table 5 Results for environmental sampling

Site No.	*Site Name*	*Sample No. and type*	Further details	Result
1	Grange	Swabs x 3	Walls, floor and nesting box	Negative
		Faecal	Wild bird faeces	Negative
		Other	Owl pellet	Negative
2	Rabbit Burrow	Faecal	Rabbit faeces	Negative
3	Badger Set & Latrines	Swab	Nest material	Negative
		Faecal	Badger faeces	Negative
4	Melvilles Trees	Faecal x 3	Wild bird, badger and fox faeces	Negative
5	Melvilles Trees - fence line	Faecal x 2	Fox and wild bird faeces	Negative
6	Black Barn	Faecal	Rat faeces – by box	Negative
			Rat faeces	Positive
		Swab	Owl pellet and droppings	Negative
7	Composting	Other	Mixed sample from compost strips	Negative
8	YSB	Faecal	Sparrow faeces – nest boxes	Negative
9	Willow Bed	Faecal	Fox faeces	Negative
10	Nut Wood	Faecal	Rabbit faeces	Negative
			Badger faeces	Positive
11	Beeches Wood	Faecal	Sparrow faeces –under feeder	Negative
12	Brooders	Faecal	Sparrow faeces –under feeder	Positive
		Swab	Nest boxes	Negative
13	Feed container	Swab	Sparrow faeces	Positive (6)
14	Brooder Barn	Faecal	Wild bird faeces	Negative
15	Feed Store	Faecal x 2	Wild bird and rat faeces	Negative
16	Trial Crops	Swab	Fence	Negative
		Faecal x 3	Wild bird & Rabbit faeces x 2	Negative
17	Production Crops	Faecal x 2	Wild bird and rabbit faeces	Negative
		Faecal	Rook and Seagull faeces	Positive
18	Dog Walk	Faecal	Dog faeces	Positive
19	Pig Field	Swab	Wild bird faeces	Positive
		Faecal	Rook and Seagull faeces	Negative
			Rook faeces	Positive
20	Pig Wood	Faecal	Wild bird faeces	Negative
22	Sheep Field	Faecal	Wild bird faeces	Negative
24	Pig Field	Faecal	Wild bird faeces	Positive
26	Sheep Field	Faecal	Rabbit faeces	Negative

Key:
Positive (4) Possible campylobacter, overgrown by another organism identification difficult
Positive (5) Possible campylobacter, not typical on gram plate
Positive (6) Not truly typical campylobacter
Wild bird faeces - Relates to any unidentified bird faecal sample –could contain any of the identified examples (sparrow, seagull or rook) or that of other birds

Management and vehicle tests

Table 6 lists all the sites at which samples relating to poultry management and vehicles used for the poultry enterprise were undertaken, the individual samples obtained at the sites, and their nature and the result when that sample was analysed.

Table 6 Results for management and vehicles samples.

Site No.	Area Type	Site Name	Sample Type	Further details	Result
27	Management	Processing	Faecal	Chicken faeces from module area	Positive
28	Management	Feed Wagon	Swab	Feed shot	Negative
29	Management	Poultry Team	Swab	Boots of stockpeople	Positive (4)
30	Management	Dirty site	Swab	Previous field shed site	Negative
31	Management	Clean herb strip	Swab	New site for clean shed	Negative
32	Vehicles	Quads	Swab	Bikes and tyres	Positive
33	Vehicles	Tractors	Swab	Tyres and forks	Positive (4)
34	Vehicles	Manitou	Swab	Tyres and forks	Negative
35	Vehicles	Other Vehicles	Swab	Tyres	Positive (4)

Key:

Positive (4) Possible campylobacter, overgrown by another organism identification difficult

Livestock tests

Table 7 lists all the sites at which livestock samples were obtained, and the result when that sample was analysed. The majority of these samples are positive, with at least one positive result for each livestock group.

Table 7 Results for livestock samples.

Site No.	Site Name	Sample Type	Further details (Plate group)	Result
19	Pig Field	Faecal	Pig faeces	Positive
21	Cattle Shed	Swab	Feeder	Negative
		Faecal	Cattle faeces	Positive
22	Sheep Field	Faecal	Sheep faeces	Negative
23	Sheep Field	Faecal	Sheep faeces	Negative
24	Pig Field	Faecal	Pig faeces	Positive
25	Sheep Field	Faecal	Sheep faeces	Positive
26	Sheep Field	Faecal	Sheep faeces	Negative

Discussion

Production tests – batch of birds

The production birds entered a clean, campylobacter free environment, this corresponds with other research, which suggests that after adequate cleaning, and disinfecting campylobacter cannot be found (Evans and Sayers, 2000). The birds entered this system clean and remained campylobacter free (based on a one percent sample of birds, 10/1000) moving into the second week. However, this trial indicated that some time after this but prior to leaving the brooder this batch of birds had become infected with campylobacter, as the results in the fourth week upon moving to the field environment were positive for campylobacter.

This result was unexpected, as the brooder is a sealed environment, without access to the outside or any enhanced biodiversity in that environment. However, this could be the result of management practice, as stockperson boot swabs tested positive for campylobacter, despite the fact that footbaths are in use at the entrance to each shed.

It is possible that this early infection of campylobacter in the brooder could be the result of horizontal infection through the water supply, as non-chlorinated water has been suggested to be a vehicle for infection (Gregory *et al*., 1997, Shane, 1992, Zimmer *et al*., 2003, and Shane, 2000). It is highly possible that this early infection may be through similar routes of transmission that might also occur on conventional broiler farms. Despite the lack of biodiversity and the high level of control and isolation from the sources of contamination such as wild birds, one study found over 40% of broilers within a flock campylobacter positive (Atanassova and Ring, 1999).

The field shed and its furniture tested positive in both sheds for campylobacter. This sample included a swab from the shed's dust bather, which is outside of the shed, and although this had been cleaned down, exposure to elements may have caused it to become contaminated with campylobacter. The module crates also tested positive in one case.

An important point to remember when considering this data is that this analysis was carried out at flock level and not at final product level. Previous testing of dressed carcases from this organic system has failed to produce campylobacter positive results. This, to some extent, tallies with research carried out in this area. A study by Hald *et al*. (2000) found that, when tested for campylobacter species prior to processing, 52% of the flock was infected. However, post processing this had reduced to 24%. It is possible, and has been noted, that some subtypes of campylobacter may not survive processing but it has been suggested that others may survive well and spread (Newell *et al*., 2001). Further research is required to follow positive testing of birds into a processing unit for repeat analysis of the carcases on completion of processing to confirm this suggestion.

Production tests – all birds

The testing of faecal samples from each shed on site, so covering all the different ages of bird on this multi-age site, demonstrated a trend for a campylobacter positive result in the older birds. This result was in the direction expected, based on the result from the batch of production birds tested. There were few early campylobacter results, but the testing of these was hampered, as campylobacter was not conclusively identified in these plates. In addition, there was one sample, from the birds at week 8, for which the sample was campylobacter negative. On the basis of previous sampling at this late stage, this result would be expected to be campylobacter positive. However, the sample obtained was from a very small subset of birds from each shed (1%). It has been shown that even in large conventional broiler sheds, in which the flocks live in very close proximity, these do not experience one hundred percent intra-flock infection (Atanassova and Ring, 1999). Further investigation could be undertaken to follow up on this preliminary work, exploring the presence or absence of campylobacter in individual birds within a flock, so prevalence within a shed can be assessed.

Further work could also consider the strains and species present on the farm to gain information about the passing of campylobacter between the different species of animal and bird on farm. It is important to note that most animals and birds carry most species of campylobacter and most of these are pathogenic to humans (Tam *et al*., 2003a).

Environmental tests

The results from the environmental/biodiversity sampling were mixed. The large majority of the results were campylobacter negative.

As noted in other studies wild birds appear to be a reservoir of the campylobacter pathogen (Gregory *et al*., 1997, Chuma *et al*., 2000, and Hänninen, 2004). In some sites, wild bird samples, including sparrow, seagull, rooks faeces and those from unidentified birds, were found to be positive for campylobacter, but in other sites they were not. This could be due to a mixed loading of campylobacter presence in the populations of these birds, as was discussed above in relation to the table birds. It could also be due to the fact that there were difficulties when sampling for biodiversity, of identifying samples with viable campylobacter pathogens within it, as the pathogen is to susceptible to cold and oxygen overexposure (Cole *et al*., 2004). Although the fragility of the campylobacter pathogen in relation to oxygen and cold would inhibit the transmission from wild birds and animals to poultry flocks, the sheer volume of poultry on the farm means that this fragility could be overcome.

Although wild birds seem to be a reservoir of campylobacter pathogen that could be transmitted to the poultry flocks, research has demonstrated that this is not always the case. In some instances, environmental samples had campylobacter with identical genotypes to those in the poultry flock they were near, but in others the environmental samples possessed campylobacter with genotypes that were distantly related to samples from the flock (Hiett *et al*., 2002). This suggests that the external environment can contribute to campylobacter contamination during poultry production but that this is not always the case.

This study suggests no real effect of the increase in biodiversity on organic farms. Although the prevalence of campylobacter was fairly high, this is comparable to that of conventional broiler systems or free-range systems and does not appear to be the result of the increase in biodiversity on this farm, as other species, for which a positive campylobacter result was found, were rats, badgers and dogs. These are not really species that have directly increased as a result of organic farming and increasing bio-diversity.

It could be argued that the sampled collected did not accurately represent the extent of the biodiversity found on organic farms. It could have included a larger range of species, such as raptors, small mammals, and even insects and flies, as these have been suggested as a route of infection for poultry (Bates *et al*., 2004, Hänninen, 2004, and Shane, 1992). However this was a preliminary study and time and resources would not permit a study to this extent. Further research should investigate this more closely.

Management and vehicle tests
The results from the management swabs highlighted some potential areas that may be possible routes of transmission into and around the poultry system. The swabs taken from the stock team's boots tested positive for campylobacter, although this was overgrown and difficult to identify. This confirms evidence from previous studies that catchers and poultry worker's boots often carry campylobacter (Gregory *et al*., 1997, and Ramabu *et al*., 2004). This study, like others (Ramabu *et al*., 2004), identified vehicles commonly used by the poultry staff, trucks, forklifts, tractors and quads, as campylobacter positive and therefore possible vectors for transmission. These findings suggest a potential route of transmission of the pathogen to the poultry, as stock people and vehicles are constantly moving around the farm and between the different age sheds. Tighter management, increased awareness of the need for good bio-security may decrease the prevalence of campylobacter as research has shown that significant larger numbers of campylobacter isolates were recovered from conventional poultry units with poor management (Kazwala *et al*., 1993).

Samples from the processing plant's module crates and module holding area were found to be campylobacter positive. This corresponds with the evidence from the literature, which suggests that despite washing, transport modules are often contaminated with campylobacter pathogens and thus are a potential route of infection (Berrang *et al*., 2003, and Slader *et al*., 2002).

The soil from the herb strip of a 'clean site' was analysed as campylobacter negative. This was an interesting find in terms of management and biodiversity. In relation to its management, this is positive as it means that a clean site is a clean site, in terms of it campylobacter loading. This is also a positive result in terms of the effect of biodiversity, as many pheasant pairs nest in the herb strips. Further work should be considered to investigate this result, as it was based on one sample within vast area.

Livestock tests
As the current research suggests (Gregory *et al*., 1997, and Ziprin *et al*., 2003), the livestock on the farm is a possible source of campylobacter contamination, as results from the livestock samples found positive campylobacter results for all types of livestock tested. The livestock enterprise should be kept as separate from the poultry systems as possible, in terms of their management and geographical distance. This would ensure campylobacter infection in the poultry flocks does not originate from livestock sources. As with the management issues, with stock people this source is potentially difficult to control, as the movement of livestock around the farm is necessary for grazing and housing.

Conclusions
In conclusion, the work suggests no real effect of the increase in biodiversity on organic farms. The samples, which were found campylobacter positive, are species that are likely to be present on conventional broiler farms, such as rats and sparrows and have been found to be transmission vectors for conventional broilers (Chuma *et al*., 2000, and Hänninen, 2004).

The work suggests some possible issues with management that may be acting as a route of transmission of campylobacter between different flocks on the farm. The study also identified a possible role for livestock in the transmission of campylobacter between different livestock species, and suggested that efforts should be made to keep these enterprises as separate as possible.

It is important to remember that, although this study has highlighted some areas of concern relating to management and avoiding contact with other livestock on the farm, and a lack of a real role for the enhanced biodiversity beyond those affecting conventional systems and free-range systems, this was a preliminary investigation. Issues have also been raised about the difficultly when sampling for biodiversity, of identifying samples with viable campylobacter pathogen within it.

Although the fragility of the campylobacter pathogen in relation to oxygen and cold would appear to be a benefit, when considering its transmission from wild animals to poultry flocks, the sheer volume of poultry on the farm means that this fragility could easily be overcome. While any positive wild animal faecal samples would rapidly deteriorate in terms of their potential to spread campylobacter to the poultry flock, contact with one single bird may cause infection. Due to the numbers in the poultry flock, in excess of 22,000, the chance of this happening is high.

Further, in-depth work will need to be carried out to explore the complex relationship between campylobacter presence and its transmission into organic poultry flocks.

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Organic egg production in Finland – animal health, welfare and food safety issues

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Introduction

Maintaining high welfare status and allowing birds access to natural behaviour and outdoors are particular challenges in organic egg production. Feather pecking, foot problems, external parasites and poor utilisation of outdoor areas have been recognised as problems in organic layer systems (Lampkin 1997, Berg 2001, Kjilstra *et al.* 2003). Inexperience might cause imbalances in feed rationing due to the absence of synthetic amino acids and use of home-grown feed (Gordon and Clarke 2002, Zollitsch and Baumung 2004). Furthermore, birds in free range systems have potentially greater exposure to bird or human pathogens than birds in systems with no outdoor access. Good stockmanship and experience in free range systems have been identified as keys to high welfare status in organic poultry systems (Bestman 2001). Thus, organic egg production poses major challenges for producers in countries like Finland, where free range egg production is not common; where climatic conditions limit both outdoor access and building design; and where biosecurity and exclusion of zoonotic pathogens from the food chain has been one of the main aims of conventional egg production.

One of the main objectives of the current study was to identify risk factors for potential problems in animal welfare and food safety on organic layer flocks in Finland. In addition, the aim was to establish potential solutions, suitable for Finnish conditions, to identified risks. In this presentation, the core findings of the descriptive statistics concerning management traits of the farms, their pastures and outside access for the hens, factors affecting health control on the farms, laboratory results of the faecal samples as well as post mortem results will be presented. The results (e.g. prevalence of cannibalism, red mites and campylobacters and absence of salmonella) will be compared to other studies in other countries and to the general disease status of non organic egg production in Finland.

Materials and methods

A total of 20 out of 23 commercial organic layer farms (in excess of 80% of all commercial Finnish organic farms) took part in the research. One flock per farm was chosen and flocks were visited twice (19 farms in Aug-Oct of 2003 and 17 farms in March-Apr of 2004). Data were collected through observation and by interviewing the producer, using a semi-structured interview guide. Laying hen welfare was estimated using environment-based and animal-based methods. Environment-based measures included ANI 35L-2001 -laying hens (Bartussek, 2001), housing environment and litter moisture and animal-based measures hen scoring (20-50 hens/flock, all together 911 hens) (Gunnarsson *et al,* 1995), hen body weight and flock-level fear of humans. Fresh faecal samples were collected from the floor for analysis of campylobacter and salmonella bacteria (5-50 samples per farm) and for internal parasite identification (4-10 pooled samples per farm). Samples were cultured for

Campylobacter spp. using both direct culturing on selective blood-free medium (modified charcoal cefoperazone deoxycholate agar) and by enrichment in Bolton broth. The egg samples were enriched in Bolton broth and after incubation in microaerophilic atmosphere on mCCDA plates. Gastrointestinal parasite eggs and oocysts were studied by flotation. For the prevalence study of poultry red mites *(Dermanyssys gallinae),* six cardboard traps per henhouse were placed into the walls of a henhouse for 2-3 days as described by Höglund *et al.* (1995). In addition, 10 untreated eggs/flock were collected for campylobacter and salmonella studies. Altogether, 38 dead hens from 12 farms were examined pathologically through post mortem.

Results

The Finnish organic egg producing farms, visited by the project, had been in organic production for an average of four years (Table 1). Approximately half of the flocks had less than 1,000 hens; and none of the flocks was greater than 3,500 hens.

Table 1 General information and management practices on 20 organic layer farms in Finland (80 % of all Finnish organic egg producers).

Variable	N[1]	Median	Min – Max	% of farms	95 % CI[2] for the %
Number of hens in the henhouse	20	1066	92 – 2666	N/A[3]	N/A
Henhouses with 1000-2666 hens		N/A	N/A	45	35 – 50
Henhouses with 92- 999 hens				55	50 – 65
Using at least some used hens for food	19	N/A	N/A	11	5 – 16
Estimate of mortality (%/month)	20	0.5	0 – 3.9	N/A	N/A
Years in poultry farming	19	5	1 – 34	N/A	N/A
Years producing organic eggs	20	4	1 – 14	N/A	N/A

[1] N=Number of farms with data
[2] Hypergeometric 95 % confidence interval for the percentage, taking account that in Finland there were altogether 23 organic egg producing farms that sell eggs to consumers through egg packaging companies or food shops in 2003-2004
[3] Not applicaple

Of the farms, 15-25 % had an outdoor area less than 2 m^2/hen. On 26-42 % of the farms, the farmer reported that access to outdoor area was offered for less than 120 days per year. Additionally, the producers on 17-44 % of the farms estimated that less than 50 % of the birds used the outdoor areas (Table 2).

Table 2 Outdoor area provision and management and farmer estimates of outdoor use and access by hens on 20 organic layer farms in Finland (80 % of all Finnish organic egg producers).

Variable		N[1]	Median	Min – Max	% of farms	95 % CI[2] for the %
Size of outdoor area/hen	< 2 (1.3-1.8) m^2	20	N/A[3]	N/A	20	15 – 25
	2-2.999 m^2				50	40 – 60
	3-3.999 m^2				20	15 – 25
	4-4.999 m^2				5	0 – 5
	> 5 m^2				5	0 – 5
Roughly estimated proportion of birds using the outdoor area (estimated by the farmer)		18	35	7 - 95	N/A	N/A
	7-25 %		N/A	N/A	33	22 – 44
	26-50 %				28	17 – 33
	51-75 %				28	17 – 33
	76-95 %				11	6 – 17
Time when access to the outdoor area is offered (farmer report)		19	132	0 - 240	N/A	N/A
	< 120 days/year		N/A	N/A	37	26 – 42
	120-149 days/year				37	26 – 42
	150-180 days/year				21	16 – 26
	> 180 days/year				5	0 – 5
Outdoor area rotated during the outdoor period		20	N/A	N/A	10	5 – 10
Outdoor area rotated annually between all flocks		19	N/A	N/A	5	0 – 5

[1] N=Number of farms with data
[2] Hypergeometric 95 % confidence interval for the percentage, taking account that in Finland there were altogether 23 organic egg producing farms that sell eggs to consumers through egg packaging companies or food shops in 2003-2004
[3] Not applicable

Only 0-10 % or 0-15 % of the farmers had recognized endoparasites or ectoparasites, respectively, in their flocks. However, 42-77 % or 48-90 % of the flocks were *Nematoda* spp. positive or red mite positive (caught with traps), respectively (Table 3). The post mortem results are biased since only 60 % (12 farms) sent some hens for *post mortem* and 42 % of the hens came from one particular active farmer. However, red mites were detected on 33-75 % of these farms sending hens for *post mortem*, which corresponds well with the trap results from all farms. Some hens that had died due to cannibalism were diagnosed from 33-67 % of these 12 farms.

Of the flocks, 71-90 % were *Campylobacter* spp. positive, the fall and spring results did not differ significantly between the seasons. The most common species detected was *C. jejuni*. Two of the farms were campylobacter-negative both in autumn and spring. Campylobacter positive egg shell sample was detected once. Salmonellas were not detected either from fecal samples or eggs.

Table 3 External and internal parasites and *Campylobacter* and *Salmonella* prevalences on 20 organic layer farms in Finland (80 % of all Finnish organic egg producers), based on faecal sampling (endoparasites, *Campylobacter* and *Salmonella*) and trapping (red mites).

Variable		**N**[1]	**% of farms**	**95 % CI**[2] **for the %**
Red mites	*In fall 2003*	17	59	48 – 71
	In spring 2004	10	70	50 – 90
Endoparasites in fall 2003		19		
Nematoda			53	42 – 63
Coccidia	*Eimeria spp.*		84	79 – 90
Endoparasites in spring 2004		17		
Nematoda (any of the three below)			65	53 – 77
Coccidia	*Eimeria spp.*		94	94 – 100
Campylobacter spp.	*In fall 2003*	19	84	79 – 90
	In spring 2004	17	77	71 – 88
Salmonella spp. Both in fall 2003 and spring 2004		20	0	0 – 0

[1] N=Number of farms with data
[2] Hypergeometric 95 % confidence interval for the percentage, taking account that in Finland there were altogether 23 organic egg producing farms that sell eggs to consumers through egg packaging companies or food shops in 2003-2004

Discussion

The parasitic and cannibalism results compare well with results found in free range/organic poultry in Denmark (Permin et al. 1999), back yard flocks or alternative systems in Sweden (Höglund *et al.*, 1995), hens in alternative systems in UK (Green *et al.*, 2000) and organic laying hens in the Netherlands (Bestman and Wagenaar 2003). However, there is clear need in transferring this information to the farmers, as parasite levels can be reduced and welfare of hens increased through management practices.

Campylobacter jejuni colonizes commonly the intestines of wild birds and poultry. The results of this study suggest that organic laying hens are more often colonized by campylobacters than conventionally reared chickens in Finland, as some Finnish studies estimate approximately 4 % contamination levels in flocks when sampled at the point of slaughter. *Campylobacter* colonization did not appear to lead to contamination of egg shells, as only one sample was positive of a total of 36 samples studied. Campylobacters on egg shell surface are not likely to survive, as they are sensitive to dryness. These facts together indicate that the risk of transmission of campylobacters on eggs to consumers is small. Intestinal colonization by campylobacters may lead to contamination of meat at slaughter as seen commonly in chickens. Meat of used organic hens is not commonly used as food decreasing the possibility of meat to transmit campylobacter infection to humans.

It was apparent in this study that outdoor access for laying hens is problematic under the Finnish climatic conditions. As the current EU Regulation requires outdoor access for one third of the birds life (KTTK 2005), including the rearing period, which is often spent entirely without outdoor access, it will be difficult for the Finnish layer producers to fulfill this requirement, particularly for birds that come into lay in during the autumn months. The EU Regulation does, however, allow reduced outdoor access due to climatic conditions, mainly as a temporary measure. When the climatic conditions limit the outdoor access on a more permanent basis, as in the Finnish climatic conditions, other solutions that allow access to natural behaviour need to be sought, for instance, in the form of winter gardens and verandahs.

Acknowledgments
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Food safety control

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Assessment of current procedures for animal food production chains and critical control points regarding their safety and quality: preliminary results from the Organic HACCP-project

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Introduction

Within the 5th EU-framework project "Recommendations for improved procedures for securing consumer oriented food safety and quality of certified organic foods from plough to plate" (QLRT-2002-02245; "Organic HACCP"), a systematic analysis was carried out among selected certified organic food production chains, such as eggs and milk but also wheat bread, cabbage, tomatoes, apples and wine, to investigate current procedures of production management and quality assurance. For each of seven quality and safety criteria, such as microbial toxins and abiotic contaminants, potential pathogens, natural plant toxicants, freshness and taste, nutrient content and food additives, fraud as well as social and ethical aspects the information was analysed to identify Critical Control Points (CCPs) and to suggest ways how the control of quality and safety can be further improved. CCPs were defined as the steps in supply chains where the qualities of the final product can be controlled most efficiently.

The project had the following overall objectives:

i) to provide an overview of consumer concerns in terms of organic food in different European regions, and a conceptual framework for setting future research in perspective;

ii) to establish a database of existing procedures and relevant control points for selected organic food production chains, prepared for extension with additional commodity groups and updated procedures;

iii) to provide systematic analyses of each selected commodity chain using procedures developed for Hazard Analysis by Critical Control Points (HACCP), for each of seven aspects of safety and/or quality; and

iv) to produce and disseminate information material with recommendations for improvements of procedures and control, to the stakeholders involved, and to define the most important research needs on subjects where current knowledge does not yield a sufficiently firm basis for practical recommendations, and disseminate this information to researchers and research policy makers.

The new aspect within the Organic HACCP project was thus to improve how consumer concerns are addressed, through the use of the CCP concept for a wide range of criteria, not only safety.

Materials and methods

Database

A questionnaire was set up by experts in the areas of the following seven quality and safety criteria: microbial toxins and abiotic contaminants, nutrient content and food additives, pathogens, freshness and taste, natural plant toxicants, fraud, social and ethical aspects.

Questions were formulated with regard to the areas of consumer concerns. An internal (confidential) database was established to carry out the analysis of collected data, representing several regions typical for the selected commodity and to overview the management steps and their critical control points. The database contains information on i) the background of the CCPs, ii) the quantitative risk related to other chains in the analysis or, if relevant, compared with data from other studies, iii) how and why the step is controlled in the chain or suggestions of means for improved control and, and iv) discussions in relation to the differences between the chains. Possibilities which may alleviate the problem at a later stage, if relevant, were also included.

CCPs and analysis of the chains in the sense of Organic HACCP

Critical control points were identified using methods developed for Hazard Analysis and Critical Control Points (HACCP), a standard system which identifies, evaluates and controls hazards that are significant for food safety {Alimentarius, 1997 #1225;NACMCF, 1997 #357}. Organic farming and the HACCP approach, the two systems have important common aspects, while they also show important differences: For example, organic production must, by definition, cover the full chain from primary production until the food is sold to the consumer, while, at present, HACCP systems are most often set up within one enterprise/operation, such as a factory. A combination of the two types of principle could utilise their respective assets and compensate for the weakness of each system. Neither system has specific provisions for ensuring other aspects of quality than food safety. This is at present entirely up to the general skills of those involved at each step of the chain of production and distribution.

In the organic HACCP project, we used some of the concepts from HACCP for identifying CCP, as a tool for defining procedures that could be used to optimise quality assurance and quality in the entire chains of production and distribution. The Organic HACCP concept differs from the standard HACCP in at least three aspects: i) it covers the entire chain, not just one enterprise; ii) it is concerned with safeguarding each of a range of qualities, such as taste, trustworthiness and authenticity, not just safety in the sense of preventing a health hazard; and iii) concentration on the aspects of procedures for analysis of risks. The project concentrated on the aspects of procedures for analysis of risks, working with representative examples, in order to provide a systematic framework for the formulation of recommendations for improving existing procedures, rather than with a view to their commercial use or as a means of obtaining HACCP certification. The definition of a CCP is a step at which control can be applied and is essential to prevent or eliminate a risk (instead of a food safety hazard) or reduce it to an acceptable level.

Publicly accessible database

Based on the internal database, an external, publicly accessible database has also been established, which is accessible on the public homepage (www.organichaccp.org) under “results”. Log-in is not necessary.

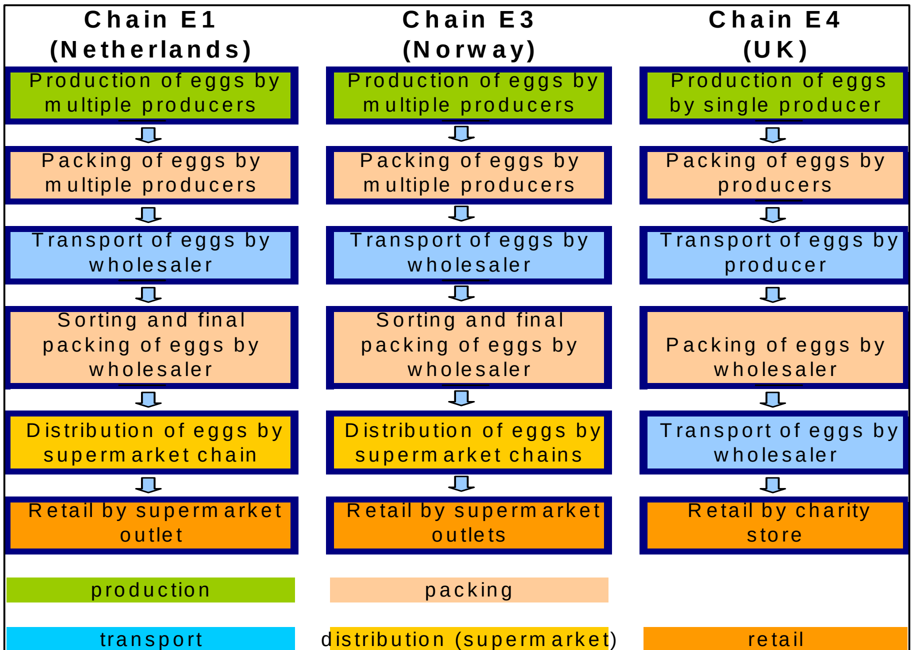

Figure 1 Typical supply chain structures for eggs from real chains in the Netherlands, Norway and UK.

Results and discussion

The internal (confidential) database has received 139 datasets from the actors (producers, processors, retailers etc.) of 3-6 supply chains for each of the seven commodities: eggs, tomatoes, cabbage, wine, milk, apples and wheat bread, each covering 3 to 4 regions. The publicly accessible database contains overviews of 29 examined chains of production and distribution for organic products.

The egg supply chain looked similar in the examined chains in the Netherlands, Norway and UK (Figure 1). Production and packaging was maintained by the producers. In all chains, a wholesaler was responsible for further sorting and packaging. Transport was mainly made by wholesalers.

In Table 1 and 2, CCPs are identified for all seven criteria regarding the three egg and the four milk chains, respectively. Generally, the organic production practices do not raise any concerns regarding the levels of natural toxicants in eggs or milk. Therefore, there was no indication to define a CCP for this criteria along the examined egg and milk chains. The listed CCPs must not appear in all of the chains investigated but can. However, at least in one of the cases per chain examined the listed CCPs must have been of a risk. The publicly accessable database (see www.organichaccp.org see "Results" Critical Control Points) gives further explanations on how small, variable or high the risk was for a particular management step in a certain chain.

Table 1 Critical Control Points (CCP) for the three examined egg chains from the Netherlands, Norway and UK and all four examined milk chains from Austria, Norway and Denmark (2). All 7 quality and safety criteria were considered with the relevant management steps.

Criteria	Management Step	CCP for eggs	CCP for milk
Microbial toxins/abiotic cont.	Production	Feed: Contamination with dioxins/pesticides	Feed: Contamination with dioxins/pesticide Fodder storage: conditions for mycotoxin formation in cereals and silage.
Nutrients/ additives	Production	Feed: Composition of diet	Feed: Composition of diet
Potential pathogens	Production	Farm situation: introduction from neighbouring land via run-off/contaminated drinking water Feed: through feed, fresh material contaminated by wild mammals/birds	Management, Labour, Equipment, Storage of milk: all faecal contamination Farm situation: introduction from neighbouring land Feed: through feed, fresh material contaminated by wild mammals/birds.
	Packaging	Storage: inappropriate conditions	
Freshness/taste	Production	Feed: type of feed (outdoor feeding)	Feed: type of feed (outdoor feeding) Storage: time frame.
	Processing		Management: information regarding homogenization.
	Packaging	Storage: storage time, condition	Storage: storage time, condition. Labelling: labelling information regarding type of processing.
	Distribution	Storage: storage time, condition	

Table 1 Continued

Criteria	Management Step	CCP for eggs	CCP for milk
	Retail	Storage: storage time, condition Display: storage time, condition	Storage: temperature regime Display: temperature regime Consumer contact: information transfer regarding type of processing.
	Delivery to private housholds	-	Storage: temperature regime.
Natural plant toxicants	-	-	-
Fraud	Production	Feed: use of not allowed additives/ higher amounts of non-organic (concentrate) feed Animal Health Care use of non-approved or higher allowed quantities, too short withholding periods	Feed: use of not allowed additives/ higher amounts of non-organic (concentrate) feed Animal Health Care use of non-approved or higher allowed quantities, too short withholding periods.
	Sorting/final packaging	Labelling: conv. eggs sold as organic	
Social/ethical aspects	Production	Management: diversification vs. specialist farms. Labour: family vs. non-family enterprise Animal Health Care: trust in animal welfare	Management: diversification vs. specialist farms. Labour: family vs. non-family enterprise Animal Health Care: trust in anaimal welfare.
	Delivery to private housholds	-	Labour: family vs. non-family enterprise Consumer contact: information transer
	Retail	Customer contact: information transfer	Labour: family vs. non-family enterprise Consumer contact: information transfer.

Based on the collected data and additional advice from the participants at the terminal workshop in Newcastle in January 2005, 14 leaflets have been prepared: 7 leaflets for producers (including eggs and milk), covering each of the 7 commodities, 3 addressing consumers, on the topics “Taste, freshness & nutrients”, “Authenticity & fraud” and “Safety

& contamination", 3 for retailers on the same topics, and 2 leaflets for processors (producers and processors of wine are covered by the same leaflet).
The leaflets have been translated into 6 languages (English, German, Italian, Spanish, Danish and Portuguese) and distributed to the subscribers of the QLIF newsletter, and they are available at the project homepage: http://www.organichaccp.org/OrganicHACCP.asp and on http://www.organic-europe.net/haccp/.

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Assessing the risk from mycotoxins for the organic food chain: results from Organic HACCP-project and other research

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Introduction

Mycotoxins are toxic compounds produced by the secondary metabolism of toxic moulds in the *Aspergillus*, *Penicillium* and *Fusarium* genera occurring in food commodities and foodstuffs. The range and potency of mycotoxins make this group of naturally occurring toxins an ongoing animal health hazard and a constant risk for contamination of the food supply.

Mycotoxicoses are diseases caused by exposure to foods or feeds contaminated with mycotoxins. Mycotoxins exhibit a variety of biological effects in animals, such as liver and kidney toxicity, central nervous system effects or estrogenic effects. There are differences between animals with regard to the susceptibility towards different mycotoxins. Poultry secrete mycotoxins relatively fast because of a particular digesting system. Ingredients used for animal feeding should be checked to ensure that adequate quality standards are maintained and that mycotoxins are not present at higher than acceptable levels. Good animal feeding practices also requires that feed is stored in such a way as to avoid contamination. As organically raised livestock are fed greater proportions of hay, grass and silage, there is reduced opportunity for mycotoxin contaminated feed to lead to mycotoxin contaminated milk.

Mycotoxins have been reported in organic produce. One theory is that organically-grown products are likely to contain higher concentrations of mycotoxins than conventionally-grown products. However, there is little evidence to support this theory (Tamm *et al.* 2002). Higher or lower mycotoxin contents in feed and food made in different production systems may be caused by i) systematic differences in the production systems during pre-harvest (e.g. use of agrochemicals), ii) differences in post-harvest handling (e.g. storage, transport) and iii) differences during the transformation of raw products into processed foods. Also differences that are in fact due to improper handling procedures during harvest or post-harvest tend to occur systematically if there are systematic differences in the type of equipment used or in the technical qualifications of those who handle the products. Obvious omissions, regarding quality assurance, lead to poor quality but this phenomenon is not linked to organic agriculture in particular (Tamm 2001).

Within the 5th EU-framework project "Recommendations for improved procedures for securing consumer oriented food safety and quality of certified organic foods from plough to plate" (QLRT-2002-02245; "Organic HACCP"), a systematic analysis was carried out among selected certified organic food production chains, e.g. milk but also wheat bread. The aim was to investigate current procedures of production management and quality assurance related to the examined chains. For the quality and safety criteria "microbial toxins" (there were six more) the information was analysed to identify Critical Control Points (CCPs) and to suggest ways how the control of quality and safety can be further improved. CCPs were defined as the steps in supply chains where the qualities of the final product can be controlled most efficiently.

Materials and methods

Details about the collection and analysis of data regarding the criteria “Microbial toxins” can be found in this proceeding in “Assessment of current procedures for animal food production chains and critical control points regarding their safety and quality: Preliminary Results from Organic HACCP”.

Results and discussion

In the investigated chains, the risk of mycotoxin contaminated milk was variable, even within single chains (Table 1).

All farmers produced their own feed, such as fresh and dry roughage and silage. Some produced also grass pellets, rape and corn. This reflects the typical practice in organic livestock of feeding large proportions of hay, grass and silage, which reduced opportunity for mycotoxin-contaminated feed. All investigated farmers also bought concentrates from feed companies. Most of the farmers did not check the fodder upon delivery for obvious mould growth or smell. They trusted the feed companies and the analysis certificate that accompanied the feed. None of the farmers mentioned the option that mycotoxins may evolve under storage in his/her own storage facilities. This represents a serious risk: spoiled fodder is not detected and then fed to lactating cows. Therefore, it is highly advisable that all farmers establish a quality assurance system, including written checklists for inspecting newly delivered feed and own storage practice.

As organically raised livestock are fed greater proportions of hay, grass and silage, rather than corn, there is reduced opportunity for mycotoxin-contaminated feed to lead to contaminated milk (FAO 2000). Studies have found that aflatoxin M1 levels in organic milk were lower than in conventional milk (Woese *et al.* 1997). An investigation by the Food Standard Agency (2001) showed that while 3% of conventionally-produced milk samples contained aflatoxin M1, no samples of organic milk were contaminated.

Table 1 Selected critical control points for four examined milk chains from European countries

CCP	Examined European Milk chains			
Feed	**M1**	**M2**	**M4**	**M5**
Mould infested feed - subsequent forming of mycotoxins at production level.	Risk variable; own for the 3 feed productions questionned; they all buy dry and fresh roughage but also concentrates; in one case is a quality assurance concept available and two of the operations trust their feed supplier.	Risk variable in this chain; all three operations maintain an own food production; they feed dry/ fresh roughage, silage, grains, grass pellets and corn. Two operations also feed concentrates and trust their supplier and the accompanied certificate; all three have no quality assurance (QA) concept.	Medium risk in this chain; the farmer buys feed from a neighbour, there is no quality assurance concept with checking of feed upon arrival.	There is a medium to high risk in this chain; all three operations maintain an own fodder production, dry/fresh roughage, silage and grains; all three buy concentrates; one of the operations checks the feed upon delivery by visual control; none of the farmers is aware of the risk or uses a QA system.
Fodder storage				
Inappropriate storage condition	There is a low to medium risk in this chain; awareness of risk available; one of the operations has temperature control, two have no temperature control but keep different types of fodder separate/in special containers. They also have an established drying facility. No use of a QA concept.	There is a medium to high risk; the awareness for a risk is not available; two operations have storage under simple conditions and one has storage in a gas-tight silo; none of them has a QA concept for feed. One operation takes samples for analysis and two trust their feedstuff supplier.	There is a low risk in the chain; storage under simple condition for some feed, but the major portion contains fresh and dry roughage/silage. There is no quality assurance concept available.	There is a variable risk in the chain. Partially, there is awareness for the risk. All three operations maintain simple storage. One checks concentrates upon delivery, one stores grain in gastight silos. No QA concept available.

Conclusions

There are no relevant differences among farming systems in terms of higher risks for mycotoxin contaminations. Major contamination sources are available in all farming systems and must be taken seriously. A well maintained quality assurance system has to be set up based on occurrence, detection and prevention. Good agricultural, handling and storage practices are required in both organic and conventional agriculture to minimize the risk of mould growth and mycotoxic contamination.

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Working group report

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Working Group Report

Food quality research of organic animal products: future research needs and implications for standards

Rapporteurs: E. Rembialkowska and K. Ellis

Introduction
The three main points arising from discussion in this group were:

1. Food quality is hard to define;
2. Further research to define a common platform of understanding of the term 'food quality' is required; and
3. Further research on factors affecting livestock product quality at farm-level is required.

Discussion of points
All stakeholders in the organic livestock food chain have different priorities with respect to food quality. Stakeholders include producers, wholesalers, retailers, advisory bodies, certification groups, regulatory and inspection groups (such as environmental health officers & food microbiologists) and the consumer. Due to the wide range in requirements by these different groups, it is difficult to obtain a common consensus on the term 'food quality'. For example, a wholesaler or retailer may require a good shelf-life for a product or an appealing looking product, whereas a consumer may want freshness and taste. Additionally, there are some aspects that could be termed objective, such as the absolute measurement of cell counts in milk or the presence or absence of *Salmonella* in chicken, and there are some areas of a more subjective nature, such as taste. However, there should be a drive to make all areas as objective as possible, and there are laboratory methods that can be used to investigate or assess factors, such as taste.

Some of the terms or areas that we suggested should be included in a definition of quality include:

- Absence of medicine and pesticide residues;
- Minimal risk of pathogenic bacterial contamination;
- High standards of animal welfare during production;
- Value for money – not the same as cheaper;
- Good taste; and
- High nutritive content.

Currently in organic farming, regulations and standards only apply to the process quality and not the end product, therefore, certain minimum standards of product quality should perhaps be suggested to enable a product to be deemed organic. For example, a 'zero tolerance' approach to *Salmonella* in poultry. However, organic farming systems introduce different challenges in terms of food safety and quality when compared to conventional systems and it may not be possible to achieve microbiological zero-risk. So, should there be more consumer education as to the production process, so that 'imperfect' products are more acceptable? For example, should the consumer be able to make a choice between minimal pathogen risk foods and extremely restrictive farming systems, such as intensive indoor poultry or pig production, or slightly higher risk of microbial contamination but a more extensive organic farming system? Is the consumer capable of making this choice? In many cases, the degree of risk to food safety due to organic production systems is not quantifiable and more basic research is needed.

There is also a consumer perception that organic food is healthier, which is also very hard to define. There should be a reduced risk of pesticide and veterinary medicinal residues as a result of the farming system, and there should also be fewer additives used in processed foods. However, there is less evidence that organic and conventional foods differ significantly in terms of their nutritive content, and even where there are some small differences, such as in vitamin or fatty acid content, there is even less evidence that this is significant in terms of human health, when placed in the context of a complete diet. More sustained or longer term research is required to address some of these points. In order to examine the impact of organic meat products on human health, wide cohort epidemiological studies on organically vs. conventionally eating consumers are necessary. Simultaneously, intervention dietary studies on the smaller well-defined groups of the consumers eating organically vs. conventionally are indispensable.

Due to the extreme variation in terms of geography and suitable production systems in different climates across Europe, it becomes even harder to generalise on product quality, as it would be predicted that there will be variation due to different feeding practices across countries, regions and seasons. It has already been shown that it is difficult to maintain product quality even on the same farm (see Albert Sundrum's presentation on pork production in these proceedings).

Therefore, in terms of both the research needs and the organic standards, establishing a basic set of criteria that include a range of product and process aspects to define the term 'food quality' should be prioritised. A common platform that is applicable across countries and different stakeholders should be used and can then be applied to organic animal products. Further research is required in terms of comparative studies of organic and conventional animal products to determine the variability within the product. Also, importantly, studies must be conducted on both farming systems, looking at the factors that affect product quality. It is not sufficient just to compare organic with conventional without investigation of the effects of the management on each system. This should be prioritised on 'raw' products such as meat, eggs and milk, but should also look at the effects of processing on products.

Part C: Veterinary medicinal inputs: Impact on product quality and food safety

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Fate of veterinary medicines in the environment

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Medicines play an important role in the treatment and prevention of disease in both humans and animals. Whilst the side effects on human and animal health have been widely documented, only recently have the potential environmental impacts of the manufacture and use of medicines been considered. Veterinary medicines may be released to the environment by a number of routes. During the manufacturing process, residues may be released from the process and may ultimately enter surface waters. When used to treat pasture animals, veterinary medicines may be excreted directly to soils or surface waters. Aquaculture treatments will be released directly to surface waters. For intensive livestock treatments, the medicines are likely to enter the environment indirectly through the application of slurry and manure as fertilisers to land. Other minor routes of entry include emissions to air and through the disposal of unused medicines and containers. Once released into the environment, pharmaceuticals will be transported and distributed to air, water, soil or sediment. A range of factors and processes including the physico-chemical properties of the compound and the characteristics of the receiving environment will affect distribution. In this paper we will provide an overview of recent studies into the inputs to and the fate of veterinary medicines in aquatic and terrestrial environments and assess the potential impacts of these on human and environmental health.

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Are antibiotic-resistant bacteria present on organic livestock farms?

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Introduction

"If antimicrobial use is the major selective pressure encouraging the development of resistance, then reduced use should result in decreased resistance."(Tikofsky *et al.*, 2003) Statements such as these would appear to be intuitive, but are they valid and what exactly is antimicrobial resistance?

Strictly speaking, antimicrobials are substances that destroy or inhibit the growth of micro-organisms, whereas antibiotics are antimicrobial substances that are produced by, or are derived from, species of bacteria or fungi. A generic definition of antimicrobial resistance could be "the ability of an organism to withstand an antimicrobial agent" (Anon, 1999), however this may be interpreted slightly differently by the clinician, the molecular biologist and the field researcher.

There are two main routes by which a bacterium may acquire resistance to an antimicrobial substance. Mutations within the bacterial chromosome may give rise to alterations in the metabolic pathways of the organism or in the structure of the microbial protein that is targeted by the drug. Alternatively, certain genes encoding for resistance mechanisms can be replicated and passed horizontally between bacteria of the same or different species independent of bacterial division. An important source of such "mobile genes" are those genes that code for the self-defence mechanisms that are necessary for the survival of bacteria that naturally produce antibiotics, such as certain species of soil bacteria. Mobile genes can be carried on a variety of genetic vehicles such as plasmids, integrons and transposons. Many of these gene vehicles are capable of carrying more than one resistance gene at a time. The consequences of this are that multiple-resistance can be spread horizontally between bacteria, and that the selection of one gene by a drug will automatically select for the other resistance genes that are linked to it, even if those genes code for resistance to a pharmacologically unrelated drug. Thus exposure to antimicrobial agents strongly selects for the survival of those members of the bacterial flora that possess mechanisms of resistance against those agents.

However if, in a given environment, antimicrobial drugs are withdrawn from use then for the return of a largely susceptible population of bacteria, those bacteria that are carrying resistance mechanisms need to be at an evolutionary disadvantage. That is the resistant bacteria should be less fit than the antimicrobial susceptible flora if the susceptible species are to replace them. Many studies have now shown that the ability to survive in the presence of antimicrobials may not, in fact, always incur a fitness cost upon resistant bacteria (Maisnier-Patin and Andersson, 2004; Nguyen *et al.*, 1989; Zhan *et al.*, 2003), therefore the removal of antimicrobial agents may not result in the elimination of resistant organisms (Enne *et al.*, 2004).

Persistence of resistance on organic and conventional farms

At the current time, there is an increasing amount of research being conducted into the occurrence and persistence of resistant bacteria on livestock farms across the world. Some research groups have found that certain resistant bacteria, and it is important not to generalise across the different bacterial species, are less likely to be isolated from organic livestock farms than conventional (Gellin *et al.*, 1999; Heuer *et al.*, 2002; Mathhew *et al.*, 2001; Sato *et al.*, 2005; Tikofsky *et al.*, 2003). However, all of the studies referenced here did isolate some resistant bacteria from the organic farms that they studied. Furthermore, other studies have found that the differences between the resistant bacteria isolated from conventional and organic farms were less marked (Heuer *et al.*, 2001; Sato *et al.*, 2004).

A trans-Atlantic study compared the antimicrobial susceptibility patterns of *Staphylococcus aureus* isolated from bulk milk tank samples collected on conventional and organic farms in both the United States of America and Denmark. They observed that there were significant differences ($P<0.05$) in the resistance patterns seen for nine antimicrobials between isolates taken from the two different countries. However, the resistance patterns of isolates collected from the conventional and organic farms within each country were very similar (Sato *et al.*, 2004).

Sato *et al*. also examined faecal *Escherichia coli* on the dairy farms in Wisconsin. This study found that the isolates of this abundant commensal species of bacteria, collected from the organic farms, were significantly less resistant than those collected from their conventional neighbours (Sato *et al.*, 2005). The results of this work also demonstrated that calves were more likely to shed resistant bacteria than adult cattle on both types of farm.

A Scottish study has also found that calves on both conventional and organic beef suckler farms are rapidly colonised with ampicillin-resistant *E. coli* after birth. On both types on farm, there was then a marked decline in the levels of resistant *E. coli* shed as the calves grew. This study also found that housing cohorts of calves was also associated with an increase in the carriage of nalidixic acid-resistant *E. coli* (Hoyle *et al.*, 2004).

In vivo model studies have demonstrated that neonatal calves dosed with resistant and susceptible *E. coli* were significantly ($P=0.001$) more likely to shed higher numbers of resistant bacteria than the susceptible counterparts even in the absence of use of antimicrobial drugs. This phenomenon was not seen when older cattle were dosed. The resistant *E. coli* were all of the SSuT phenotype, thus they expressed resistance to streptomycin, sulphonamides and tetracycline. Of the resistant isolates, 49/50 contained a large plasmid of 140kb that was not present in the susceptible strains (Khachatryan *et al.*, 2004).

So, why is it possible to isolate resistant bacteria on organic farms where by definition there should be little or no antimicrobial use? It is possible that resistant bacteria have further evolved such that carrying a resistance trait is no longer an ecological fitness disadvantage and, therefore, there are limited selection pressures acting to decrease their presence in the farm and/or animal. Alternatively, the resistance genes themselves may code for other adventitious bacterial traits besides antimicrobial resistance. Or it may be that the resistance genes are closely linked to genes coding for traits, such as increased colonisation ability or virulence or inter-bacterial competition. It is for reasons such as these that Thomas O'Brien wrote that "the levels of resistance at any time and place may….reflect in part the total number of bacteria in the world that have been exposed to antimicrobials up until then." (O'Brian, 2002).

Therefore, the practical implications of these observations are that, in order to minimise levels of resistant bacteria on farms, it may be necessary to do more than simply decrease, or even halt, the use of antimicrobial drugs. Work currently being carried out within the Veterinary Laboratories Agency in the UK is attempting to relate farming practices and management decisions to the levels of resistant *E. coli* present on those farms.

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Is the doubling of withdrawal time a suffcient measure? Evaluations of oxytetracyline residue persistence in sheep milk

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Introduction

The milking sheep production system.in Sardinia has been changed during the last few years, passing.from extensive breeding, characterized by the absence of permanent shelters, from free outdoor grazing and manual milking, to semi-extensive husbandry, characterized by nocturnal shelters with litter, integrated nutrition management and the introduction of milking machines. These modifications in farm management have become necessary in order to adapt the production to all EU hygienic and sanitary requirements. This semi-extensive management does not differ markedly from the specific guidelines for organic farming. Subsequently, these husbandry systems are considered to model oganic farms and are seen as easy to convert into organic production.

The application of the new specific hygiene rules has, on one hand, led to the disappearance of traditional mastitis pathogens, such as *Staphylococcus aureus*, and, on the other, reduced the spread of sub-clinical mastitis caused by environmental and opportunistic micro-organisms. Different strains of Coagulase-Negative Staphylococci(CNS), mainly *S. epidermidis*, *S. xylosus*, *S. chromogenes*, *S. hyicus* and some Streptococci, like *Streptococcus uberis* and *Enterococcus faecalis* are frequently isolated from milk of sheep with no clinical mastitis symptoms. These micro organisms, together with others, are thought to be the main causes for sub-clinical.mastitis in sheep and goats. Furthermore, mastitis is the main cause of culling in the milk sheep. These pathologies cause a quantitative decrease and a qualitative depreciation in the milk production and increase veterinary expenses. Overall, while the pathological symptoms of sub-clinical mastitis are less obvious, the economic losses that they cause are more consistent than with clinical mastitis. The greater difficulties of diagnosis allow the persistence of the infection in the flock, facilitating the spread of pathogens. Most sub clinical mastitis is caused by environmental micro organisms (bacteria found in the environment, such as litters, folds, milking rooms and so on,) and/or opportunist micro organisms (bacteria that are commonly found on the animal and human skin).

As use of allopathic medicine is permitted in organic husbandry by the Council Regulation (EEC) n. 1804/1999, in particular situation under veterinary control, when bacterial pathologies appear, the use of antibiotics is often unavoidable. Oxytetracyclin, in a long-acting formulation, is one of the most common pharmaceutical preparations used in Sardinia.

The definition of the withdrawal period given in Council Directive 81/851/EEC is: "it is defined as the interval between the last administration of a veterinary medicinal product to animals under normal conditions of use and the production of foodstuff from such animals to ensure that such foodstuffs do not contain any residues which might constitute a health hazard to the consumer". (Now: Maximum Residue Limits established according to Council Regulation (EEC) n. 2377/90). On the other hand, the presence of residue from pharmacological treatment is regulated at the EU level by the Council Regulation (EEC) No

2377/90 of 26 June 1990 regularly updated. The residues are divided in two main groups: those originated from forbidden substances and those from allowed substances. The first one are not, at the moment, relevant to our discussion, being involved only in illegal practices. The second ones require closer inspection. The risk assessment carried out by the EU institutions sanctioned the possibility to accept a small quantity of residue that, for each different substance, is expressed by the maximum quantity allowed, just the MRL (Maximum Residue Limit). Obviously this legislation doesn't discriminate between conventional and organic products.

In this way the concept of "withdrawal period" (WP) means, particularly for the oldest drugs, only an important indication that provides practical guidelines for the farmers. However, especially for those preparations that were licenced before the current residue legislation came into force, there is the concrete possibility that the withdrawal period may not be adequately aligned with the residue at the level of the established MRL. Even in conventional livestock production, there may not be complete compatibility between these two ways to evaluate the fitness suitability of the final products.

However it is obviously important that the foods do not contain more residue than the foreseen MRL. On this point, organic production is not different from conventional. Nevertheless, what the organic consumer expectations assume food free from any kind of residue, in particular substances like antibiotics and pesticides. Recently, the European Agency for the Evaluation of Medicinal Products (EMEA)—Committee for Veterinary Medicinal Products (CVMP) - laid down a very important document (EMEA/CVMP/473-98-FINAL): "Note for guidance for the determination of withdrawal periods for milk". This document deals with the standardisation of a harmonized method to evaluate the withdrawal period, but this guideline is applicable only to new products.

The objective of this study was to estimate if doubling the withdrawal period is a sufficient measure to guarantee the respect of the EU principle of organic farming and the legislation in the field of food safety control.

Materials and methods

Experimental animals

We selected 21 ewes that had lambed within three days of one another, with a medium weight of 42 kg, from a flock of 1300 animals; the suckling lambs were not separated from their mother during the sampling period.

The extensively managed farm was situated in the Province of Sassari. The feeding was constituted by alfalfa grassland (2 hours/day) and an integration of maize (250 g/h). The sheep shed had a permanent litter and the animals was fed with alfalfa hay."*ad libitum*".
The anamnesis showed repeated problems of clinical and sub-clinical mastitis caused by *Staphylococcus aureus* and Coagulase-Negative Staphylococci(CNS).

All 21 ewes were physically examined and udders were inspected and sampled aseptically for milk. The milk samples were immediately chilled at 5°C and submitted to microbiological tests within two hours of sampling. The refrigerated milk was tested for chemical assay within two days.

10 μL of milk was streaked on sheep blood agar incubated at 37°C for 24 hours. Bacteria were identified using standardized Api-Staph® BIO Merieux® for the speciation of Streptococci and Coagulase-Negative Staphylococcus (CNS). All the bacteria isolated were tested using Kirby-Bauer method to assess the response to oxytetracycline.

Clinical situation

All sheep appeared to be healthy, reacting and in.a sufficient nutritional status. Local clinical signs in the udders were follwoing: no pocks, sloughs, nodules, ulcers or cysts could be seen in the udder skin; during palpation, mammary parenchyma.was.normally elastic; some animals showed a light reactivity in the mammary lymph nodes.

Bacteriological results indicated that , out of 21, 15 sheep were positive and six were negative. Positive samples were identified as seven out of 15 *Staphylococcus epidermidis*, five as *Staphylococcus.aureus*, two as *Staphylococcus xylosus*, and one as *Staphylococcus chromogenes*. All strains were oxytetracycline sensitive.

Treatment

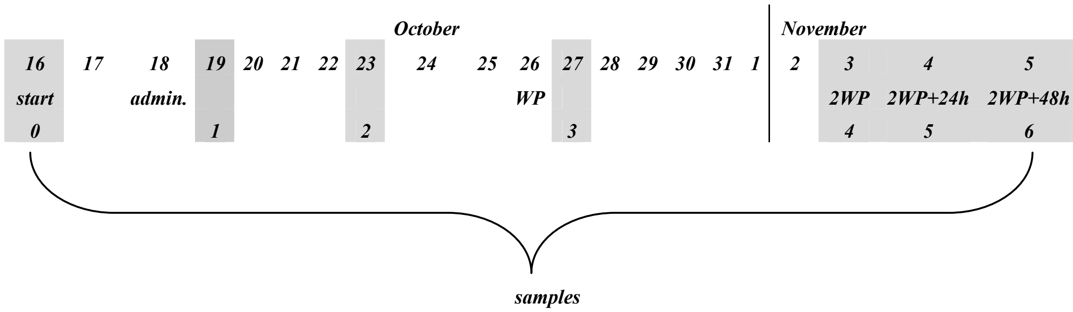
On the first day, the sheep were given intramuscular injection of 1g of oxytetracycline (Terralon® 20% LA - Virbac®). The pharmaceutical data sheet assured a four-day pharmacological effect with only one administration, and recommended a withdrawal period of eight days.

Sampling

The milk was sampled as follows (see also Figure 1):

- Sample 0: the day before the treatment
- Sample 1: 1 day after the treatment
- Sample 2: 5 days after the treatment
- Sample 3: 1st milking after the WP
- Sample 4: 16 days after the treatment = at 2WP
- Sample 5: 1 day after the 2WP
- Sample 6: 2 days after the 2WP

Figure 1 Sampling plan for milk



Analytical methods

We carried out the evaluation of the milk elimination rate of the antibiotic using three different analytical methods:

a) microbiological,
b) immuno-receptorial, and
c) chromatographic HPLC.

The first two methods are usable in all kind of labs and in particular in ground analysis (i.e when the bulk milk arrives in the cheese factory) and reveal the antibiotic residues, respectively, at the level of 150 ng/g and.30 ng/g.

The most sophisticated method was the chromatographic (HPLC) with the Diode Array Detector. This appliance can reveal very low quantities of oxytetracycline, so the limit of quantification (LOQ) of the whole analytical procedure was 5 ng/g, significantly lower than the MRL (100 ng/g).

Detection of residues by screening methods

Microbial inhibitor tests with *Bacillus stearothermophilus* as test microorganism (Delvotest SP® (DSM Food Specialities) and receptor assay Snap Test® (Idexx) were used. Test procedure was according to the instructions of the manufacturers and determination of detection limits with spiked samples according to IDF Standard 183:2002. In the case of oxytetracycline, the sensitivity of microbial inhibitor tests applied is not sufficient to detect this residue at ≤ MRL concentration, whereas the receptor assay fulfils this requirement.

Determination by liquid chromatography methods

An aliquot of 5 mL of milk, precisely weighed, was added to 8.3 mL of Mc Illvaine.buffer. The mixture was shaken for some minutes and centrifuged for 15 min at 3000 rpm. 5 mL of the solution were purified by SPE using Waters Oasis HLB® 3 mL cartridge inside the ASPEC Gilson® appliance. The final extract was evaporated to dryness under stream of Nitrogen and re-suspended in 1 mL of mobile phase (methanol/acetonitrile/ aqueous formic acid 0.1%). Evaluation is via linear regression between peak areas and concentrations of mobile phase standard solutions, considering the concentration factor. The evaluated concentration was corrected by the recovery factor.

Method validation

All the determinations of antibiotic residue were carried out in our laboratory, accredited by the Italian accreditation body SINAL, and as such fully comply with the European standard UNI CEI EN ISO/IEC 17025. The three methods have been submitted to a validation process aimed at estimating their performances. The HPLC method was validated with particular regard to Limit of Quantification (LOQ) defined as the minimum level at which a quantitative determination is still possible. The laboratory takes part in the European proficiency tests for all three methods.

Results and discussion

The results confirm a considerable individual variability in the elimination rate of the antibiotic (Figure 2 and 3,). We have used the experimental model proposed by EMEA which takes in to account this situation foreseen an adequate number of animals and the statistical evaluation. In the graphic presentation, we used the same criteria as adopted by the EMEA.

Figure 2 Data set of the residues, expressed as log concentration vs time, related to one single ewe

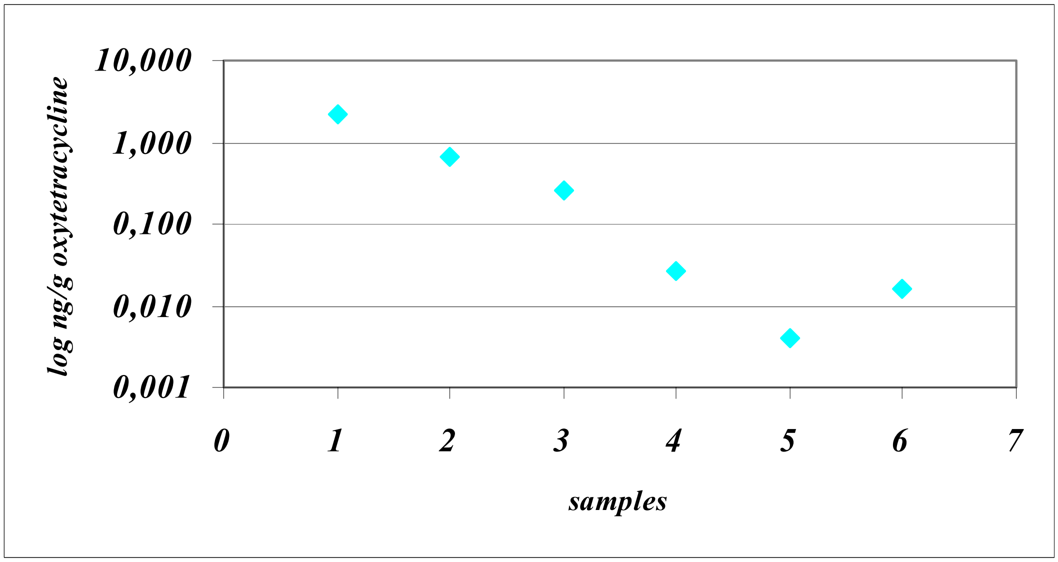


Figure 3 Data set of the residues, expressed as log concentration vs time, related to one single ewe

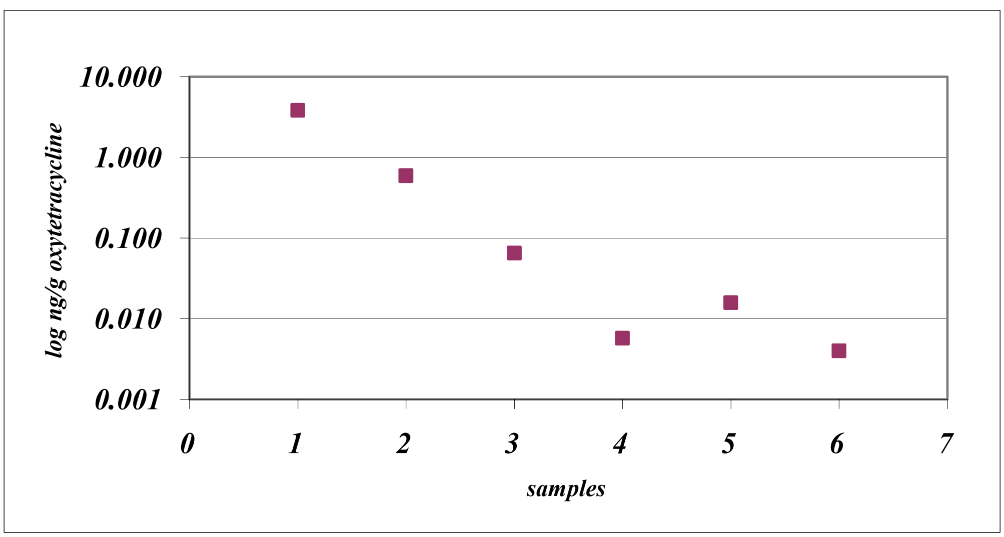
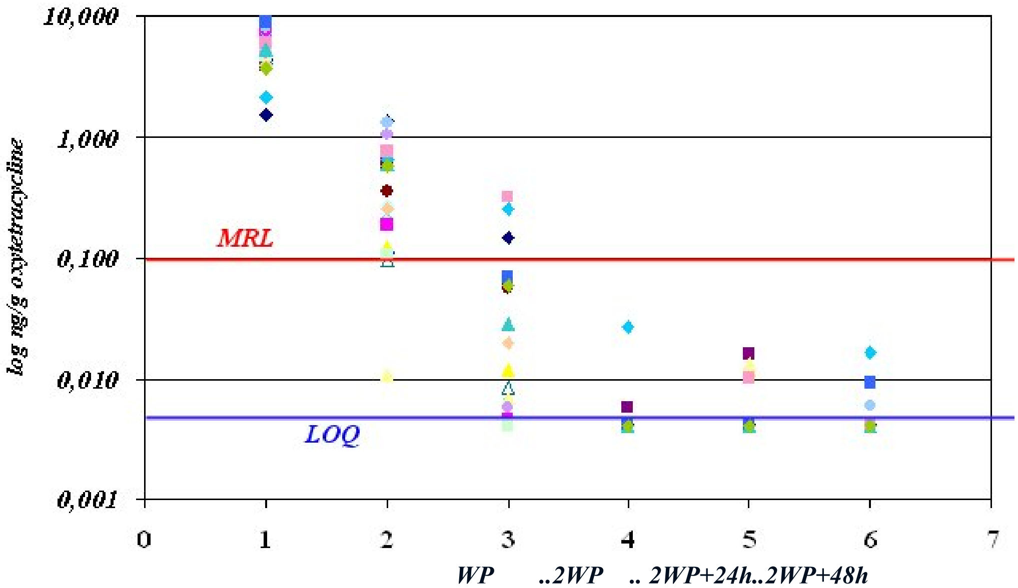


Figure 4 Data set for all the animals involved in this study, the horizontal lines mark MRL (0.1 ng/mL) and LOQ (HPLC method = 0.005 ng/mL).



The results show that antibiotic residues remain after the 2WP at a level of about 15% (Figures 5 and 6). This demonstrates that the empiric measure of doubling the WP does not fully guarantee the absence of residue. As a result, it may be necessary to reassess the actual period required to guarantee the absence of residues, following, wherever possible, the European guidelines (EMEA), at least for those molecules most used in organic farming.

Similar preliminary studies, which we have undertaken using different specialties containing the same molecule, have highlighted the same result with the presence of residues after 2 WP.

Figure 5 Percentages of.samples with residue above the.MLR, between MRL and LOQ, and below the LOQ level.

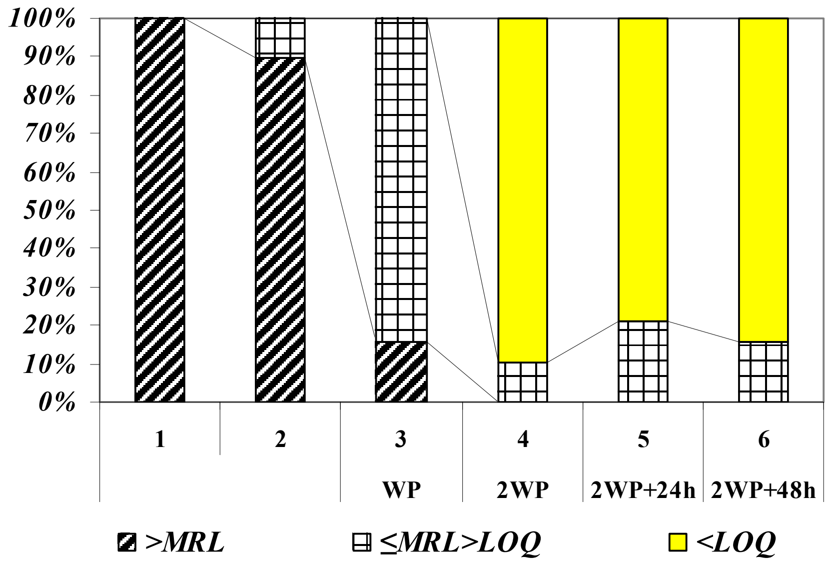
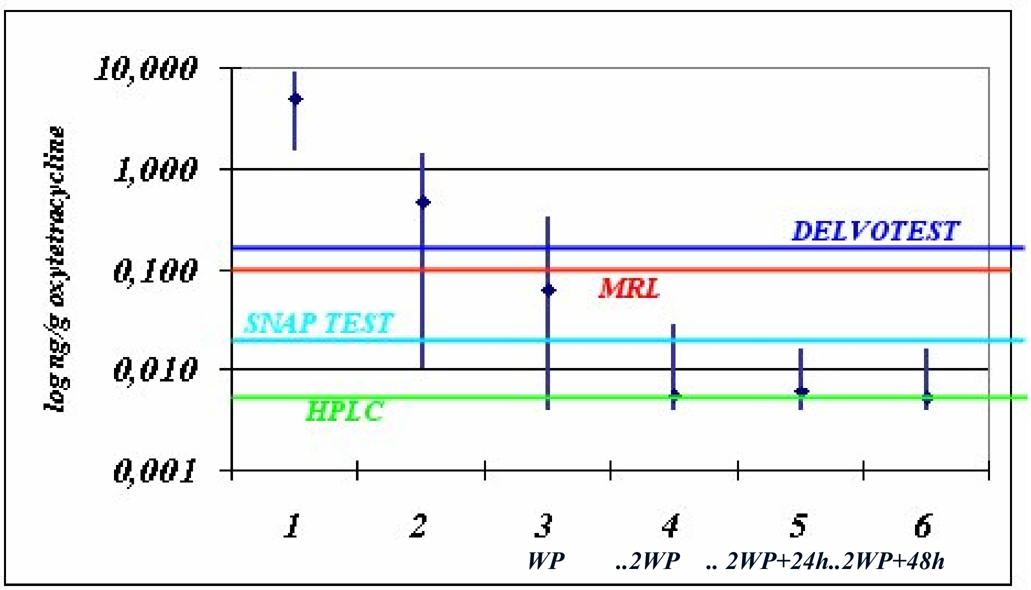


Figure 6 Mean values and related variability (max-min) of.samples; the horizontal.lines are related to MRL, LOQ for the HPLC method, sensitivity level for Delvo test and Snap test.



Thus, it is suggested that there is a real possibility that the unsuspecting organic farmer, although respectful of EU rules, may unknowingly put products containing residue on the market. Should this happen, it could affect the consumer in two ways: it could lead to a lack of understanding of the reason, and to a mistrust of organic products. However, if we assume that organic products need to be free from residue (zero residue of veterinary medicinal products), we suggest the use of Minimum required performance limit (MRPL) established at the EU level by the EC Decision 2002/657 for certain forbidden molecules. MRPL means minimum content of an analyte in a sample, which at least has to be detected and confirmed. It is intended to harmonise the analytical performance of methods for substances for which no permitted limited has been established.

If MRPL were to be adopted in the control of organic products, it would be possible to evaluate the absence of the residue on the basis of organic holistic requirements, rather than on the approach of risk assessment as is required for conventional products.

Conclusions

As it was observed from the results of our own study, the doubling of the WP is not a sufficient measure to assure the zero residue in milk when older veterinary medicinal products that do not comply with current EU legislation on residue testing are used. Because of the empirical nature of doubling the WP measure we may suppose the same could be true for other substances.

In order to guarantee the absence of veterinary medicine residues in the organic products, it would be appropriate to evaluated the WP following the EMAS guideline. Given that the MRL approach seems to be inadequate in the organic farming context, the MRPL approach should be implemented. It would allow us to establish, with great accuracy, the WP which assures “zero level” of residues. Moreover, if the MRPL approach is adopted, the use of adequate analytical methods, like the HPLC method, will become compulsory.

In order to harmonise these aspects of organic farming production, it would be necessary to find, with general consensus, the equilibrium between residue laws, public food controls, organic consumer expectations, organic farmers and certification bodies.

Acknowledgements

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Analysis of disease prevalence and medical treatments in organic dairy herds in the Netherlands

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Introduction

Health management in organic livestock production is based on the assumption that disease can be prevented by optimal breeding, feeding, housing and care of the animals (Kijlstra *et al*., 2003). In case disease does occur, the current EU regulations (2092/91) state the following:

> ” Phytotherapeutic (e.g. plant extracts (excluding antibiotics), essences, etc.), homeopathic products (e.g. plant, animal or mineral substances) and trace elements and products listed in Part C, section 3 of Annex II, shall be used in preference to chemically synthesised allopathic veterinary medicinal products or antibiotics, provided that their therapeutic effect is effective for the species of animal, and the condition for which the treatment is intended; If the use of the above products should not prove, or is unlikely to be, effective in combating illness or injury, and treatment is essential to avoid suffering or distress to the animal, chemically synthesised allopathic veterinary medicinal products or antibiotics may be used under the responsibility of a veterinarian.”

Based upon these rules, many farmers will be inclined to use phytotherapeutic or homeopathic treatments as a first line of treatment and only use conventional veterinary medicines if the alternative treatments are not effective. Correct interpretation of the EU rules, however shows that these so called “alternative” treatments can only be used if their effect has been proven for the species and for the disease the animal is suffering from. As Hammarberg (2001) has pointed out, there is insufficient scientific proof showing the effectiveness of these so-called alternative medicines. Furthermore it is not clear whether, for instance, homeopathic drugs that are currently used by organic farmers comply with EU regulations stating that these drugs should be registered (EU regulation 1992/74).

Treatment of diseased animals is regulated by local laws in many countries of the EU. According to Hammarberg (2001), veterinarians in Sweden are not allowed to use homeopathic or phytotherapeutic preparations to treat sick animals. In the Netherlands, treatment of diseased, disabled or wounded animals is governed by a local law (Diergeneesmiddelenwet) that states that any substance used to treat an animal is considered a “veterinary medicinal product”. Law protects the term “veterinary medicinal product”, and only substances that are formally registered by a special governmental agency (Bureau for the Registration of Animal Medicines; BRD) are allowed to be used. Use is restricted according to the diagnosis and species of animal involved. All substances are registered in a databank that is available via internet (www.brd.agro.nl). A special database with homeopathic products is available, allowing the use of these products in the treatment of diseased animals according to the Dutch law. The list of homeopathic products was published in the early 1990’s and has, since, not been updated. New products cannot be added and changes in the formulation or ownership of these products results in the loss of the registration. As indicated above, EU regulations and local regulations may differ as to the type of veterinary medicinal products that can be used in organic livestock farming. In view of these issues, we decided to investigate the current disease prevalence in organic livestock farming in The Netherlands and how farmers dealt with these diseased animals. The report discussed here is focussed on disease prevalence and medicinal veterinary treatment on organic dairy farms.

Methods

All organic dairy farms in The Netherlands were identified via the list of the farms, publicly available on the website of the certification and inspection body for organic producers in the Netherlands (www.skal.nl). In the month March of 2003, a total number of 438 producers enlisted as having organic milking cows were identified. We chose to only include farms (n=312) that had no other organic farming activities than dairy farming. From this list of farms, we chose farms in a random order and contacted farmers by telephone. Inclusion criteria to participate in our project included the following:

1) have at least 25 milking cows;
2) certified organic dairy farmer as from May 2002 or earlier;
3) privately owned farm; and
4) willingness to fill in an extensive questionnaire and allow an inspection visit on the farm.

The farmers were randomly contacted by telephone, until 30 farms conforming to the selection criteria were selected. To obtain this number we had to contact 43 farms. Six farms had stopped with organic dairy farming, 4 did not have enough time to participate, 2 were unwilling and 1 farm had less than 25 cows.

The study was undertaken in the months April and May in 2003 and the questionnaire dealt with farm data of the previous year (2002). The questionnaire included six main parts, dealing with general data of the farm, details of the herd, feeds, hygiene, disease and treatment registration and the encountered diseases and actual treatments.

Veterinary medicinal products were divided into “regular” and “alternative” products. Regular products were those that were formally registered as a veterinary medicinal product by the BRD. Although, for instance, peppermint ointments (Cai pan) has a formal BRD registration, we included this product under the heading of “other alternative” medicine. Alternative medical products included homeopathic and phytotherapeutic products. Under the heading of “other” alternative therapies we included remedies such as massage with peppermint ointments, and the use of natural soap, salt or acetic acid.

Results

Description of participating farms

The participating farms had been certified as organic dairy farms for a mean number of 5.5 years, with a range between 1 and 17 years. The mean number of milking cows amounted to 60 animals and the mean farmland area was 53 hectares. Seven farms had only one type of breed, four had only Holstein Frisian (HF) and three had only the Maas-Rijn-IJssel breed (MRIJ). Most farmers had several breeds or a mix of breeds on the farm. The HF breed was the most frequently encountered (61%), followed by MRIJ (19%) and FH (5%). Some farms had Brown Swiss (5 farms), Jersey (2), Montbeliarde (2), Blaarkop (1) or Belgian Blue (1). Mixed breeds mainly originated from HF or MRIJ.

All farms were associated with the two quality assurance programs in The Netherlands (IKB and KKM). Most farms participated in various disease prevention and control programs, such as leptospirosis (30 farms), Bovine Herpes virus type 1 (13), Bovine Viral Diarrhoea BVD (7), paratbc (7) and salmonella (6).

Of the 30 farms, 23 removed the horns from the calves. This was carried out between 3 and 10 weeks of age.

Treatment prevalence in the participating herds
Treatment prevalence was scored as number of animals treated by the farmer for a certain disease during the year 2002. In certain cases, this included animals treated with antibiotics in the dry period for mastitis prevention or herd treatment in case of parasitic disease.

As is evident, from Table 1,clinical mastitis treatment was the most frequently treatment type encountered. All farms, apart from one, had treated animals for clinical mastitis. The farm that had not treated cows for mastitis was a small farm with 30 MRIJ milking cows. The number of animals treated is skewed due to the fact that, on one large farm (190 cows), all animals were preventively treated with antibiotics during the dry period. According to EU regulations preventive treatments are not allowed and hence this farmer is not working according to these regulations.

Table 1 Numbers of different animals treated for reported conditions in 30 Dutch organic dairy herds.

Disease	Total number of treated animals
Clinical mastitis	737
Claw disorders	615
Gastrointestinal/lung worms	464
Fasciola hepatica	216
Subclinical mastitis	166
Calves diarrhoea	149
Endometritis/Uterine infection	147
Milk fever	142

Treatments for claw and leg problems were frequently encountered, followed by treatments for parasitic diseases. Most parasitic treatments were seen in young animals, with the exception of liver fluke treatments. The numbers of animals treated for parasitic diseases was high, as most of these treatments were group treatments, without evaluating disease status in individual animals. The list of disease treatments, shown in Table 1, is not exhaustive; only major disease treatments are listed. One should also keep in mind that the list is based on retrospective answers of the farmers and was not checked with the veterinary service of the farm.

Treatment types
Most farms (29) indicated that they had used regular veterinary medicinal products in the treatment of their animals (Table 2). On three farms, only regular products were used. The other 27 farms used alternative products, of which 17 used homeopathic products, 1 used phytotherapy and 22 used various alternative types of treatments.

In total, we recorded approximately 157 different products that were used to treat diseased animals. Of these products 57% were regular veterinary medicinal products and 43 % belonged to the category “alternative” products. Although many of the regular products have different brand names, they often contain the same generic substances.

Table 2 Types of treatment categories in 30 Dutch organic dairy herds.

Regular	Homeopathy	Phytotherapy	Others	Number of farms
+	+	-	+	17
+	-	+	+	1
+	+	-	-	5
+	-	-	+	3
+	-	-	-	3
-	-	-	+	1
				30

Table 3 shows the most often used regular and alternative products, sorted according to the number of farms using the product. A registered Calcium Magnesium infusion preparation was used by many farmers to treat cows with milk fever. The second most used product was Avuloxil (Amoxicillin and clavulic acid), which was used to treat clinical mastitis. Excenel RTU (ceftiofurhydrochloride) is an antimicrobial agent that was used by many farmers to treat claw problems. Delvomast MC (Streptomycin and Nafcillin) was used to treat clinical and subclinical mastitis. Nine farmers used afterbirth capsules containing oxytetracycline to treat uterine infections and the retention of afterbirth. Of the alternative products, Cai pan (peppermint preparation) was the most often used product (12 farmers). The second most used product was Mamil phyt plus, which was also used to treat mastitis. Lachesis compositum was used by 5 farmers for indications such as clinical mastitis, uterine infectionss and skin cancer. Calcarea carbonica (n=4) was used to treat milk fever. Calcarea phosphorica (not shown in the table) was used by three farmers to treat diarrhoea in calves.

Table 3 The most often used veterinary medical products in 30 Dutch organic dairy herds.

Regular product	Number of farms	Alternative product	Number of farms
Ca-Mg-infusion	20	Cai pan (uddermint)	12
Avuloxil	14	Mamil Phyt Plus	6
Excenel RTU	14	Lachesis Compositum	5
Delvomast MC	9	Calcarea Carbonica	4
Afterbirth Capsule	9	Uterale	4

Table 4 shows the ten mostly used regular products for the treatment of clinical mastitis on the organic dairy farms investigated. Some products have different brand names but have a similar composition (generic names).

Table 4 Top ten regular veterinary products used to treat clinical mastitis in 30 Dutch organic dairy herds.

Products used	Generic name/ingredient	Number of farms using product
Avuloxil	Amoxicillin; clavulic acid	14
Delvomast MC	Streptomycin; Nafcillin	8
Mamyzin	Penethamate hydriodide	8
Cobactan	Cefquinome	8
Dofatrim-ject	Sulfamethoxazol ; trimethroprim	5
Albiotic formula	Lincomycin; neomycin	3
Finadyne	Flunixinum megluminum	2
Diatrim	Sulfamethoxazol ; trimethroprim	2
Pathozone	Cefoperazone	2
Nafpenzal	Streptomycin; Nafcillin	2

Of the alternative products used, Cai pan and other mint ointments were widely used among farmers to treat cows with mastitis (Table 5). Cai pan is an ointment based on an extract from the plant Mentha arvensis and is formally registered in The Netherlands for the treatment of this condition in cows.

Table 5 Top ten alternative medicines used to treat mastitis

Alternative product	details	Number of farms using product
Cai-Pan/and other mints	peppermint	16
Mamil Phyt plus	Homeopathic/phytotherapy?	6
Mammicurine	homeopathic	3
Traumeel	homeopathic	2
Lachesis	homeopathic	2
Mastex	homeopathic	2
Nosode	homeopathic	2
Bryonia	homeopathic	2
Tigerbalsem	phytotherapy	2
Lava powder	?	1

The most often used (6 farms) homeopathic product for mastitis was Mamil phyt plus. According to the manufacturer this product contains the following ingredients: Phytolacca Decandra D1, Calendula officinalis MT, Apis mellifica D3, Belladonna D1, Echinaceae purpurea D1, Hepar Sulfur D8 and Myristica D1. The notation D1 and D3 indicates (the number of repeated) decimal dilutions of the original extract (1/10 and 1/1000, respectively) and MT indicates the original extract (Mother Tincture). As is evident, some of the ingredients in this ointment are quite concentrated and it is the question whether this product should not be considered a phytotherapeutic product.

Discussion

This study shows that udder health, claw disorders and parasitic infections are the most frequently treated conditions on Dutch organic dairy farms. As yet limited studies are available addressing the management of animal health on organic livestock farms (Kijlstra *et al* 2003; Hovi *et al* 2003). The health problems treated on the organic dairy farms were similar to those reported earlier in Germany by Krutzinna *et al* (1996). These investigators reported that the main problems in descending order were mastitis, fertility disorders and hoof diseases, whereas metabolic disorders such as acetonaemia and milk fever were infrequently observed. Studies carried out in the UK reported a higher incidence of dry period mastitis and subclinical mastitis in organic dairy herds, as compared with matched “conventional” herds (Hovi *et al* 2003). As yet little attention has been paid to parasite problems in organic herds. Since the prophylactic use of antihelminthics is not allowed in organic livestock production, management of parasite infection may be a problem. A high incidence of lung worms (*Dictyocaulus viviparous*) was recently reported in organic calves (Hoglund *et al*, 2001). It should be noted that the treatment prevalneces reported in this study were based on enquiries of the farmers and were not verified by the veterinary practitioners. On the other hand, we chose to include farms that only had dairy production activities, suggesting a high degree of stockmanship and involvement by the farmer.

We found that 157 different products were used to treat various health disorders, of which approximately 40% belonged to the “alternative” category. These data are similar to the findings of Krutzinna *et al* from 1996 who noted that approximately 50% of treatments used in organic dairy herds in Germnay were conventional veterinary products. European regulations for organic livestock farming discourage the use of regular veterinary products by prohibiting preventive use, by restricting the number of treatments within a certain time period and by doubling the normal withdrawal period for products following their use. Despite this discouragement, most Dutch organic dairy farmers include regular veterinary medicinal products in the health management of their herds. An important argument for farmers to use regular drugs stems from the fact that the effectiveness of many of the alternative products has not been demonstrated, and many of the veterinarians involved in the care of the animals are reluctant to use these drugs (van Sluis; 2004). Part of the Dutch association of veterinarians is even inclined to remove homeopathic veterinarians from its organization. The (only) Faculty of Veterinary Medicine in the Netherlands, at the University of Utrecht, has stated that it will not include “alternative” therapies in its teaching curriculum.

Many organic farmers, however, are disappointed in the practice of “regular” medicine and are, therefore, seeking new methods to prevent or treat diseases in their herds. Here, a dilemma is formed by the fact that farmers want to produce sufficient milk to earn a living and, therefore, tend to continue to use breeds with a high production level. It has been suggested that these breeds may not be optimally suited for organic dairy farming due to, for instance, the regulations on feed composition (restricted supplements and restricted use of synthetic vitamins) and source of the feed for the animals (Hovi *et al* 2003). Recent surveys on Dutch organic dairy farms have indicated that changes in management may play an important role in the prevention of mastitis (Jelsma and Kloeze, 2004). Stepwise logistic regression analysis showed that mineral supplementation, frequent replacement of liners of the milking machine, refraining from homeopathy and not using automatic cluster removal systems were positively correlated with healthy udders (Jelsma and Kloeze, 2004).

It is obvious, from our study and also from data reported by others (Hovi *et al*. 2003), that there are still serious problems concerning the animal health situation on a number of organic dairy farms. Farmers should not be encouraged to use treatments that have not been proven to be effective and more emphasis should be given to preventive strategies involving animal husbandry methods, the use of appropriate breeds and the nutrient requirements of the herd. Introduction of health management plans and continuous monitoring of animal health on the farms may be instrumental in pointing out the optimal conditions needed for organic dairy farming. In view of the growing wish to reduce the use of antibiotics, scientists and pharmaceutical industry should set up studies to investigate the effectiveness of alternative veterinary products. In view of the presence of very potent antibiotics on the market, both the application of preventive strategies as well as the use of alternative veterinary products can only be stimulated if the use of certain antibiotics is further restricted. Such a policy should be carefully followed since inappropriate treatment of diseased animals can be in a conflict with animal welfare. In this respect, further monitoring of animal health problems on organic livestock farms and the evaluation of the medicinal treatments on these farms may provide valuable information for organic as well as general animal husbandry.

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Is Orbeseal® - an internal teat sealant - the answer to mastitis problems in organic dairy herds?

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Introduction

In addition to fertility problems, mastitis is a major animal health problem on organic dairy farms. A lot of therapeutics, mostly conventional, are used for this indication. Losses due to lower milk production, treatment costs and replacement costs are enormous. Furthermore, the regulations for organic farming favour complementary therapies over the use of antibiotics or other chemical-synthetic drugs. Consequently, a non-antibiotic teat-sealer, with a trade name of Orbeseal® (Pfeizer) could be a solution to udder health problems in organic farming.

Dry period mastitis a problem

More than 50% of clinical mastitis cases have their origin in the dry period (Bradley, 2000; Todhunter, 1991). According to Dingwell (2003), more than 50% of the cows have open teat-ends at the end of the first week of the dry period and 23% after 6 weeks. In this early dry period of open teat ends, mastitis pathogens can enter the teat canal and an infection develops in the udder tissue. This could also be a result of a breeding strategy, which has preferred cows with a high milk flow and a weak teat canal sphincter. The development of a teat-sealer was an approach to deal with these problems. The teat-sealer closes the teat duct at drying off. Two kinds of teat-sealer have been generated, an external and an internal one. The external teat-sealer, which covers the teat end like a second skin, could not be implemented successfully, due to insufficient adhesion at the teat end.

Orbeseal® - a solution?

The internal teat-sealer, Orbeseal®, consists of 65% bismuth subnitrate and the remaining 35% are paraffin wax, aluminium-hydroxid-distearat and siliciumoxid. At drying off, Orbeseal® is applied intramammarily and forms a physical barrier in the teat end (Berry and Hillerton, 2002). It remains in the udder over the dry period and, after calving, is milked out. But frequently, the removing of this chewing gum like substance lasts several milkings. According to Berry and Hillerton (2002, flecks of teat seal in the foremilk were reported for up to three weeks after calving. There is a possibility that these flecks are confused with clinical signs of mastitis.

Studies of the application of Orbeseal® show lower new intramammary infections after calving than in the untreated control group and also better results than after use of long-acting antibiotics at drying off (Berry and Hillerton, 2002; Woolford *et al*., 1998; Huxley *et al*., 2002; Godden *et al*., 2003). In a new Swiss study, the Orbeseal® treated group shows no difference comparing to the untreated control group in the CMT results after calving, even though there are more quarters infected with coliforms after calving than in the untreated control group (Schaeren and Maurer, 2005; see a poster presentation in these proceedings).

Potential problems?

Based on our experiences with Orbeseal®, we also consider the application of the sealant to be problematic. In case Orbeseal® enters accidentally the milking system, surfaces of pipes and clusters will be clotted with it. Leaky sealing and loosing of the teat-sealer plug are also described in practice with Orbeseal®. Furthermore, inorganic bismuth compounds, including bismuth subnitrate, are used orally in veterinary and human medicine for their antacid action and for their mild astringent action in gastrointestinal disorders (EMEA 1999). The half-life period for the substance in humans is described between minutes and several years (Slikkerveer and de Wolff, 1989). Different side effects in human therapies with bismuth have been described, such as mathaemoglobinaemia, encephalopathy, nephropathy, stomatitis and colitis (Nigam *et al*., 1991; Loiseau *et al*., 1976). Between 1974 and 1976, more than 100 cases of iatrogenic encephalopathy due to ingestion of bismuth, taken for the treatment of chronic digestive disorders, have been reported in France. The levels of bismuth in the blood and urine in these patients were between 10 and 100 times as high as those in patients who had taken the same treatment without ill effect (Loiseau, 1976). Studies in rats showed that the acute toxicity of bismuth was enhanced when bismuth was given as a complex with cysteine. The increase in the concentration of thiol compounds, like cysteine, in the gastrointestinal tract arising from food, or more probably from microorganism synthesis, could be an explanation for human encephalopathies (Chaleil *et al*., 1981).

On organic dairy farms, calving often happen without immediate interference by the herdsman. For the health of the calf, it is important that it suckles a minimum of 2-3 litres of colostrum in the first 12 hours after birth. This colostrums intake is very important for a sufficient immunity in calves (Rademacher, 2003). Unless the cow is hand-milked, to remove the teat sealant before the calf suckles for the first time, we have to assume that the calf ingests the whole or a part of the administered teat-sealer and, with that, it also receives bismuth subnitrate. The producer of the Orbeseal® presumes, in their accompanying literature, that both with humans and with animals bismuth will be ingested only in traces (<1%), but there are no pharmacokinetic or residue data available in target animals after oral use of bismuth subnitrate (EMEA, 1999). Animal experiments in rats described a bismuth accumulation mainly in the kidney, followed by bone, red blood cells and the lung (Dresow *et al*., 1991). A further problem is the increased permeability of the intestine in calves during the first 24 hours. Base on this information, it is possible that the absorption of bismuth in new born calves is higher than the absorption in adult rats, mice or humans, which have been the basis for decision for EMEA.

A further, ecological problem could be the waste management of bismuth in milk, if the milked teat-seal is deposited in the liquid manure. - For these reasons, it is suggested that studies of Orbeseal® use in organic farming are carried out to establish the impact of such use on humans, animals and the environment.

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Posters:

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The use of an internal teat sealant, Orbeseal®, as a preventive measure for the dry cow period

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Introduction

Udder infections still are one of the most important problems in milk production. This is also true for organic milk production (Rösch, 2004). Many investigations have shown that the dry period has an important influence on the mastitis situation in the following lactation. One of the measures to protect the udder from infection during the dry period is the application of antibiotics for dry cow therapy and prevention (Williamson *et al.*, 1998). However the preventive use of antibiotics is prohibited in organic production. Therefore, internal teat sealants without antibiotics could be an alternative in preventing new intramammary infections during the dry period (Huxley *et al.*, 2002).

Materials and methods

A total of 542 cows on 29 farms were included in the study. Three different procedures at drying off, i.e. dry cow prophylactic treatment with antibiotics, no dry cow prevention and an internal teat sealant, Orbeseal, were compared. Approximately one half of the cows on each farm were treated with Orbeseal and the remaining cows according to the procedure commonly used on the corresponding farm. The assignment of the cows to the different procedures was left to the farmers.

Maximally two weeks before dry off, milk production advisors checked the udder health of each quarter. All quarters showing a positive California Mastitis Test (CMT) result (≥ +) were sampled aseptically for bacterial culture.

Within three weeks after calving the cows were checked again. From all quarters with a CMT score ≥ + milk samples were collected aseptically and examined for udder pathogens according to the guidelines of the NMC. Finally, data of a total of 527 cows, 2096 quarters (bacteriological analyses) and 2101 (CMT scores) could be included in the evaluation.

Results

In 88.5% of the cases, the CMT scores were considered to be equal or lower after the dry period then before the dry period (Table 1). The percentage for quarters treated with Orbeseal was 86.5%, for quarters treated with antibiotics 93.4% and for quarters without any treatment 88.9%. It is notable that significantly more inflammed quarters (CMT ≥ ++) were dried off with antibiotics (43.0% instead of 20.2%) than with Orbeseal (46.2% instead of 54.2%) or without any preventive treatment (10.8% instead of 25.6%). Healthy quarters (CMT ≤ +/-) were assessed to be inflammed after the dry period in 15.1%, 8.5% and 13.1% of the cases with Orbeseal, antibiotics or without any treatment, respectively.

Table 1 Comparison of CMT results before and after dry period

Treatment (nb. of cows)		CMT score after the dry period (nb. of quarters) lower		equal		higher		total	
Orbeseal	all quarters	244	21.4%	741	65.1%	154	13.5%	1139	54.2%
(285)	healthy quarters [1)]	7	0.8%	699	84.1%	125	15.1%	831	55.6%
	inflammed quarters [2)]	104	89.6%	11	9.5%	1	0.9%	116	46.2%
Antibiotics	all quarters	185	43.5%	212	49.9%	28	6.6%	425	20.2%
(107)	healthy quarters	4	1.8%	191	89.7%	18	8.5%	213	14.3%
	inflammed quarters	94	87.0%	10	9.3%	4	3.7%	108	43.0%
No treatment	all quarters	76	14.1%	401	74.7%	60	11.2%	537	25.6%
(135)	healthy quarters	0	0.0%	390	86.9%	59	13.1%	449	30.1%
	inflammed quarters	24	88.9%	3	11.1%	0	0.0%	27	10.8%
Total	all quarters	505	24.0%	1354	64.5%	242	11.5%	2101	100%
(527)	healthy quarters	11	0.8%	1280	85.7%	202	13.5%	1493	100%
	inflammed quarters	222	88.4%	24	9.6%	5	2.0%	251	100%

[1)] CMT score before dry off ≤ +/- *[2)] CMT score before dry off ≥ ++*

Quarters dried off with Orbeseal or without any treatment showed higher percentages of infections by streptococci after calving than at dry off (3.7% vs. 7.6% and 5.3% vs. 9.7%). Inversely, percentages of infections with streptococci declined from 9.5% to 3.8% in quarters dried off with antibiotics and of samples where no bacteria could be isolated increased from 18.6% to 35.8% (Table 2). Percentages of infections with *Staphylococcus aureus* slightly increased in all groups, with no clearly evident trend for one dry off procedure.

Cases of clinical dry cow mastitis were recorded by the farmers in three quarters of three cows treated with Orbeseal, three quarters of two cows treated with antibiotics and one quarter of a cow with no treatment.

Conclusions

The comparison of the three preventive measures showed that Orbeseal

- offers a good protection against new infections in healthy quarters, even though slightly less effective than antibiotics;
- did not led to an increased number of cases of clinical mastitis during the dry period;
- can prevent milk leaking;
- was removed easily in most cases after calving (in few individual cases, possibly in cows with very short teats, residues of Orbeseal were excreted during an extended period); and
- is inferior to antibiotics in cases of existing udder infections by streptococci.

Table 2 Results of microbial examinations of milk samples from quarters with CMT scores ≥ +

	Treatment at dry off											
	Orbeseal				Antibiotics				No treatment			
Nb of cows	285				107				135			
Bacteria isolated	at dry off		after calving		at dry off		after calving		at dry off		after calving	
Streptococcus spp.	14	3.7%	31	7.6%	21	9.5%	4	3.8%	6	5.3%	16	9.7%
Staphylococcus aureus	9	2.3%	17	4.1%	13	5.9%	7	6.6%	4	3.5%	8	4.8%
CNS [1)]	157	41.0%	156	38.0%	75	34.1%	38	35.8%	54	47.8%	57	34.5%
Coryne-bacterium spp.	113	29.5%	78	19.0%	64	29.1%	12	11.3%	27	23.9%	24	14.5%
A. pyogenes			1	0.2%								
No growth	70	18.3%	102	24.9%	41	18.6%	38	35.8%	20	17.7%	55	33.3%
Coliforms		0.0%	3	0.7%	2	0.9%	2	1.9%		0.0%	1	0.6%
Other organisms [2)]	20	5.2%	27	6.6%	6	2.7%	6	5.7%	4	3.5%	6	3.6%
No sample			5	1.2%	2	0.9%	1	0.9%	2	1.7%	2	1.2%
Not tested	757	66.4%	725	63.6%	206	48.1%	321	75.0%	425	78.7%	373	69.1%
Total	1140	100%	1140	100%	428	100%	428	100%	540	100%	540	100%

[1)] *Coagulase-negative staphylococci*
[2)] *mixed flora, Bacillus spp., Proteus spp., Pseudomonas spp.*

On farms with insufficient udder health, the use of dry cow antibiotics still belongs to the recommended measures during the sanitation period. In contrast, under normal circumstances, blanket dry cow therapy cannot be recommended for Swiss dairy farms. We recommend selective dry cow therapy, i.e. cows with an existing udder infection or at high risk (e.g. animals with damaged teats) should be dried off with antibiotics, healthy cows at medium risk (e.g. suffering from milk leaking, still at high milk production) are dried off with an internal teat sealant and healthy cows at low risk can be either dried off with an internal teat sealant or without any special preventing measure at all.

Acknowledgments

We would not have been able to perform this study without the help and collaboration of the milk production advisors Hans Baumann, Andreas Vogel, Max Waldburger, Hans Wüthrich and the cooperation of the farmers. In addition, we gratefully acknowledge Alois Tschopp, Pfizer AG, for providing the Orbeseal injectors.

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Health and welfare in organic animal rearing in Spain: what do the veterinarians who advise organic farms say?

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Introduction

Organic livestock rearing is a sector that has grown markedly in recent years in Spain. However, the development has been very slow compared to other organic production (MAPA, 2003). Furthermore, very few studies have been carried out to assess health and welfare of organic livestock. The studies that exist describe the structure of organic livestock farms (García Trujillo, 2001), or described the productivity of some specific systems, such as beef and sheep production (García Trujillo, 2002; Eguinoa, *et al* 2002; García Torres, *et. al* 2002, García Trujillo, *et al.,* 2003). The works of García-Menacho in Valencia (García-Menacho *et al*., 2003; García-Menacho and Rivas, 2002) and García Trujillo *et al.* 2003, make reference to incidence of some illnesses in organically reared poultry, rabbits and sheep.

This paper describes the results of a questionnaire study of Spanish veterinarians who work with organic livestock enterprises.

Methodology

A surveys of veterinarians who advise organic livestock producers in different parts of Spain was carried out. The survey focused on the different symptoms observed and the treatments used and on the preventive measures taken to keep animals healthy. The veterinarians were asked to quantify and describe levels of illness and disease in a semi-quantitative way (see Table 1) and to compare it with their experience with conventional systems regionally. The veterinarians were also asked to quantify the effectiveness of treatments and disease prevention by using a qualitative range (very well, well, regular and bad).

Table 1 Numeric value assigned to the qualitative classifications of illnesses incidence and comparison of organic with conventional ones.

	High	Medium	Low	Null
Morbidity	1	2	3	
Mortality	1	2	3	4
Relationship between organic with the conventional one	>	=	<	
Value	1	2	3	

A total of seven veterinarians, working with approximately 1,500 organic sheep/goats, 1,160 organic dual purpose cattle, 17,700 organic layers and broilers and other species, like rabbits, all organic. On average, each veterinarian dealt with approximately 20 organic production units. Most organic units involved with the interviewed veterinarians were extensive, particularly the ruminant units that utilised extensive, all-year-around grazing and autochthonous breeds. Most dairy cows were Friesian and all, apart from one, poultry systems were free range.

Results

Main diseases

Adult cattle. Classification of incidence and severity of the most important diseases the veterinarians had encountered in organic, adult cattle is presented in Table 2.

Table 2 Classification of incidence and severity of the most important diseases the veterinarians had encountered in organic, adult cattle, as perceived by veterinarians who work with organic herds (N=number of respondents).

Illness	N	Morbidity (1)	Mortality (1)	Relationship with conventional (2)
Mastitis	4	2.75	4	2.5
Respiratory diseases	2	3	3	2.5
Liver fluke	1	2	3	2
Symptomatic Carbunco	1	3	1	2
Placenta retentions	1	3	4	3
Milk fever	1	3	4	3
Lameness	1	2	4	3

(1) Morbidity: 1 = high; 2 = medium; 3 = low. Mortality: 1 = high; 2 = medium; 3 = low; 4 = null
(2) relationship organic/conventional:> = 1; same = 2; < = 3

Young ruminants. The main problems that veterinarians found in the young ruminants were diarrhoea, parasites and respiratory diseases. The results are presented in Table 3.

Table 3 Classification of incidence and severity of the most important diseases the veterinarians had encountered in organic, young ruminants (calves, lambs and kids), as perceived by veterinarians who work with organic herds/flocks (N=number of respondents).

Illness	N	Morbidity (1)	Mortality (1)	Relationship w. conventional (2)
Diarrhoeas	3	2.33	3.33	2.33
Parasitism	1	2	3	1
Pneumonia	1	3	4	3

(1) Morbidity: 1 = high; 2 = medium; 3 = low. Mortality: 1 = high; 2 = medium; 3 = low; 4 = null
(2) relationship organic/conventional: > = 1; same = 2; <= 3

Poultry. Coccidiosis, feather pecking and viruses, like pock, were considered to be the main problems in organic poultry units. For coccidiosis, a medium morbidity, null mortality and smaller incidence than in conventional units was reported. Feather pecking was reported in housed flocks 4sqm/hens, but not on grass. Feather pecking was reported with medium morbidity, low mortality and as a greater problem than in conventional units.

Treatments used on organic farms

Adult cattle. The most common treatment appeared to be homeopathy in combination with conventional veterinary treatments. Both homeopathy and teat sealants for dry period protection were considered successful in mastitis therapy and prevention. Results are presented in Table 4.

Table 4 Treatments and their perceived effectiveness for different conditions in adult cattle, as perceived by seven Spanish veterinarians.

	Treatments	Efficacy
	Homeopathy	Good
Mastitis	Sealed nipples to the drying with ointment antibiotic	Good
Pneumonia	Homeopathy	Very good
	Homeopathy + antibiotic	Good
Placenta retention	Antibioterapy + antiinflamatory	Very good
Milk fever	Ca intravenous	Very good
Lameness	Disinfectant local treatment	Regular

In the case of the goats in humid areas, it was felt necessary to deworm the animals every year (Hapasil or Abendazol.) This practice is also continued by organic cattlemen rearing sheep in Extremadura (Grueso and García Trujillo 2001); although in Andalusia the majority organic ruminant breeders did not use anthelmintics. The management techniques and preventive treatments that were recommended for organic adult cattle by the interviewed veterinarians are presented in Table 5.

Table 5: Management techniques and preventive treatments to control disease and promote health in adult cattle, as recommended by 7 Spanish veterinarians.

Illness	Management technique/preventive treatment	Efficacy
	Isolation of sick animal	Very Good - Good
Mastitis	Hygiene and take care during the milking	Very Good - Good
	Carefully dry	Good
	Antibiotic ointment at drying	MB
Placenta retention	Bulls selection that give normal calves	MB
	Corporal condition control	MB
Milk fever	Preventive treatment with injectable Ca to high risk animals	MB
Lameness	Hoofs functional arrangement annually	Regular
Pneumonia	Animal isolation in appropriate lodgings	Not inform
Liver flukes	Grass rotation	Regular
	Selection for resistance	Not inform

Young ruminants. The preferred treatments and disease control techniques for the main problems in young ruminants and the veterinary perceptions abut their efficacy are presented in Tables 6 and 7.

Table 6 The preferred treatments for the main problems in young ruminants and the veterinary perceptions abut their efficacy.

Illness	Treatment	Efficacy
Diarrhoeas	Oral rehidration plus kaolin plus natural lactic flora	Very Good
	Homeopathy	Good
	Homeopathy + fluid therapy	Regular
Pneumonia	Homeopathy	Very Good
Parasitism light	Homeopathy	Good
Parasitism sharp	Conventional Antiparasitic	Good

Table 7 Management techniques and preventive treatments to control disease and promote health in young ruminants, as recommended by 7 Spanish veterinarians.

Illness	Management technique/preventive treatment	Efficacy
Diarrhoea	Animal isolation	Regular
	Supply appropriate quantity of colostrums	Regular
	Good hygiene in stable	Very Good
	Feeding control	Good
Parasitism	Increase rotation	Regular

Poultry. The veterinary perceptions about the treatments and management practices used in organic poultry flocks are presented in Table 8.

Table 8 Treatments and managements practices applied to birds in organic flocks and the veterinary perceptions about their efficacy.

Illness	Treatment	Effectiveness
Coccidiosis	Homeopathy	Very Good
	Acidification of drinking water	Good
Feather pecking	ClNa in drinking water	Very Good
Respiratory syndrome	Homeopathy	Very Good
Deficiency	Natural Supplements	Very Good
Pock	Vaccination	Very Good

Veterinary perceptions on what limits and what should promote animal health in organic livestock systems

Ruminants. Among the aspects that were seen to limit animal health and welfare in organic systems were:

- High production levels in some milking breeds;
- Difficulty in transforming old buildings and facilities to meet the requirements of the animals and the organic standards;
- Proximity to non-organic herds and flocks; and
- Difficulty in treating some sporadic illnesses in organic animals due to the strict organic limits on conventional veterinary medicinal use.

Among the recommendations that were made to promote animal health were:
- Selection of more resistant and locally suited breeds;
- Establishment of better understanding of health status and better surveillance in herds/flocks, use of diagnostics;
- Avoidance pf changes in feeding;
- Provision of adequate space and ventilation in buildings; and
- Maintenance of appropriate body condition.

Poultry. Among the aspects that were seen to limit animal health and welfare in organic poultry systems were:
- Inappropriate bird densities;
- Poor disinfection and cleaning; and
- Poor ventilation of buildings.

Among the recommendations that were made to promote animal health were:
- Reduction of bird densities further down than the current organic standards;
- Management of poultry in small units (smaller than 400 birds in a flock) to avoid feather pecking;
- Improvement of insulation and ventilation of housing;
- Ensure dry bedding;
- Stimulation to encourage full use of the range; and
- Appropriate temperature control for very young birds.

Discussion

While the sample of veterinarians interviewed was small, they all had substantial experience in dealing with organic livestock units and their perceptions on the most important disease types in the different production systems correspond well with findings by others who have carried out similar investigations in organic livestock systems in other European countries (Hovi and García Trujillo, 2002). For instance, mastitis appears to be the only serious disease problem in adult cattle, as reported by others (Hovi and Roderick, 1996). In small ruminants, parasitism is perceived as the only real problem by the interviewed Spanish veterinarians. This coincides with findings by others (Roderick and Hovi, 1999; Svenson, et al., 2000; Ketinge, 1996). However, we should expect lower parasitism incidence in the dry south than humid north of Spain.

The most frequently problems in poultry reported by the Spanish veterinarians (coccidiosis and feather peaking) appear to be less severe than those reported in organic flocks in the northern European countries (Thamsborg et al. 2004). The dry and hot/warm Spanish climate and extensive use of range may be the reason

In spite o the small sample size, the group of veterinarians interviewed presented different approaches to treatments used in organic systems: some were more willing to consider homeopathy than others and, subsequently, found the treatment issues easier on organic farms than the colleagues who only resorted to conventional veterinary medicinal products. However, the veterinarians who were not interested in homeopathy were keen to promote alternative management and prevention techniques instead. This tendency may, in fact, be preferable to the tendency of replacing conventional medicine with alternative medicine, at the expense of introducing better management and focusing on prevention. This dichotomy is seen as an area where further research is needed. Also, it is suggested that the veterinary training should address this issue more explicitly than it does at the moment.

Internal parasitism in young ruminants was perceived as the greatest problem from the veterinary point of view and appeared to lead to most routine treatments in the systems examined. Parasitism in young ruminants and its sustainable control have been identified as a problem in organic systems widely in Europe (Thamsborg *et al.* 2004). Thamsborg *et al.* (2004) outline a series of alternative control techniques and management measures, such as plants with antiparasitic properties, biological control, animal selection for resistance and feeding and grazing techniques, that could be used, but point out that these are still not sufficiently developed to be adopted by the organic stockmen. However, the experience of several organic stockmen in Spain suggests that reduced stocking densities and good grazing management allows sufficient control of parasites without veterinary medicinal inputs (García Trujillo *et al.* 2003).

On the whole, the Spanish veterinarians with experience in organic herds and flocks did not perceive animal health problems to be greater or more severe in organic than in conventional systems and, indeed, considered some major problems to occur at lower levels in organic than in conventional systems. The veterinarians also appeared to have a good grasp of alternative management techniques to control disease and promote health. This was particularly apparent with the veterinarians who dealt with organic poultry, where less intensive methods bring problems but also offer new solutions.

An aspect that was raised by most of the veterinarians was the importance of planned health promotion and disease prevention on organic farms. Health planning in organic certification system has been highlighted by others as a way to promote improved health and welfare in organic systems in general (Hovi and Gray, 2002; Hovi et al. 2004).

References

The references are available from the author on request.

Ruminant health in organic agriculture – a research and development project in Austria

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Introduction

A research and development project has been initiated in Austria, with the financial help of the Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Economy. The main objectives of the project are:

- Improving the health of ruminants on organic farms;
- Training veterinarians on basic principles and rules of organic farming; and
- Developing an information hot line and a database for frequently asked questions about animal treatments on organic farms

Project activites

Current project activities include:

- Designing manuals on organic agriculture for veterinary practitioners;
- Running of training courses for Austrian veterinarians on appropriate therapies and treatment of livestock on organic farms;
- Selecting of farmers and veterinarians to participate in a health programme aimed at minimal use of antibiotics (this includes designing and realising a therapy plan and evaluating the results);
- Designing and populating a database on frequently asked questions; and
- Running and designing of training programmes for organic advisers.

The project is run in partnership with the Austrian Service for Herd Health, veterinary profession, farmers, organic associations, public institutions and the Agricultural Research & Education Centre.

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Exploring the potential of clinoptilolite for the control of gastrointestinal nematodes in organic sheep production

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Introduction

Gastrointestinal (GI) parasitism is considered a major issue in sheep and goat production systems, because it is related with reduced animal productivity and compromised animal welfare. There is evidence that the incorporation of natural zeolites in the ration of ruminant animals have favourable effects on their growth and performance. The question is whether natural zeolites may have also a beneficial effect against GI. The objective of this work was to assess the effect of clinoptilolite (a natural zeolite) on the growth and performance of lambs, which were, or not, infected with GI nematode parasites.

Materials and methods

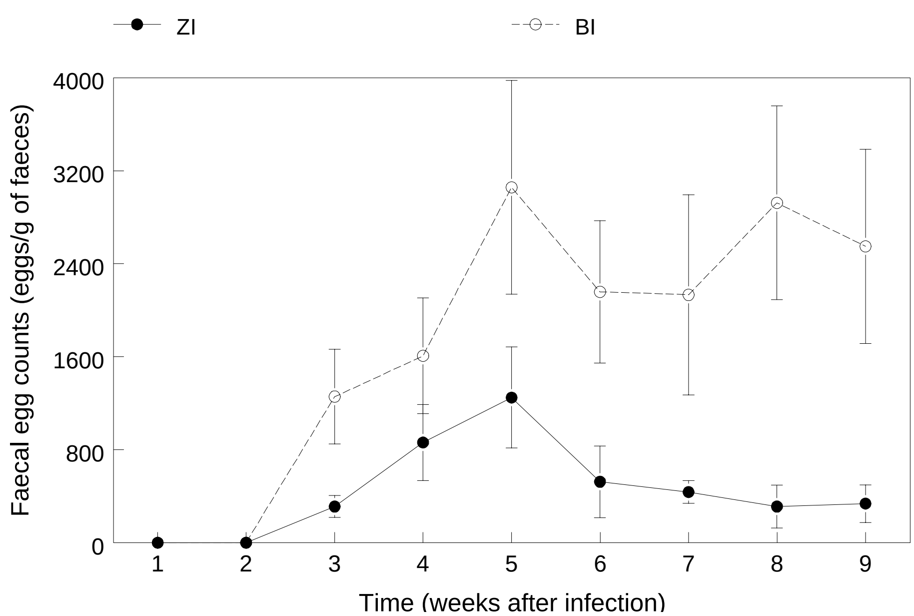
The experiment was carried out over a period of three months, starting in February 2003. Twenty-four entire lambs of the indigenous Greek dairy breed Karagouniko were used. They were weaned at six weeks of age. Lambs were given free and continuous access to a nutritionally non-limiting pelleted concentrate that was either a basal diet (B) or a zeolite diet (Z). The latter (Z) was formulated by supplementing B with clinoptilolite at a level of 3%. Both diets had similar crude protein (CP) and metabolisable energy (ME) contents. A 2 x 2 factorial design, consisting of two feeding treatments (B and Z) and two levels of parasitic status, infected (I) and uninfected (U) was used. Taking into account their live weight (LW), lambs were randomly assigned to one of four (n=6), treatment groups: BU (basal-uninfected), BI (basal-infected), ZU (zeolite-uninfected) and ZI (zeolite-infected). At that point (day 1), lambs of groups BI and ZI were infected with a single dose of 15,000 L3 larvae of GI nematodes. Feed intake and LW were measured weekly. At the same time, faecal samples were obtained directly from the rectum of each individual animal. Sixty-two days later, all lambs were slaughtered and their abomasums with intestines were removed in order to recover the adult worms.

Results and discussion

1. There was a significant interaction ($P<0.01$) between group and week on average food intake.
2. Lambs in groups BU and BI did not increase their feed intake to the same extent as those in groups
3. ZU and ZI. There was also a significant difference ($P<0.05$) in the LW of lambs at slaughter,
4. with lambs of groups ZU and ZI being the heaviest. Average growth rates were significantly
5. ($P<0.05$) different between lambs of different groups; lambs of groups ZU and ZI were growing to
6. a faster rate compared with those of groups BU and BI, respectively.

However, there were no significant differences in carcass characteristics between lambs of the four groups. There was a significant (P<0.001) lower FEC of lambs fed with natural zeolite when compared with those that were also infected with GI nematodes but were fed on the basal diet (710 vs 2,242, s.e.d. 731, for ZI and BI groups, respectively) (Figure 1). This study suggests that there is a potential for using clinoptilolite in sheep rations as a natural alternative that could prevent the build up of GI nematodes, especially in organic systems. This regimen appears to lead to the production of carcasses with good conformation.

Figure 1 Faecal egg counts (egg/g of faeces) of lambs that were given *ad libitum* access to a basal diet or the same diet supplemented with clinoptilolite and were infected with GI nematodes.



WORMCOPS - Worm control in organic production systems for small ruminants in Europe: Towards the implementation of non-chemical sustainable approaches (EU-project: QLK5-CT-2001-1843)

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Introduction

Organic agricultural production has grown rapidly in recent years in most EU countries. It is, however, clear from several investigations that organic production of livestock will have implications for animal welfare and health, based on e.g. the requirements regarding outdoor access and certain limitations on the preventive use of medicines. The project was, therefore, formulated in recognition of the difficulties that organic small ruminant farmers in the EU face when they wish to control parasitic infections without resorting to preventive use of parasiticides, in accordance with the principles and official standards of organic farming. In conventional (i.e. non-organic) farms, non-chemical control is also an attractive alternative to heavy reliance on parasiticides due to, amongst others, increasing problems with parasiticide resistance, e.g. as observed in nematodes infections in sheep and goats and in liver flukes in sheep in NW-Europe in the last decade. Coping with the problems caused by parasitic nematodes on organic farms currently and in the future will only be possible through implementation of integrated, sustainable parasite control. This goal can most likely be achieved by using combinations of both existing non-chemical options (i.e. grazing management), as well as novel approaches such as biological control and bioactive forages. It was, therefore, the general objective of the project *to develop and analyse such options for an integrated strategy for control of gastrointestinal parasitic nematodes in organic small ruminant production systems across Europe.*

Objectives of the project

The specific objectives were as follows:

- Evaluation of the potential benefits of bioactive plants and forages in mitigating the effects of parasitic nematodes in economically important small ruminant livestock (sheep and goats).
- Evaluation of the potential of biological control of the free-living stages of nematode parasites of sheep and goats by means of the nematode-destroying fungus *Duddingtonia flagrans*, including evaluation of the environmental impact of field application of the fungus.
- Assessment of various grazing management strategies for the control of parasitic nematodes in sheep and goats.
- Pilot field testing of integrated control strategies involving two or more of the three options mentioned above.

- Provision of recommendations for sustainable parasite control in organic production of sheep and goats in Europe that comply with organic standards for sustainable, non-chemical parasite control at farm level.

Results

Bioactive forages

Repeated studies within the project focusing on the bioactive forages have revealed that plants with high levels of condensed tannins (e.g. sainfoin and sulla) and other plants with secondary metabolites (e.g. chicory) possess anti-parasitic activity against common gastrointestinal nematodes of small ruminants, i.e. nematodes of the genera *Teladorsagia (s. Ostertagia), Haemonchus* and *Trichostrongylus*. Effects found *in vivo* in both goats and sheep with natural mixed infections or mono-specific experimental infections have been confirmed *in vitro* using different assays on nematode larvae. However, it is also clear that the effects depend on species and stage of parasite and the specific crop. These assays have enabled us to identify certain fractions of forage extracts which are responsible for the observed effects, e.g. certain sesquiterpenlactones in chicory seem to possess substantial anti-parasitic activity. Chicory is the main candidate for an anti-parasitic forage in the Northern Europe context but it is evident that the effect of chicory *in vivo* is solely directed against the abomasal genus *Teladorsagia. Haemonchus,* another abomasal nematode, is not affected. Variations in the contents of active compounds may explain the differences observed between years and places. The results with sainfoin in goats in France have been very promising, and most studies are already published.

Biological control and evasive grazing

Plot studies and *in vitro* testing of the nematophagous fungus *Duddingtonia flagrans* have shown marked reductions in worm burdens of goats but, in summary, grazing trials with ewes and suckling lambs under close-to-normal farming conditions showed no or inconsistent effect on any of the parasitological parameters examined. This lack of effect when the nematophagous fungus is applied to ewes in early lactation at turn-out is puzzling and the project has only briefly researched the background. Obviously, the situation is very different from the turn-out of calves where excellent results have been obtained, also in the early grazing season. However, studies in Sweden and Denmark have indicated a clear production benefit of applying this novel approach. I should be emphasized that a product for biological control is not at present marketed commercially. The backbone in all non-chemical parasite control strategies is evasive grazing i.e. repeated moves to clean pasture during the season. Although sufficient control of *Haemonchus contortus* may not be achieved with 3 weekly moves in trials conducted in the Netherlands with heavy challenge, it must be emphasized that other infections are well controlled by this procedure. An interesting feature in several studies is the unexpected persistence of some of the infections in the lambs e.g. for more than 2 months during a period of rapid moves to clean pasture whereby re-infection was eliminated. This has been observed for *H. contortus* but probably also holds true for *Trichostrongylus* spp.

Other novel approaches to control, e.g. selection of resistant/resilient animals and development of sub-unit vaccines (compliance with organic standards depend on manufacturing specifications), which may in the future play a role in worm control on organic farms, have not been considered within the project.

General guidelines arising from the project

In conclusion, diseases caused by internal parasites pose a major threat to the health and welfare of sheep and goats within organic production systems. Basically, organic farmers need to enhance and exploit the animal's own immune status and resilience to parasitic infection, in so doing they need to recognise and take account of differences in host immunity due to age, genotype, nutritional status and level of productivity. The losses associated with infection by roundworms are known to be challenge density dependent with high levels of challenge being associated with mortality and less severe challenge with morbidity and reduced productivity. For these reasons organic producers need to moderate exposure to parasitic infection to allow the development of acquired resistance in susceptible stock, without succumbing to clinical disease or heavy production losses.

Within organic production systems, the development of host resistance/ resilience together with other non-chemical means of moderating the challenge from pasture are the two fundamental prerequisites for good worm control. Effective worm control also relies upon utilising our understanding of the epidemiology of the key species of gastrointestinal nematodes implicated in these diseases such as *Teladorsagia, Haemonchus, Trichostrongylus* and *Nematodirus.* Farmers should take and develop an evidence-based approach to targeting anthelmintic inputs, taking account of individual farm circumstances, which safeguards animal health and welfare. This approach will lead to the identification of key system limiting parasites, which pose a particular challenge to animal health and productivity, and may require substantial changes to the farming system (i.e. housing periods, reduced stocking density) or the limited use of anthelmintics.

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Working group report:

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Working Group Report

Restricted veterinary inputs in organic systems: how should their use be restricted?

Rapporteurs: G. Smolders and E. Stoeger

Introduction

There should be more focus on preventive measures to restrict the use of medicine. Researchers and advisers must be able to make it clear to farmers that prevention, in the long run will be the best solution, and the safest way to sustainable farming. It was, however recognised that even with the best preventive management; animals will get diseased some times. Farmers do have the obligation to give diseased animals the best possible care, medicine included. Restriction of medicine use should never go at the expense of animal welfare. All this is already enshrined in the organic legislation.

Restricted 'conventional' medicines vs. 'alternative' medicines

Current restrictions on conventional veterinary medicinal inputs in the organic standards do not appear to be a major problem for farmers in any of the countries with representative in the working group (7 member states). It was, however, suggested that the inspection procedures required to certify for the implementation of these restriction were not always carried out due to lack of time and lack of procedures. Several studies on disease and treatment on organic farms suggest that farmers do not always record all treatments, even if it is required by the standards. The working group suggests that there is a limited insight into medicine use in organic animal husbandry in most countries.

It was suggested that the complementary medicine has been the main driver in reducing the use of conventional medicine on organic farms. The research, however, appears to suggest that farmers find it easier to apply conventional medicine than complementary treatment. More knowledge is needed about efficacy of these medicines and about the choice of the proper animal/medicine combinations. It was reported that, in the Netherlands, the majority of the organic farmers attended a course on homeopathy use and most of them experiment with the knowledge and a variety of remedies. In the UK, complementary medicine use is also common among organic livestock producers but training and research is not organised. In Austria, organic farmers are dependent on the approaches of the local veterinarian. In some areas there are no vets who use complementary medicines, and the farmers have to depend on him as he is the only vet in the valley. Generally, it was concluded that the farmers are keen to learn about homeopathy but appear less enthusiastic about preventive measures. There is a risk that on some organic farms the only change is from conventional to complementary medicine, rather than from conventional to organic husbandry.

A discussion about a total ban on antibiotics in organic livestock (as in the USA) concluded that this was probably not acceptable. It was, however, pointed out that, in the Netherlands, farms using antibiotics and farms using only homeopathy for clinical mastitis therapy had similar ranges of proportions of cows with high somatic cell counts in the herds. The research suggested that the attitude of the farmer and his preventive management has a more important role than the applied treatment. More research should be carried out in systems that produce good results on low medicinal inputs.

Concrete suggestions

While there was no consensus on whether the current restrictions should be changed, the following recommendations were made with regard to how the discussion should be taken forward. The following issues should be in the forefront of the discussion:

- Residue testing;
    - Consumers expect organic animal products to be free of medicine residues. Withdrawal period should always meet these expectations. In Sweden, for meat there are prolonged withdrawal periods of 6 month for antibiotics and of at least 2 month for other therapeutics. While the recently authorised medicines are probably ‘safe’ in terms of the organic withdrawal period, there might be ‘older’ drugs in the market, that have inadequate withdrawal periods, even when the organic principle of doubling the statutory period is used. Such drugs should be identified and special measures should be taken within n the organic systems to ensure no-residues-principle.
- Environmental impacts;
    - These have not been considered by the EU regulations adequately. As there is a requirement for an Environmental Impact Assessment for newly developed medicine, these assessment results should be used as a basis for setting ‘organic’ limits to the use of medicines that appear to have high or risk impacts. With the older medicines and compounds, a more open discussion on the environmental risks and alternatives to these compounds should be had (e.g. about the use of copper sulphate and the use of antiparasitic agents).
- Antimicrobial and other drug resistance:
    - While it is likely that organic farms are already reducing their antibiotic and other drug use, in comparison with the conventional farmers, and thus contributing less to the growth in resistance, areas were problems might arise should be addressed, e.g. the continuous use of synthetic pyrethroids in the absence of organophosphorous compound in the UK.

Part D:
Other posters

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Opportunities for Hungarian organic goat milk producers

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Introduction

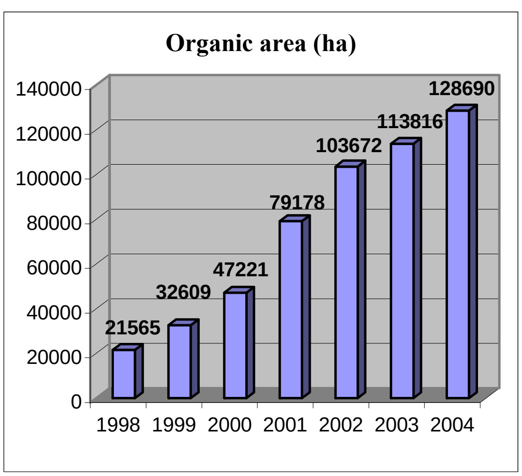
While the level of consumption of organic food is markedly lower in Hungary than in many other European countries, there is an increasing trend among consumers to look for functional and ethically and environmentally sustainable food. This potentially opens up new perspectives for the organic food producers who currently are mainly small scale farmers and family enterprises.

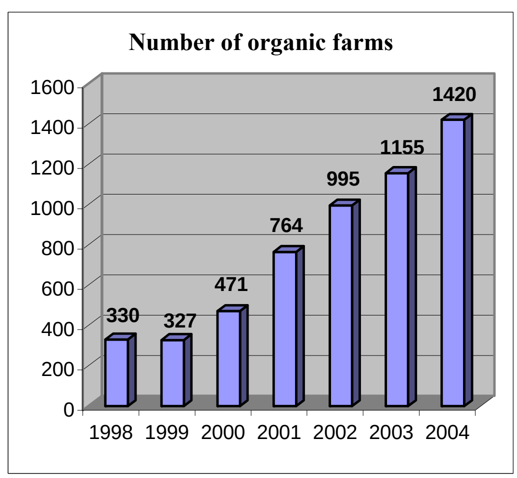
Of the whole agricultural area of Hungary (6,193 thousand hectare) only 2,07% is certified as organic (Biokontroll Hungária Kht.), but there has been a very rapid growth of the organic area in recent years (Figure 1 and Table 1).

Because of the high prices of organic products a great mass of them is exported to the European Union and to Switzerland. From the beginning of the 1990s, 10% of organic products is sold in Hungary. The volume of organic animal production is low. In 2004, there were 160 farms in organic animal husbandry. The number of animals in organic production was 12,254, of which 253 were goats (2,06%) (Biokontroll Hungária Kht.).

This paper describes the potential for organic goat production in Hungary in the light of a case study.

Figure 1 Development of organic farming in Hungary





Data source: Biokontroll Hungária Kht.

Table 1 Number of organic product processors and dealers in Hungary.

Year	Number of processors	Number of dealers
1998	17	2
1999	36	22
2000	36	54
2001	67	72
2002	100	92
2003	215	53

Data source: Biokontroll Hungária Kht.

The suitability of goats in organic animal production

Goats were never kept in intensive systems in Hungary, and it could be argued that intensive systems are not suited for goat keeping. As a result, goats in Hungary have not been selected for intensive production, making most breeds suitable for organic production.

Goat milk is very popular all over the world. It plays a very important role in the nourishment of people suffering from allergy of cow milk. Products made from goat milk are easily digestible. Curd and cheese made from goat milk is the staple diets in many places in the world. The meat from goat is tasty and has a low cholesterol content (Seléndy, 1997).

The case study farm

The farm is situated in a special surrounding called "eco village", which was founded in 1992 by the Gyűrűfű Foundation. The village is an experiment in its own right, as in the late 70's the village became depopulated. The villagers aim is to find solutions in their architecture, farming and lifestyle, harmonizing with the surrounding flora and fauna. The farming parcels are hired from the foundation with the aim of organic farming. The explored family enterprise has approved organic farming status since 1997 and organic milk production since 1999. The farmers have no agricultural education. Their professional knowledge arises from own experience, and only the family members are working in the enterprise. The farm has 100 alpine breed goats (60 milking goats). From the hired 20 hectares, 13 ha is used for pasturage and 7 for meadow. The raw milk is processed in the farm's own cheese factory. The products are made from pasteurized milk. The quality of products is very high. The enterprise has won prices in national cheese competitions several times.

Marketing strategy of the enterprise

Products:

- fresh and pasteurized goat milk
- yoghurt
- 1 kind of nature cheese
- 2 kinds of spicy cheese
- curd cheese

Price:

- under the prices of hypermarkets-supermarkets and bio shops

- price is based on the costs and the prices of competitors

Place: -
- direct sale on the biggest organic food market of Hungary in the capital
- direct sale on the farm
- for retail dealers

Promotion:
- self-designed logo and packaging
- leaflets
- attendance on special programs: exhibitions and fairs
- for a distributor

Strengths, weaknesses, opportunities and threats (SWOT)-analysis of the enterprise

Strengths:	**Weakness**:
o Demand has grown o Organic food consumption is in trend o Costs are lower than in conventional farms o The farm is situated on a perfect place for organic production	o Distribution channels are not organized o No quota for goat milk o Goat meat cannot be sold above the upbringing costs o HACCP system can hardly be realized in such a small scale farm o Missing encouragement in the organic sector-Lack of financial resources o Deficient knowledge about the advantages of goat milk consumption among the consumers
Opportunities:	**Threats:**
o Organic tourism o New distribution channels: internet o Organic farming and rural tourism can be well connected	o Many farmer sell products as organic without certification o Purposely depraved image of goat milk

Characterisation of the consumers

By characterizing the consumers we suggest that most of them are highly educated, are in good financial situation, and spend considerable amount of money on organic products instead of medication. Many of the consumers are doctors and parents with young babies using the goat milk to replace milk by breast feeding.

There are four shorts of consumers of organic products in Hungary:
- **"Strong" consumers"**: (1%). They buy only organic products in special shops and on markets.
- **"Selective consumers":** (3-4%) They buy a few products in special organic shops, and the others in normal shops. In their preference list the rate of price and quality is determinative.

- **"Case consumers":** (40%), They are well informed about organic products and they prefer the supermarkets, and the organic products and the weekend shopping and they buy organic products only sometimes
- **"Non buyers:"** (55-56%), in general they are uninformed about organic products (Sz. Seléndy, 1997).

Conclusions

The studied enterprise, on one hand, is an excellent example to demonstrate the situation of the Hungarian organic food producers but, on the other hand, is not a typical one because of its special facilities. It is suggested that limited consumer interest is the main difficulty for small scale organic producers. The demand for functional and 'alternative' food in Hungary is concentrated in the capital and in the biggest cities. Furthermore, the demand for such food is undermined by simultaneous demand for convenience foods by the same consumer groups.

A second problem for small scale organic producers is the fragmentation of farms, which makes it difficult to co-operate in farming, processing and organizing the distribution channels of products.

In spite of the difficulties, the studied farm was successful, owing to the fact that the enterprise included both primary production and processing and, to some extent, the marketing. The latter is important, as personal selling plays a very important role in the producer's marketing strategy: 80% of the consumers come back every week. This makes the calculations of weekly demand easier.

In the future these kind of enterprises have to connect their production activity with rural tourism, which can open up new perspectives with more income for the enterprise. The government also has a responsibility in helping to propagate to the consumers the healthy lifestyle with healthy nourishment.

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Opportunities for the Hungarian organic sheep and deer farmer

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Introduction

Nearly 1,600 organic farming enterprises are inspected by the Hungarian organic inspection authority, Biokontroll Hungária Kht.. Only 160 of these farms keep livestock. Cattle are the most common species, but the percentage of sheep is also significant (Biokontroll Hungária Kht., 2004). The sheep are generally kept in extensive circumstances, on pastures and meadows that form over 46% of the controlled 128,690 organic hectares in Hungary. As the number of organic producer has increased markedly since 1996 (Figure 1.), there is a growing confidence in organic farming as a viable production enterprise.

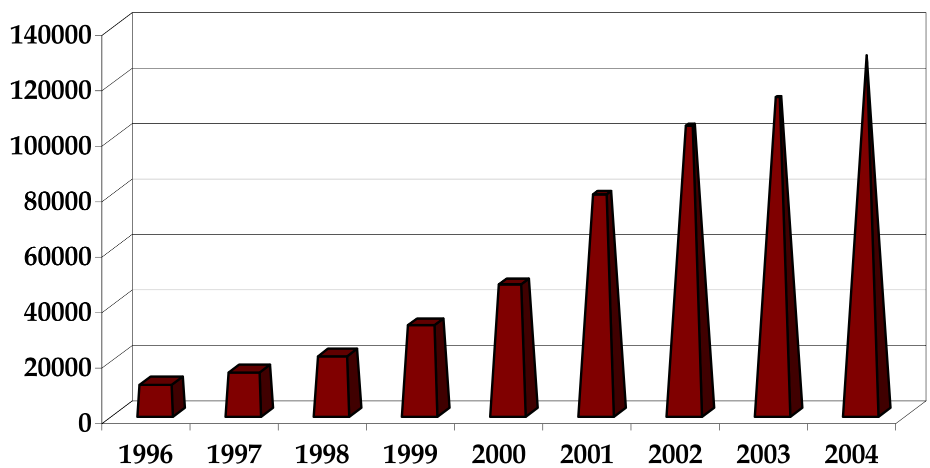

Figure 1 Changes in inspected organic land area in Hungary between 1996 and 2004 (Source: Biokontroll Hungária Kht., 2004).

However, only 5% of the Hungarian adult population should be considered to be consumers of organic food. The main reason for this low consumption prevalence has been reported to be the higher price of organic food, when compared with conventional produce (Lehota *et al.*, 1997). According to Marselek and Abay (1997) the Hungarian organic production still needs coordinated support and a subsidy system (financial assistance of logistical, product, techniques and communal marketing).

The research described in this paper was based on in-depth interview with a sheep farmer. The objective of the exercise was to explore the opportunities and difficulties of organic sheep production, to establish better understanding of sheep keeping, feeding and the natural parameters and to investigate the farmer’s opinion on the processing and the marketing of organic sheep products.

Results

The Hungarian sheep production has been in decline for years. Cheap imports of lamb from New-Zealand and Australia have contributed to this decline. While lamb consumption has always been low in Hungary, this has been limited even further by the popularity of pork and poultry meat that lend themselves better for easy cooking and processed food production. Furthermore, declining economics of farming prevent development, and the current lambing patterns reduce the marketability of the produce.

Among the decreasing number of sheep producers in Hungary, there are a few success stories. The farmer studied in this case, had decided to extensify his production system and started converting his farm in 2000, completing in 2002, when the first lambs were sold as organic. The farm system is based on 40 hectares of improved pasture land, where the sheep graze without shelter or supplementary feeding. According to a study (Máté, 1995) from 1994 to 1995, the ratio of *Poaceae* and some species of *Asteraceae* decreased and the proportion of perennial plants (*Papilionaceae*) increased, increasing the grazing period from 139 days to 260-320 days).

As organic feed is preferably produced on the farm, this farm has had the advantage of being able to do so in most years, despite the low rainfall in the area, eg. in the year of 2003. In 2004, the proportion of *Papilionaceae* was particularly high due to a wet summer.

Livestock production on the farm started in 1993 with pigs, with a later introduction of deer and sheep (70 deer and 150 ewes and offspring). Currently, only the sheep production is organic. It is intended that the deer will also be certified in the future, once there is demand for organic venison in the market.

The crossbred sheep, a cross of non-traditional, non-native, specialized sheep breeds (Charollais x Texel), provides good meat quality and high dressing percentage. All lambs are born outside in spring and run at pasture with their dams until weaning in autumn (August-September) each year. The breed on this farm is principally suitable for yearly lambing (mating: 15th of November and lambing: April), due to the Texel breed takes part in the genotype. This usually means low lamb prices as the market is saturated. Therefore, to avoid the seller's dumping in Eastern, the farmer rears the lambs forward. Consequently, the rams are castrated at the first days of their life castrated, and he sells all the lambs in August (30-35 kg live weight ewe and wether).

Resistance to disease is maintained with good quality feed and free range husbandry, with high welfare standards (Seléndy, 1997). A disinfectant solution and a salt, which combined by an original formula from an old shepherd: organic copper, selenium, salt, clay and etc. The disinfectant solution is used to control lameness: to gain access to the salt, the sheep need to step into a disinfectant solution, which contain organic copper, vinegar, lime and $ZnSO_3$. Due to the wet summer of last year, charcoal and magnesium-oxid were added to the salt to avoid diarrhoea.

Considerable disadvantages are the long privatisation process and the slow start of organic farming due to the late acknowledgement of its role (Tóth and Szente, 2003). However, the current direct payment offers a marked advantage to the organic producers: 4,600 Ft/ewe for organic producers over the 1,600 Ft/ewe for conventional producers. Furthermore there is available a subsidy for the field: 17000 HUF/ha from the national source (75% of the inclusive sum) and from EU (only 25%), which sum is due to every owner. The farmers can apply for subsidy from the National Agricultural and Rural Development Operational Programme 15000 HUF/ha (in which the ratio of EU source is 80%), it is in the framework of National Agri-environment Programme in grassland utilization target vice-programme. Independently of keeping livestock or not. But this type of payment is not working for the ecological animal farming (+ 4600 HUF/ewe) mentioned above. Presently neither the subsidy of conventional nor the subsidy of ecological animal farming is paid out in spite of the agreements, which deals were done in a year before.

Nevertheless, currently the farmer is unable to market his lamb product with an organic premium in Hungary. It is suggested that one reason for this are the higher and the perception of consumers that there is little difference between organic and conventional product.

To improve his situation, the producer in this case could:

- Slaughtering in agreement with an abattoir and direct marketing from the farm;
- Find a good foreign market in common with the slaughter-house, eg. Switzerland, Austria or Greece;
- Co-operation with other farmers and conclude an agreement with the slaughter house supplying lambs for continuous slaughtering, or
- Introduce a secondary service (e.g. eco-tourism, demonstration farming, therapy activities for adults or children etc.).

The existing deer production on the farm could also contribute to future success, as long as markets for the produce are found. Intensification or enlargement of production/yields is not seen as an option for this farm that would loose many of its strengths by doing so (self-sufficiency, suitable soil type, manageable size of the farm with no outside work force etc.).

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Native breeds in organic animal production in Hungary

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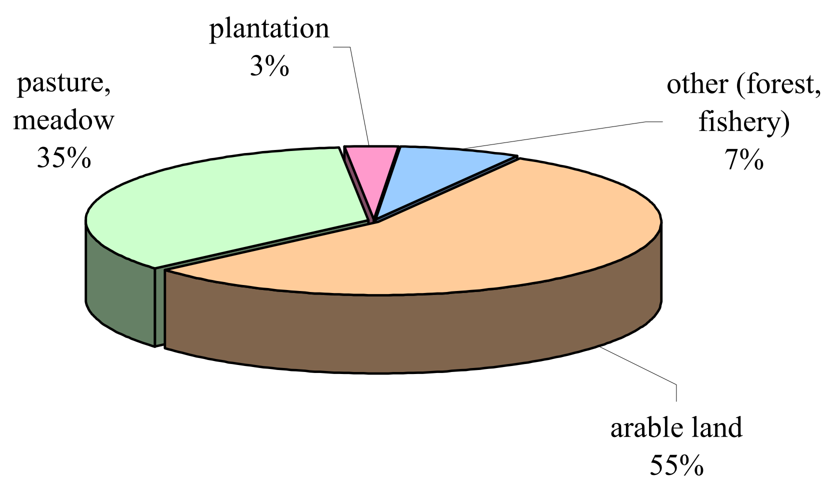
Introduction

Hungarian organic farming activity is mainly based on crop farming. However, half of the total inspected area consists of permanent pastures and meadows (see Figure 1). This farming system composition is the same as in conventional farming in Hungary.

Figure 1 Organic area composition of Hungary in 2004, by Biokontroll Hungária KHT.



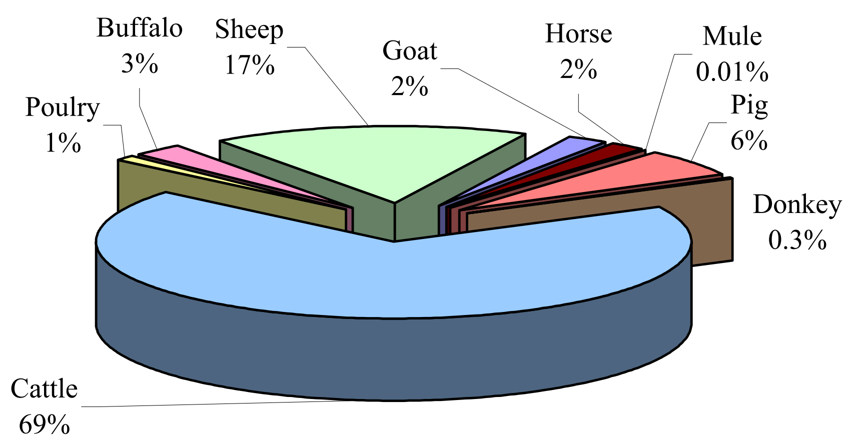
Animal husbandry has been a depressed farming activity during the last ten years. Total number of livestock units in Hungary has declined by 50%. Previous agricultural system was only based on conventional farming. Organic farming came into practice after the 90's. Agricultural policy changes, with radically reduced governmental subsidies, found animal husbandry in great difficulties. The only way to keep agricultural production on a market level and to ensure income for the farmers was to convert more fields and flocks into organic production. Traditional organic farming practice, working with native breeds, was only carried out on small scale farms (less than 0.5 hectares) and mainly in home gardens. These farmers had traditional breeds and agricultural techniques, but this practice was suitable only for garden scale production. The large scale intensive agricultural management, breeds and farming system that were typical before 90's had to be changed, in order include alternative breeds into the practice. The main task was to develop ecological production systems and to combine techniques from garden scale farming systems (breeds, alternative techniques) and large scale systems (machinery).

Native breeds

To fulfil requirements of EU and Hungarian regulations, farmers had to change their stock. Native or native based breeds and free range farming systems had to be developed. Several local Hungarian breeds and varieties of high genetic value, including chicken, turkey, Guinea fowl, duck, the frizzled Hungarian goose, famous Hungarian grey cattle, 'racka' sheep and 'mangalica' pigs are now available. The biggest problem is changing the milking cow breed from high-genetic merit intensive Holstein- Friesian cow to less intensive production. The current cow breed is not considered fit free range farming and natural grazing in the Hungarian climate. It would be better to convert into Hungarian spotted cow, but this radical change will require financial support.

Two thirds of the total organic livestock units in Hungary are grey cattle and one fifth of it is sheep (mainly 'Racka') (see Figure 2). These two species mainly come from Hortobágy region. Products from these breeds are usually sold in Hungary as baby food processing components, but almost all the organic eggs produced and more than two third of honey is exported. It is very rare to find fresh organic meat for sale in the retail chain in Hungary. Pig meat is manly sold as sausages and salami, partly locally or exported into other EU countries, sometimes mixed with Hungarian grey cattle meat as a special product.

Figure 2 Composition of organic animal husbandry in Hungary in LU percent by Biokontroll Hungária KHT.



Model organic farming systems for demonstration – our project

While organic farming activities in Hungary grow from year to year, the traditional mixed farming family production method is very rare. It is necessary to spread special farming systems to change the unemployment rate of countryside and to establish more stabile rural living conditions. Organic farming, as a principle, has to be based on special complex systems of soil-plant-animal cycles. These systems need to be established. A mixed farming practice, based on vegetable and crop farming, involving native animal breeds, can provide local healthy food on family scale farming. The development of local food processing facilities for local trade mark products or just provide products for local markets has potential.

Our department, with co-operation of research institutes, public organisations and processing units has started a new investigation titled 'Elaboration of the genetic basis, management and control of production of the hungarikum quality poultry. This development has the main aim to build up farming units to produce high quality and marketable organic horticultural plant products combined with native poultry breeds (turkeys and chickens) that give additional products and help the plant production by its plant protection effect and by the improvement of soil fertility. The ultimate aim is to demonstrate a family farming model for market production.

This model farming system is established on 6,000 m^2. That was previously used for winter wheat production. After the harvest in 2005, turkeys will be grown here until November. The 300 turkeys will be native ‘Bronze’ and ‘Copper’ breeds, ‘Bronze’x’Copper’, and ‘Copper’x‘Bronze’ crossbreeds. Mobil housing system is established for poultry. The total surface area is $6m^2$/bird. Twelve houses will be put into the area for the turkeys and a big temporary shelter made of plastic green house. Turkeys will be fed on own organic alfalfa hay, and organic bought corn as it was traditional for free range turkey keeping in Hungary for centuries. During the summer/autumn period, turkeys will be weighted each two weeks to record the growth characteristic. Slaughtered samples will be tested as organic/rural turkey meat in public food chains and laboratory analysis will be carried out.

Second year of this project will start in spring 2006. The whole $6,000m^2$ area will be divide into five same size plots of $1,200m^2$ as follows:

barley + clover	chicken	mixed vegetables	red clover	potato

Each plot is 30x40m. The twelve mobile houses will be reconstructed for the needs of chickens, i.e. perch distance and the temporary shelter will be moved from the field. The mixed vegetable plot consists of: carrot, celery, parsley, onions and red beet. When the vegetables are harvested, chickens will be allowed to the harvested area. Chicken breed is ‘Hungarian yellow’. Chickens will be slaughtered and analysed as turkeys. Then 480 young laying hens will be put in the area. Half of them will be slaughtered before winter, but the rest is kept for next year for egg production. Third year of the experiment is for egg production test of 240 laying hens ‘Hungarian yellow’ breed. The actual crop rotation design is:

red clover	potato	barley + clover	hens	mixed vegetables

Finalising this project we will be able to give a sample of poultry based vegetable farming system, which fulfils all the organic requirements. This project can be extended with other animal species e.g. pigs, or other poultry species. Another way of developing the results is to change a scale and crop rotation to fit sheep/goat or cow production.

Limitations to organic livestock production: Turkey as a case study for developing countries

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Introduction

The increasing world population, in the mid-20th century, increased the demand of plant and animal products, leading to intensive and monoculture agriculture systems in conventional agriculture. The abundant and low-cost production from per unit and/or animal head were seen as primary objectives in these systems, and ecologic balance and health criteria in product quality were taken as secondary objectives (Şayan and Polat, 2002*)*. Some of the intensive practices started showing harmful side-effects, such as acute and chronic toxicities, cancer, allergic reactions, nervous system destruction, retardation of learning**,** memory loss and mutations *(*Aksoy et al, 2005). Organic livestock production has emerged as an alternative to the intensive systems and their problems, also in developing economies, such as Turkey.

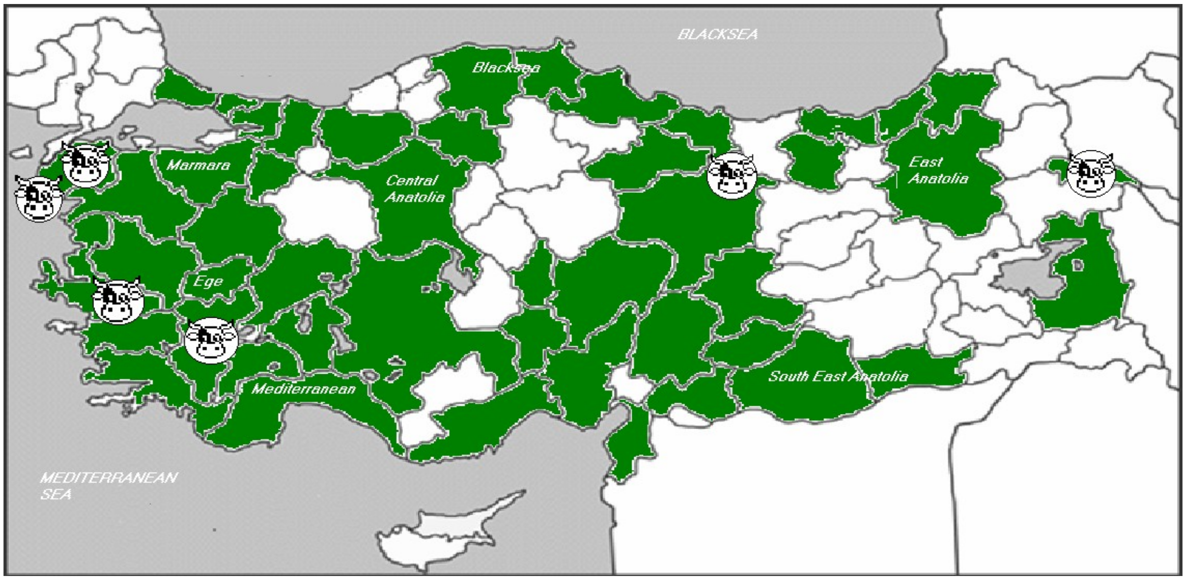
In every country, supplying safe milk, meat and egg as animal protein sources, that are necessary for a balanced nutrition, is an integrated part of the food security and safety policies (Duru and Şahin, 2004). Providing nutrient requirements of the society from plant and animal source foods and food safety are not major issues in developed. In developing economies, such as Turkey, food security and also safety problems are related with insufficient nutrient requirements of the society from animal protein sources like meat, milk and eggs (Andrew, 2003; Anonim, 2001a).

The aim of this paper is to discuss the factors limiting organic livestock production in Turkey and to evaluate the conditions in Turkey as a case study for developing countries.

Organic plant and animal production in Turkey

Turkey has a certain potential of organic plant production, with its diverse ecosystems and rich biodiversity. It also has a high capacity of pasture and meadows for organic livestock production in south, southeast and north regions (Şayan and Polat, 2004). Although organic plant production started in 1980's and reached a certain level, organic livestock production has not reached the desired level, yet. Currently, only 0.5 % of total agriculture area is in use for organic farming in Turkey (Anonim, 2004a). Figure 1 shows the provinces in which certified organic plant and animal production is carried out in Turkey. There are a few organic animal production farms (Anonim, 2004b) that are in conversion (Iğdır Animal Husbandry Organization, Doğan Holding Company and Aysüt Company from right to left on the Figure1 have organic certificate, another three farms which are on the west coast of Turkey are about to get the certification*).

Figure 1 Turkish provinces with certified organic plant and animal production



Provinces in which certificated organic plant production

*Organic animal production farms

Food security and safety in developing economies and Turkey

The basic reasons of food insecurity are often social and technical limitations, frequent changes of policies, low productivity in agriculture and periodical fluctuations of supply and demand. It is hard to solve these problems, because they are all inter-connected. FAO and WHO (World Heath Organisation) determined certain aims to reach enough and secure food for everyone during the National Nutrition Conference in 1992. One of the most important aims was to provide sustainable agriculture production. To achieve these, organic agriculture should be extended (Ulusoy and Aksoy, 2004).

Table 1 shows the percentage of insufficiently nourished population in developing regions of the world (Dölekoğlu, 2003). As can be seen from the table, according to the means of 1979/81, in 17 years, the number of people who has got the problem of reaching enough food decreased by 11 % in 1996/98 in developing regions. Turkey has the opportunity to provide its population to lead healthier and longer life (Anonymous 2001c). Table 2 shows total meat, milk, egg and fish consumption in developing and developed countries and in Turkey in 2002 (Anonymous 2005). According to FAO Food Balance sheets, Turkish people appeared well nourished and in the diet pattern of Turkish population, cereals play an important role. Following cereals, fresh fruits and vegetables are widely consumed and are available throughout the year (Anonymous, 2001c). Since the beginning of 1980's, the total food production reached to sufficiency level. Daily energy allowance is 3,357 kcal/day, of which 3,039 kcal/day is of plant and 318 kcal/day is animal source foods in Turkey. Although meat and meat products have an important place in Turkish diet, the consumption is 3% among the other food groups (Ulusoy and Aksoy, 2004). Yogurt, ayran and various cheeses are the most frequently used milk products. If the animal food consumption is compared with developed countries, consumption of animal foods is very low so iron, calcium, riboflavin and zinc deficiencies are identified in the country (Table 2). For this purpose, various support policies are planned for livestock production by Ministry of Agriculture and Rural Affairs (MARA). The diet pattern in Turkey contains nutritional problems of both developed and developing countries and it varies significantly according to regions, seasons, socio-economical state and urban or rural locations of the country (Anonim, 2001a).

Table 1 The percentage of insufficient nourished population in developing regions of the world

Regions	1969/71	1979/81	1990/92	1996/98
Africa (Sub-Sahara)	34	37	35	34
Near East and North Africa	25	09	08	10
Near and Near South Asia	43	29	17	13
South Asia	38	38	26	23
Latin America and Caribbean	19	13	13	11
Means of all developing regions	**37**	**29**	**20**	**18**

Table 2 Total meat, milk, egg and fish consumption in developing and developed countries and in Turkey in 2002 (kg/cap/yr).

Years	Developing countries	Developed countries	Turkey
Total Meat	**28.3**	**79.4**	**19.2**
Bovine	6.3	22.1	4.7
Mutton and Goat Meat	1.8	2.0	4.7
Pig meat	11.7	28.6	-
Poultry meat	8.0	25.3	9.8
Meat other	0.5	1.4	-
Milk (excluding butter)	**45.6**	**202.1**	**98**
Egg	**7.2**	**12.8**	**6.9**
Fish (seafood)	**14.2**	**24.0**	**7.3**

Factors limiting organic livestock production in Turkey

In Turkey, as a developing country there are some factors, which limit the organic animal production. The most important factors limiting organic livestock production are lack of consumer awareness and insufficient experience and level of education of farmers. The demand of European consumers for organic products increases fast, especially due to risks of dioxin, health scares and concern over genetically modified organisms. After EU countries, USA and Japan are also the group of countries demanding organic products. There are few initiatives in Turkey and other developing countries.

According to inheritance laws in Turkey, farms are permanently getting smaller in size and increasing in number. The mean livestock farm size is 4-5 cattle or 1-2 dairy cows. This is the opposite of EU countries. In EU countries, livestock farms are increasing in size and decreasing in number, and the mean farm size is 19.6 dairy cows (Anonim, 2001b). Due to the small and divided lands in Turkey, producer income is low, and they are poorly organized. Therefore, they cannot cover the cost of inspection and certification expenses.

A further limiting factor for organic livestock in Turkey is that, first organic products were plant products such dried fruits and nuts, especially demanded by European firms. Due to the lack of demand for organic animal products in domestic market, the number and products increased steadily in organic plant production, but organic livestock was limited with organic honey for a while. In addition to this, organic plant production was not integrated with animal production like in many Mediterranean countries. Fodder crops are not taken into rotation programmes.

In spite of these limiting factors, there have been movements in domestic market since 1999, and demand for organic livestock products is predicted to rise to 10-15 % in the larger cities. It is also important that organic animal production farms should have pasture and meadows land for low-cost production of forages. Pasture and meadows in Turkey are overgrazed and their capacity is very poor, constituting a further limiting factor for organic animal production. Due to the lack of rotation in fodder crop production and insufficient and overgrazed pasture and meadow lands, providing organic feed becomes hard for the producers.

It is not, yet, possible to claim that scientific studies have got a share in these developments regarding organic plant and animal production. The studies which compare the conventional and organic livestock enable the optimization and provide data in management are still being planned. Research work on organic beekeeping, sheep and fish husbandry are about to begin by Agricultural Research and Development Directorate of MARA. Because of these reasons, the producers consider that they will face problems related to diseases, metabolic disorders etc., limiting their desire to convert their farms to organic production.

The last limiting factor for organic animal production in Turkey is related to legal aspects. Organic agriculture regulation in Turkey is based on the EU regulation (Council Regulation EEC No 2092/91), was prepared by MARA and came into force on 18 December 1994 (No 22145). This regulation was revised and put into force on 11 July 2002 as “Principles and Application of Organic Farming”. Animal production was included in this revision and modified according to Council Regulation EC No 1804/1999 (Anonim, 2002). Due to longer terms for the preparation, application, revision and their adaptation to the country conditions of the regulations, transition to organic from conventional farm is a limiting factor, which need to be solved immediately in developing countries.

Conclusion and suggestions

In Turkey, as a developing country there are some problems related to providing food security and safety in respect to food requirements from animal protein sources like meat, milk and eggs. The encouragement of organic animal production may contribute to the solution of these problems. Organic animal production is still at the initial phase due to a number of limiting factors. It is possible that this production method can grow, if the following suggestions are taken into consideration:

- Consumer awareness of organic production methods needs developing.
- Graduate and post-graduate organic farming lessons/courses should be given to agriculture students at the universities. Agricultural engineers and veterinarians should be educated with special courses and training programmes to orient producers. The contribution of organic plant and animal production on each other should be emphasized especially in these courses.
- The studies and research projects targeting organic animal production should be carried out with the support of relevant organizations. In addition, pilot projects for the specific

regions should be prepared. Integration of organic plant and animal production should be emphasised in the projects. The pilot producers should be shown the contribution of animal production to plan production, such as providing manure and introducing fodder crops into rotations.

- Holistic strategies should be adopted; necessary input opportunities should be provided to the producers and producers organizations in organic livestock production from the initial phase. These inputs should be discounted in certification or analyses of costs should be carried out to determine levels of support needed to encourage conversion.

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Opening channels of communication between the associated candidate countries and the EU in ecological farming

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Introduction

An SSA proposal entitled "Opening Channels of Communication between the Associated Candidate Countries and the EU in Ecological Farming", with the acronym CHANNEL, was submitted in 2003 to the European Commission to Brussels. The proposal was favourably evaluated, so the Project has started on the 15^{th} November 2004 and lasts till 15^{th} May 2006.

There are major differences in the historical background and the level of development among the Associated Candidate Countries. Organic agriculture is an area that reached different stages of development in the different countries. The different forms of organization, the legislative and economic framework and the cultural background impose different tasks on the ACC countries in this area.

Objectives of the project

In accordance with the described situation, the main objectives of the project are:

- Monitor the situation of organic farming in the new accession countries and in potential candidate countries;
- Create communication channels between the new accession countries and candidate countries and between these countries and the European Union, which are necessary for starting the harmonization and equalization process in organic agriculture;
- Create links to stakeholders of participating countries;
- Disseminate knowledge in organic agriculture;
- Create an interactive central data bank; and
- Create a common web site and discussion forum of the project.

The database

The central instrument for the fulfilment of these objectives will be a complex database with homogeneous information organized around the following six thematic units relevant to organic agriculture:

1. **Plant protection:** As organic farming does not allow the use of GMO and chemical treatments, successful plant protection without them is essential for its success. There are many unsolved questions requiring further scientific investigation in this field.
2. **Organic seed and propagation materials:** In organic farming, the production of seeds and varieties has not yet developed to a sufficient level. The varieties suitable for organic production are not determined. Specific measures in the seed production technology should be developed for each species, as there are marked differences between these and the conventional methods.
3. **Organic animal production** is an important part of the farms' production cycle and helps to overcome the imbalance between labour and income that is typical for

agriculture. Organic animal husbandry contributes also to the preservation indigenous breeds.

4. **Agro-technology** gains a special importance in organic farming. All activities should be carried out to fit the needs of the cultivated plant. In order to achieve this, all activities should be carried out in accordance to the most recent developments of science and technology.
5. **Weed management: T**he question of weeds is very complex. On one hand, weeds can cause great damage to cultivated plants but, on the other hand, they are useful in preventing erosion, deflation and in sustaining biodiversity.
6. **Soil fertility improvement** is also very important, as organic farming manages without synthetic fertilizers. Sustaining and enhancing natural soil fertility is of much greater importance in organic than in conventional farming.

Existing data on the above topics will be collected and processed in working groups with a responsible group leader. Data collection will be carried out by all participating organizations in their respective area of competence (thematic or geographical). Information, based on the data, will be disseminated in leaflets and newsletters, aiming at spreading knowledge in organic agriculture and producing a multiplication effect, by involving a large group of stakeholders and beneficiaries, also from the non-governmental organisations, farmer groups, small and medium sized-enterprises and educational, administrative, religious and other institutions.

The survey

A survey will be carried out at three different levels: experts, scientists and public authorities, according to the six topics outlined above.

The survey of organic animal production is organised by a dedicated working group. The following issues will be covered:

1. Current situation:
   - Organisational background of animal breeding and organic animal production.
   - Legal background, general conditions.
   - Share and structure of animal production of the country (total and organic).
   - Production, export/import and consumption of organic animal products of the country.
   - Genetic bases and resources of organic animal production.
   - Organic nutrition.
   - Veterinary and welfare issues of organic animal farming.
   - Other types of registered alternative animal production (e.g. label type, free range, family mixed farming) in the country surveyed.
2. Outlook
   - Characteristics of governmental/public awareness of the need of sustainability in agriculture and especially in animal production.
   - Characteristics of governmental/public awareness of the need of gene conservation of local domestic animal breeds (local domestic animal genetic resources) in your country, and of their importance in present day agriculture, especially in organic farming.
   - Governmental/non-governmental channel to maintain/develop ecological mixed farming.
   - Governmental/non-governmental channel to save traditional animal farming.

- Personal opinion on the near/far future of organic animal production in the country surveyed, the most important tasks to complete.

Project activities
There are several means to achieve project goals. The first is to gather and process information about organic farming according to the six thematic areas. Then these data will be processed and evaluated together with the participants of the project during the four major local meetings and excursions and across the established channels. Leaflets and newsletters will be published to inform stakeholders and disseminate knowledge about organic farming. A final international disseminating conference will be organized at the end of the project in May 2006 in Budapest.

The potential impacts of the objectives are that the European Union gets a clear idea about the situation of organic farming in the new accession candidate countries and in potential candidate countries. It helps in harmonizing and equalizing the level of knowledge about organic agriculture in the "new" and "old" member states and in familiarising organic agriculture in the widest possible scope.

We measure success with the high quality of data and information contained in the database and with creation of durable links (channels) between stakeholders. Also, the established ability in the new accession countries to take place of the present Working Group leaders of this project and to maintain the established channels, and the ability created in the new accession countries to develop the evolved network in the future indicate success. We consider as success of our work that the participants from the new accession countries will integrate into the EU and to call in new stakeholders successfully. Also means to measure success the increasing number of visitors of the central common web site of the project and the large number of users of the data bank.

Participants of the project
There are 25 participants from 15 countries taking part in the Project (see Table 1).

Table 1 Participants of the Opening Channels of Communication between the Associated Candidate Countries and the EU in Ecological Farming (CHANNEL)-project.

Partner	Participant name	Country
1	CORVINUS University of Budapest, Faculty of Horticultural Science, Department of Ecological and Sustainable Production Systems	Hungary
2	Central Service for Plant Protection and Soil Conservation	Hungary
3	National Institute for Agricultural Quality Control	Hungary
4	Institute for Small Animal Research	Hungary
5	University of Kassel, Department of Organic Farming & Cropping Systems	Germany
6	Center for Agricultural Landscape and Land Use Research	Germany
7	Ludwig Boltzmann Institute for Organic Farming and Applied Ecology	Austria

8	Federal Agricultural Research Centre	Germany
9	Nikola Poushkarov Institute of Soil Science	Bulgaria
10	Faculty of Agriculture, University of South Bohemia	Czech Republic
11	Biokontroll Hungaria	Hungary
12	Association of Hungarian Small Animal Breeders for Gene Conservation	Hungary
13	Agricultural University of Wroclaw	Poland
14	Institute of Agricultural Research-Development Fundulea	Romania
15	University of Veterinary Medicine	Slovakia
16	Slovak Agricultural University in Nitra	Slovakia
17	University of Maribor, Faculty of Agriculture	Slovenia
18	Estonian Organic Farming Foundation	Estonia
19	Institute of Botany	Lithuania
20	Lithuanian Institute of Agriculture	Lithuania
21	Mediterranean Agronomic Institute of Bari	Italy
22	University of Lecce, Deparment of Biological and Environmental Science and Technology	Italy
23	Agricultural Research Institute of Cyprus	Cyprus
24	The Genista Foundation	Malta
25	Priekuli Plant Breeding Station	Latvia

The completed data base will be presented and discussed at an EU level conference that will provide politicians, policy-makers and players in all the relevant sectors, such as economy, education and research, with a valuable set of information on organic agriculture to be used for strategic planning and evaluation.

Further information on the Project can be found on CHANNEL website:
www.channel.uni-corvinus.hu

Part E:
Report: SAFO messages

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Key messages from the EU-funded concerted action network sustaining animal health and food safety in organic farming – results of a participant consultation

M. Vaarst, M. Hovi, S. Padel, D. Younie and Albert Sundrum

Introduction

In 2001, an EU-funded Concerted Action project, Network for Animal Health and Welfare in Organic Agriculture (NAHWOA) identified that organic livestock production faced major challenges with regard to harmonisation and successful integration of organic animal husbandry into the whole organic production system. One of the results from the NAHWOA-network was a number of recommendations for further development of organic animal husbandry (Hovi *et al.*, 2003; Hovi, 2004). One of these recommendations suggested that there was a need to address food quality and safety issues. Based on this, a group of European research institutions initiated a new network project, with focus on the safety and quality of organic livestock production. The objective was to understand better the links between the farm situation, animal health and welfare status on the farm and the impact of these on the quality and safety of the products.

The new network, Sustaining Animal Health and Food Safety in Organic Farming (SAFO), has now been in place for two years and has organised four workshops and facilitated discussions and contacts between the 26 organisations that participate in the network. SAFO has a broad spread across member states, with partners from most established member states, most of the new member states (the Czech Republic Hungary, Slovakia, Estonia, Latvia and Poland) and four emerging member states (Slovenia, Bulgaria, Rumania and Turkey).

As stated in an earlier report from the SAFO network (Vaarst, 2004), the expectations of the network and what it could contribute varied widely among partners. Consequently, it is understandable that partners have focused on different issues within the whole range of topics dealt with in the network. Therefore, it is expected that the messages the partners of the network take home from the SAFO experience also vary. To describe these 'take-home' messages, a process was put in place to enable a collation of information on the partners', members' and workshop delegates' perceptions in this area. The aim of this paper is to describe these key messages, as perceived by the participants to the network activities. It is hoped that these messages are useful when considering future activities in the area of organic livestock production in Europe.

Materials and methods

The process of formulating key messages from the SAFO network was initiated by the network Steering Committee and various steps of partner and stakeholder consultation followed. Table 1 describes this process in detail.

Table 1 The steps taken to solicit key take-home messages among the partners and participants in the SAFO network.

Time frame	Initiative
Step 1: December 2004	The Steering Committee decide on the best way to proceed. It is decided that all SAFO network members are asked to submit a response to an e-mail consultation, with the question: What are the three key messages that you take home from the SAFO-network?
Step 2: January 2005	The e-mail consultation was sent to members, with a three week deadline for responses. 12 responses were received from 27 members.
Step 3: February 2005	The key points from the responses were identified and categorised by the Steering Committee.
Step 3: March 2005	The summary of key points by the Steering Committee was presented to the network members and other participants of the 4th Workshop of the SAFO network. Further comments and responses were solicited from five working groups during the workshop. The subject areas of each working group arose from the summary of the initial comments submitted to the e-mail survey. They were: 1. The value of research network for organic animal husbandry and food safety. 2. How can we foster innovative research and development of organic animal husbandry? 3. How to balance food safety and process quality in organic livestock production?. 4. The role of knowledge and training networks in organic animal production and food safety. 5. How to ensure good animal health and welfare in organic farming throughout Europe?

Some of the responses from both the consultation and the working groups were difficult to summarise under the working group titles mentioned in Table 1. These are summarised under separate subheadings of 'research needs' and 'involving stakeholders'.

Results

Networking is valuable

In the written response, 12 partners reflected on the importance and potential of networking, and how to use the network in different ways: to improve organic farming, to collaborate in research, to transfer knowledge and to learn from people from different fields of expertise. The establishment of personal contacts was seen as invaluable, in terms of seeking advice, comments, visiting speakers and collaboration.

Five of the partner from the new member states highlighted the importance of exchanging experience concerning the implementation of standards. The importance of two-way learning was reflected in various statements. The process of disseminating knowledge from countries with more experience in the organic livestock to those with less experience was seen as particularly important in preventing some of the mistakes made in the past. However, the importance of learning from the countries with less experience, particularly with regard to novel interpretation of the EU standards on organic farming practices, was also emphasised, e.g. as stated by one of the British partners: '*the new member states appear to have new interpretive angles to the organic regulation (e.g. emphasis on indigenous breeds, organic farming seen as the saviour of marginal areas of agriculture, soil contamination seen as a potential barrier to conversion etc.)'*.

One of the German partners felt that *'Networking between the few actors in organic animal husbandry research is crucial for development'*. This also highlights the relevance of networking, particularly in a situation where there are few actors in a research area. An Austrian partner emphasised the need to search for specific organic approaches to problems in the organic livestock sector: '*While conventional approaches are unlikely to improve the situation in organic animal husbandry, new strategies for closing this gap should be elaborated'*.

Diversity needs to be respected

In the responses to the questionnaire, there were several comments regarding the definition and characteristics of organic farming. The comments reflected the diversity of organic farming, including the many different development phases of organic farming in the member states. Some SAFO project participants viewed organic animal husbandry as still being in a very fragile phase. Respect for the diversity of existing systems was seen as one way to support emerging organic systems. Many comments also highlighted the need to include local conditions in the analysis of the problems as well as the solutions. Cultural differences, e.g. in regard to attitudes towards animal welfare, must be both subject to open discussion as well as addressed when finding possibilities for improvements in each individual country. It was emphasised that diversity should be seen as an opportunity rather than a threat to the development of organic farming across countries.

Knowledge and training networks among farmers are important in organic livestock production

A working group at the 4th workshop discussed training and networking in organic animal husbandry. A number of examples of existing networks and sources of support to development of organic animal husbandry were listed, some of which are presented in Box 1.

The group emphasised the need for farmers to document and analyse their own farms, in order to understand how their own initiatives work in practice. It was felt that farmers should be involved in all research and advisory initiatives, to optimise the use of existing resources. Selection of suitable breeds in organic livestock systems was identified as a major research need, where different experiences and participation of farmers would be crucial.

It is important to maintain an innovative approach to organic farming

Both Danish and British partners expressed concerns over potential loss of innovativeness in the development of organic farming systems, as more formal and established regulatory systems are introduced. The importance of producers participating in the development of 'innovative solutions' was highlighted. It was also suggested that the organic principles have to be maintained as the framework for organic production. This would include the standard development. Other partners pointed out that training and education of all stakeholders, including consumers was an important task and that all communication needs to involve all stakeholders, farmers, advisors, consumers and researchers, to maintain the innovativeness of organic farming.

Three main conclusions from the working group, focusing on future initiatives of innovative research and knowledge for farmers, are presented in Box 2.

Box 1 Examples given by country representatives in a group discussion at the 4th workshop to illustrate various approaches to innovative networks involving organic farmers.

- Scotland: Advisory networks with 30 farmers and 6 meetings per year. One-day participative training courses (optimal 15 farmers).
- Bulgaria: Some initiatives with training of farmers. Information data base exists, but improvements are needed.
- Czech Republic: Organisations do a good job including market orientation. Homoeopathic veterinary service, grassland renovation and laboratory services. Advisors organise farmer training.
- Poland: 16 provinces with 200 people participating in regional centres in various types of courses.
- Finland: Annual trainings courses for farmers, 1 day. Good conditions for farmers, and training activities partly based on visits on farms.
- Switzerland: Lots of research initiatives in e.g. homoeopathy and production of leaflets on various themes. Monitor farm conditions, work with farmers. Database of organic farmers.
- France: Farmers are very positive to establish research in order to develop basic knowledge. Organic farmers can make agreements with vets on annual basis and then call them any time for advice and training.

Box 2 Three main conclusions from the working group on ‘how to maintain innovativeness in the development of organic livestock production systems?’.

- Establishment of European information resource data base for organic farmers and advisors including ‘grey’ literature and advisory literature.
- Establishment of training groups of farmers, perhaps including arrangements with veterinarians and nutritionists
- Research needs: Focus on the suitability of appropriate breeds for organic farming, information of complementary medicine, phytotherapy and strategies of application, mastitis control and learn from well adapted organic herds.

It is important to close the ‘gap’ between ‘organic philosophy’ and ‘organic practice’ to ensure good animal health and welfare.

Many SAFO project participants, particularly from countries with a long history of organic livestock farming, pointed out that there appeared to be a gap between ‘organic philosophy’ and the reality at farm level. In particular, one of the German partners expressed concern about the development of organic farming away from the original basic principles of promotion of animal health and welfare by species-specific husbandry.

To address the need for further improvement of the animal health and welfare situation, different countries had developed different approaches, ranging from organic breeding programmes and training of farmers to implementing obligatory health planning on organic farms. A Hungarian partner suggested that *'veterinarians should be involved in the whole process of organic farming, emphasizing the role of prevention by elaboration of animal health plans, tailored to each individual farm'*.

A working group based around the topic of how to ensure good animal health and welfare in organic farming throughout Europe made suggestion at three levels, farm, certification and research (see Box 3). The group also recommended that a virtual workshop on health planning should be organised in the near future on the SAFO website.

Box 3 Main conclusions from the working group on 'how to ensure good animal health and welfare in organic livestock production?'

Farm level:
- Farmer attitudes
- Farmer training / awareness (minimum level of skills)
- Quality assurance with financial incentives
- Benchmarking
- Health planning; evidence based

Certification:
- Initiatives to encourage/introduce animal based assessments into inspection
- Risk assessment based – who pays?

Research (see also Box 5)
- Animal health economics
- 'Acceptable level of disease'?
- Do health plans work?
- Health planning network

It is important to define food quality and safety of organic animal products

The need to put more emphasis on food safety issues in organic livestock production was acknowledged by some of the respondents to the consultation. The concepts of 'process' and 'product' quality that had been introduce in some presentations was also highlighted as one of the key messages from the SAFO project. Apart from these statements, not many key messages touched the subject of food safety itself.

The working group on this issue concluded that consumers expect both high process and high product quality from organic food products. The difficult (at times) interface between process and product quality was highlighted. The organic requirement for outdoor access for stock was mentioned as an issue that potentially contributes to good animal welfare but also exposes the animals to both human and animal pathogens, such as salmonellas, *Campylobacter* spp. and *Mycobacterium paratuberculosis*. However, it was recognised that it is difficult to quantify the food safety risks associated with good process quality. An example of this was highlighted in one of the SAFO workshops, where the prevalence of Johne's disease in the Netherlands was similar in organic and non-organic herds, in spite of a much greater risk profile of the organic herds. The group acknowledged that food safety issues are likely to become more prominent in the future, with regard to both organic and conventional livestock production. The three main conclusions from this group are presented in Box 4.

Clearer criteria for animal health and welfare and product safety were discussed in another working group. It was recognised that these criteria should be accessible to inspection and should be based on scientific evidence, especially for aspects that are crucial in terms of consumer confidence, i.e. the minimisation of the risk of residues and pathogens.

Box 4 Main conclusions from the working group on 'how to balance food safety and process quality in organic livestock production?'

- There are specific food safety risks posed by farming according organic livestock regulations
- There is a need for more epidemiological studies to identify and deal with risks, and a need to relate epidemiological results to farming process (i.e. tease out relationships between process quality and product quality)
- There is a need to define and establish quality criteria for organic products including need to identify advantages and disadvantages of establishing organic product quality parameters. Transparency in terms of quality was concluded to be very important in relation to this.

Further research needs

The different views about research needs in organic farming reflected the diversity between the countries. The need to coordinate research efforts was emphasised by many partners, as expressed by one of the German partners: *'In order to prevent that research in organic livestock production will develop into a quite arbitrary series of investigations and solving strategies there is need for structuring the debate and the research work, although it is yet not very clear how to be able to gather the divergent forces under the same umbrella'*.

Some specific research topics were mentioned as requiring more attention, such as preventive animal health, food safety, breeding, nutrition, veterinary treatment, castration of pigs, milk/meat quality in sheep and the close, mutual dependence between crop production and animal production. It was also highlighted that it is important to find a balance between getting an overview and addressing all these specific questions.

Apart from issues already mentioned a number of suggestions to promote research initiatives, which could utilise local resources, knowledge and innovation, were developed by the working groups in the 4th SAFO workshop. These are summarised in Box 5.

Box 5 Suggestions made by working groups on fostering of innovative research and development of organic animal husbandry.

- Research should focus on well balanced farming systems.
- Research should support regional production of organic food, involve consumers, local politicians and governments, and ensure that the financial basis for this research comes from the region as a part of its own priority.
- There should be adequate focus on consumers. Opinions, discussions, dialogue and training in ‘organic product consumption’ are needed.
- Research on the utilisation of local feedstuffs on organic farms should get more attention.
- Small, low-budget learning groups of farmers and researchers should be considered as a means to enhanced technology transfer.
- Old food processing techniques should be investigated in order to add value to organic produce.
- The usefulness of homoeopathy and phytotherapy needs to be confirmed by research.

Involving stakeholders

Many partners emphasised the need to disseminate results from the SAFO network to stakeholders, producers, policy makers, researchers, advisors, and consumers.

Discussion

Both the consultation responses and the working group conclusions show that exchange and active communication has taken place during the network activities. The implementation of the common organic standards in different European countries was mentioned as one important area for this exchange, particularly by partners from the new member states. The opportunity to learn from each other, was identified as an important achievement of the network. It was also suggested that, in some respects, the organic farming sector in the new member states seems to be closer to ‘organic principles’ than some of the organic livestock systems in the established member states, but countries with established organic sectors contribute more experience with organic livestock production. This gives new impetus to the notion of respecting diversity in production systems. This view is further supported by the many participants who mentioned that they had changed their views and understanding of organic farming, as a result of the learning experience during the network activities. All in all, the network appears to have achieved one of its main objectives: to provide a platform for exchange of experience and knowledge.

A further aim of the network is to support the process of development of EU standards on organic livestock production. Five of the new member state members specifically mentioned the importance of exchanging experience concerning the implementation of standards. This suggests that SAFO is facilitating the ‘disseminating knowledge from countries with more experience to countries with less experience in the organic livestock sector’, but it is also apparent that the new member states offer new interpretive angles to the organic regulation, adding further to the understanding of the diversity. In order to obtain a more profound characterisation of organic farming in Europe, more fact-oriented descriptions will be made as a part of the SAFO standard development work.

A clear message from the consultation and working group feedback is the need to recognise the potential of diversity of the livestock systems to stimulate solutions to potential problems at regional level, while also gaining universally from a better understanding of it. A search for local solutions is also likely to stimulate an ongoing innovativeness, which was felt to be a important characteristic of organic farming.

Even though one of the intermediate objectives of the SAFO project was to identify important food quality characteristics linked to organic livestock products, including food safety with regard to zoonoses, drug residues and anti-microbial resistance, relatively few respondents to the consultation included food safety in the list of the proposed key messages. As food safety is a core issue in the SAFO project, a working group was formed around this subject. The main conclusions of this group suggest that there is a need to increase the knowledge base in this area, with improved monitoring and research.

Finally, it is important to recognise that the messages discussed in this paper refer to the subjective comments made by the partners and participants of the SAFO network and the 4th workshop, respectively, with regard to their personal take-home-messages from the network activities. A separate summary of the messages arising specifically from the papers and posters presented in the workshops will be made for presentation in the 5th and last SAFO workshop.

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Part F:
Report on standard development

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4th Report from the SAFO Standard Development Group

Preliminary recommendations for the development of organic livestock standards in relation to animal health and food safety - working group feedback

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Introduction

Organic agriculture has a long history, in which production and processing standards have been an important part. The first guidelines were developed by private associations to formalise an alternative production system. Labelling for organic products was introduced in 1954 by the bio-dynamic association '*demeter*' in Germany. The starting point for 'organic' labelling was the trademark legislation that required clear criteria to identify organically produced goods. Because the variety of production sites and the resultant product properties did not allow the identification to be linked to products in terms of quality that could be described exactly and understood analytically, the production method itself became the identifying criterion. In the following decades, the standards have been further developed on national level and supranational levels. The basic standards of the International Federation of Organic Farming Movements (IFOAM) are applied worldwide. The fundamental principle, to describe the production method as the identifying criterion, has been kept in all basic standards to the present day and has also been adopted in the EC Regulation.

Until recently, livestock production had a minor role in the development of organic standards. The current basic IFOAM objectives consist of 15 standards (IFOAM, 2000). Only three of these standards refer to organic livestock production. First one of them sets the maintenance of biodiversity as one of the main goals of organic farming. Secondly, organic livestock husbandry is expected to offer freedom and access to natural behaviour to livestock. Thirdly, organic farming systems should promote a balanced mix of crop and livestock production, leading to closed and sustainable nutrient cycles. These principles contain no explicit objectives to maintain or promote high animal health or welfare.

In contrast to the IFOAM standards, the European Commission Regulation 1804/99 (CEC, 1999) contains implicit standards that put a strong emphasis on livestock production in order to enhance both health and welfare of organically managed stock. However, the EC-Regulation was not implemented to achieve a certain level of quality within the production process or the organic products. The focus of the Community rules of production, labelling and inspection are intended to:

- enable organic production to be protected, in so far as it will ensure conditions of fair competition between producers;
- give the market for organic products a more distinctive profile by ensuring transparency at all stages of the production and processing; and
- thereby, improving the credibility of such products in the eyes of the consumers.

In the EC Regulation, the framework conditions for organic livestock production have been specified and specific prescriptions were enclosed that are expected to improve animal health and food safety. The EC Regulation does not demand that organic farmers ensure a minimum level of animal health and food safety and does not promise the consumers that such minimum levels exist on organic farms. However, it is obvious that consumers have developed certain expectations with regard to organic products. These expectations assume a high level of animal health and welfare and adequate food safety. Indeed, the level of these attributes is usually expected to exceed that found in conventional production systems.

It is obvious that the organic standards, in many areas, exceed the legal minimum requirements. Furthermore, the guidelines are supervised by independent certifying authorities. For the external perception of organic farming, however, it is an important question whether compliance with the guidelines will generate effects that correspond to the self-proclaimed quality claims and to the expectations of the consumers. From the previous SAFO-workshops and from the literature, the following preliminary conclusions are drawn:

- There appears to be no general advantage or disadvantage of organic compared to conventional farming, in relation to animal health and welfare and food safety;
- Review of published data shows that the variation regarding prevalence of diseases is bigger within than between the organic and conventional production methods; and
- The main health problems in organic livestock production are production diseases, primarily caused by multiple factors, for which the farm management is holding the key responsibility.

Working groups
In the 4th SAFO workshop, a series of working groups discussed the current EU organic standards, with the aim of identifying potential improvements. The participants were asked to focus primarily on possible modifications of the regulation that might be necessary to improve the level of animal health and food safety in organic livestock production. The participants of the workshop were allocated to four working groups, addressing the following, specific questions:

(1) Harmonization or regionalisation of the standards?;
(2) Disease prevention principle – article 5.1 & 5.2;
(3) Treatment of diseased animals - article 5.3 - 5.8; and
(4) Should food safety be addressed directly in the EC regulation?

The outcomes of the individual working groups are reported below.

Working Group 1: Harmonization or regionalisation of the standards?
Rapporteurs: Georgios Arsenos and Ulla Holma

The discussion in the working group focused on two main questions:

- Should the standards be common to all countries?
- Would it be better to form a baseline of standards with similar principles and then to move further to regionalisation of standards?

The common feeling was that the standards needed to be revised to make their objectives more explicit. Specific wording in existing regulation is implicit, at best, and needs modification to avoid confusion. Issues such as “high quality feed”, “use of phytotherapeutic products”, “stocking density”, “breed selection” etc. need further clarification. In some cases, annexes with examples would be helpful. It was felt that there is a need for a baseline regulation, outlining the general principles and separated from the inspection standards. This would allow specific rules to become more regional and more appropriate to the particular needs of the different countries.

The participants of the working group agreed that transparency of national standards is another key issue. The need for an open database regarding the situation in each country and the interpretation of standards would provide the means for more objective criteria in relation to import and export of organic food.

The group discussed the relevant paragraphs of the regulation in more detail. The discussion is summarized as follows:

Disease prevention:
Paragraph 5.1.(a): The demand for the selection of appropriate breeds remains unclear. Currently, problems occur especially in poultry production when using conventional strains. There was no common agreement on whether indigenous breeds are more appropriate than 'non-indigenous' breeds. There are cases where the quality of products derived from indigenous breeds are in conflict with the consumers' expectations (e.g. fat content of meat) and with the realities of production economics.

Paragraph 5.1.(c): The term 'high quality feed' should be clarified in the feed section. Quality should be defined in terms of objective criteria, e.g. chemical composition.

Paragraph 5.1.(d): The appropriate density of livestock, as it stands in the regulation, does not prevent overstocking and/or temporary overstocking. Specific instructions and examples should take account the m^2 and m^3.

Paragraph 5.2): In the section regarding animal health problems, the wording is not clear and needs to be revised.

Appropriate treatment of diseased animals:
Paragraph 5.3): The use of isolation units is not a panacea, and it should be clarified in the regulation that the best practice is to act according to the nature of the disease.

Paragraph 5.4): The group felt uneasy with the use of the term 'allopathic veterinary medicinal products'. The suggestion was that the section should be revised because, in the present version, it provides room for different interpretation. It was also suggested that all type of products used as medicines should gain approval from local authorities.

Paragraph 5.4.(a): The experience from all countries represented in the group was that phytotherapeutic and homeopathic products were neither officially tested nor registered. Some members of the groups expressed their concern about the suggestion in the regulation that phytotherapeutic, homeopathic products should be used in preference to chemically synthesized allopathic products. The main argument was that animal health is not ensured when phytotherapeutic and homeopathic products are used, as they are not effective in all cases. Their effectiveness must be justified in clinical trials.

Paragraph 5.4.(b): The missing point in the regulation is a clear justification with regard to the question: who is responsible for assessing the level of disease and the health status of farm animals? It was suggested that this section should be deleted from the regulation. Instead, a specific explanation is needed concerning animal health plans that could be easily modified to meet the requirements of different farming systems in each European country.

Paragraph 5.5.(a): The prohibition stated here is a general rule in EU conventional farming. The differences should focus on the management practices.

Paragraph 5.6): The issue of recording was another key point of the discussion, and it was concluded that not only veterinary products but every single treatment should be recorded. More effort should be made to improve the recording of all products used in the farm, including phytotherapeutic, homeopathic, vaccines and antiparasitic products. The identification of treated livestock was questioned. The participants believed that since all treatments are regularly recorded in the animal's individual records any further use of identification methods for individual animals (e.g. colour paint, extra ear tags) was not necessary.

Paragraph 5.8): The wording here should be clarified, and either ONLY TWO or THREE treatments should be allowed.

The participants agreed that the regulation should set a range of objectives rather than a series of inspection standards, in order to deal with the diversity of production systems in different European countries. Using the objectives as a general principle, the prescriptions could become more regional. There should also be a constant effort to revise the standards in order to assure that organic production is updated with consumer demands.

The issue of harmonization should be questioned under each point of the regulation from an EU-wide perspective: e.g. what does a particular paragraph mean in a specific country, as certain husbandry management may not be applicable in both Northern and Southern European countries. Harmonization must take into account the differences in climatic conditions, animal breeds and husbandry practices, cultural differences and local tradition between and within the member states.

Working Group 2: Disease prevention principle – article 5.1 & 5.2
Rapporteurs: Malla Hovi and Michael Walkenhorst

Paragraph 5.1:
"Disease prevention in organic livestock production shall be based on the following principles:

a) the selection of appropriate breeds or strains of animals as detailed in section 3 of this Annex (paragraph 3.1 states: In the choice of breed or strains, account must be taken of the capacity of animals to adapt to local conditions; their vitality, and their resistance to disease. In addition, breeds or strains of animals shall be selected to avoid specific diseases or health problems associated with some breeds or strains used in intensive production. Preference is to be given to indigenous breeds and strains.);
b) the application of animal husbandry practices appropriate to the requirements of each species, encouraging strong resistance to disease and the prevention of infections;
c) the use of high quality feed, together with the regular exercise and access to pasturage; having the effect of encouraging the natural immunological defence of the animal;
d) ensuring an appropriate density of livestock, thus avoiding overstocking and any resulting animal heath problems."

The participants of the working group felt that, apart from a minor amendment in point c), the paragraph was valid. It was, however, felt that the standards set in it were too vague to be enforced by the present certification system. In the light of the existing data, suggesting that animal health and welfare on organic farms is no better than on conventional farms, the following recommendations for the development of the standards on disease prevention were made:

- Formal, but dynamic, health planning must be part of the standard requirements. Such health planning, if it was evidence-based, i.e. detailed and summarised the health status of the herd/flock, would provide a management tool and would help the certification authorities to enforce the other requirements of the paragraph if the status indicated poor/inadequate health. The UK national compendium of organic standards has an additional paragraph before the current 1804/99 5.2-paragraph that could be used as an example and states:

  > "The development and management of organic livestock systems requires special care in nurturing positive animal welfare. This must be provided for by a plan drawn up by the farmer, preferably working in partnership with a veterinary surgeon and agreed between them during and after conversion, to develop and operate an organic livestock system which conforms to these Standards. The plan must ensure the development of a pattern of health building and disease control measures appropriate to the particular circumstances of the individual farm and allow for the evolution of a farming system progressively less dependent on allopathic veterinary medicinal products."

- An additional point on maintenance of health status with regard to infectious/contagious diseases by closed herd/flock policy or other bio-security policy should be introduced to this paragraph, to strengthen the current provisions in paragraph 3.13 ("Where livestock are obtained from units not complying with these Standards, special attention must be paid to animal health measures."). In particular,

there should be no suggestion that it is ‘safer’, from disease control point of view, to buy in stock from organic than conventional farms.
- The word “immunological” should be deleted from point c).

In addition to the above points that directly relate to the development of the current standards, the working group wanted to emphasise the need to improve certification procedures with regard to health and welfare in organic livestock production systems. Animal and health plan-based risk assessment needs to be carried out as part of the inspections on organic livestock farms to ensure that the producers receive useful feedback from the inspection process and that animal welfare problems are identified and rectified as early as possible.

Working Group 3: Treatment of diseased animals - article 5.3 - 5.8?
Rapporteus: Tina Leeb and Lise Grøva

The working group focussed at article 5.3 – 5.8, and discussed:
- Is there a need for modifying these articles?
- What are the arguments to strengthen the necessity for modification and what argues against it?
- Which concrete modifications do you suggest and which benefit and which disadvantage do you expect from modifications?

Paragraph 5.3: “If an animal becomes sick or injured, it must be treated immediately, if necessary in isolation and in suitable housing.” - The participants saw no need for modification of this paragraph.

Paragraph 5.4): “The use of veterinary medicinal products in organic farming shall comply with the following principles: 5.4.(a) Phytotherapeutic, homeopathic products and trace elements and products shall be used in preference to chemically-synthesized allopathic veterinary medicinal products or antibiotics, provided that their therapeutic effect is effective for the species of animal and the condition for which the treatment is intended.”

The participants concluded that:
- The article needs modification.
- The article is badly written and unclear. The terminology is contradictory. The therapeutic effect of all the products mentioned is sometimes difficult to prove, especially since adequate and sufficient studies are lacking. The participants, therefore, suggest to remove this last section as provisions for ineffective treatment are also dealt with in paragraph 5.4 b). This will make the article clearer. It will make it easier to use alternative medicine without fear of being outside the regulation. We do not expect disadvantages. Veterinarians might worry that alternative medicine is used uncritically and wrongly, but 5.4 b) and 5.6 will provide some security.
    - ‘Allopathic’ is everything which is not homeopathic, so also phytotherapy is allopathic, but is mentioned together with chemically-synthesised. So it is better to cancel the word allopathic here.
    - Furthermore the EC-regulation demands phytotherapy, but at the same time European legislation does not allow their use (2004/29/EG), except those which are registered. The use of phytotherapy for therapy by vets is not allowed in many countries, but it can be used in feedstuffs and by the farmer from home grown plants. Every substance used must have an approved minimum residue level (MRL),when used for food producing

animals. The participants were concerned that the use of phytotherapy will be very difficult or even impossible in Europe.
- Only methods with a long tradition and clearly defined drugs can be used.
- Homeopathy is one of these methods, but only listed homeopathic drugs can be used. All the other methods, like Bach-Flowers, 'anthroposophic medicine', etc. are not allowed in the 2004/29/EG anymore.

The participants suggest the following modification:

5.4 a) Phytotherapeutic, homeopathic products and trace elements and their products shall be used in preference to chemically-synthesised veterinary medicinal products.

Paragraph 5.4b): "If the use of the above products should not prove, or is unlikely to be effective in combating illness or injury, and treatment is essential to avoid suffering or distress to the animal, chemically- synthesised veterinary medicinal products may be used under the responsibility of a veterinarian."

The participants concluded that:
- The paragraph needs some modification.
- It is important to have an animal health plan for each organic farm. Demanding an animal health plan is necessary for appropriate documentation of medicine use, but also an important tool for prevention of problems. A requirement for health plans in all European countries needs to be well prepared before it is actually introduced in order to avoid confusion and lack of sufficiently trained people. On the other hand, it is important to be prepared, especially as animal health plans are increasingly used in conventional farm assurance as well.

The participants suggest the following modification:

5.4 b) If the use of the above products should not prove, or is unlikely to be effective in combating illness or injury, and treatment is essential to avoid suffering or distress to the animal, chemically- synthesised veterinary medicinal products may be used under the responsibility of a veterinarian, ***preferably within the context of an animal health plan.***

Paragraph 5.4c): "The use of chemically-synthesised allopathic veterinary medicinal products for preventive treatment is forbidden."

The participants concluded that:
- The paragraph needs to be modified;
- There is need for a definition of chemically-synthesised veterinary medicinal products, potentially within an introductory definitions part, as otherwise some phytotherapeutic products and trace elements could be excluded as well.

The participants suggest the following modification:

5.4 c) The use of chemically-synthesised veterinary medicinal products for preventive treatment is forbidden.

Paragraph 5.5.(a): "The use of substances, including hormones or similar substances, to promote growth, production, control reproduction or for other purposes is prohibited. Hormones may be administered to an individual animal as a therapeutic veterinary treatment.

(b) Veterinary treatments to animals or treatments to buildings, equipment and facilities which are compulsory under national or Community legislation shall be authorised (…) when a disease has been recognized (…)"

The participants concluded that there is no need for clarification.

Paragraph 5.6): "Whenever veterinary medicinal products are to be used the type of product must be recorded clearly (…) together with details of the diagnosis, the posology, the method of administration, the duration of the treatment, and the legal withdrawal period. … Livestock treated must be clearly identified."

The participants concluded that:

1) Modification is needed.
2) Benefit: It will give the farmer a record of the treatment and its efficacy. Also, good for the veterinarian to see if the treatment works. Against: Recording does not tell the truth. More paperwork for the farmer needed.
   Maybe 'posology' can be deleted?
   Currently, there is no definition of veterinary medicinal products. It should be defined, if/that homoeopathy, phytotherapy other complementary medicine are a form of treatment as well. Additionally, there are several areas, such as the use of the medicinal product oxytocin, local and general anaesthetics and treatment of injuries (including castration wounds) with antibiotic sprays, which need clarification.

The participants suggested:

5.6) Whenever veterinary medicinal products are to be used the type of product must be recorded clearly (...) together with details of the diagnosis, the posology, the method of administration, the duration of the treatment ***and outcome of treatment****, and the legal withdrawal period. ... Livestock treated must be clearly identified.*

Paragraph 5.7): "The withdrawal period is to be twice the legal withdrawal period or, in case in which the period is not specified, 48 hours."

The participants concluded that:

- There could be a need for modifying the paragraph.
- The prescriptions provide danger for farmer, consumer, and animal. We know too little about the products. Some drugs need more than double withdrawal period. Some do not need double withdrawal period. Withdrawal period is not the same in all countries. Problems arise in the use of antibiotics in the dry cow therapy. Additionally, there is little knowledge about environment effects and resistance. There should be individual withdrawal periods for each drug. When zero withdrawal, there might be a need for differential withdrawal period depending on the product; egg, meat, milk. Vitamins and phytotherapeutics have no legal withdrawal but they are chemical-synthesised so they have should incur a 48-hour withdrawal on organic farms.

The participants provide no clear suggestion for concrete modification, but felt it important to comment on it.

Paragraph 5.8: "With the exception of vaccinations, treatments for parasites and any compulsory eradication schemes established by Member States, where an animal or group receive more than two or a maximum of three courses of treatments with chemically-synthesised allopathic veterinary medicinal products or antibiotics within one year (or more than one course of treatment if their productive life cycle is less than one year) the livestock concerned or produce derived from them, may not be sold as being products produced in accordance with this Regulation."

The participants concluded that:

- The paragraph needs modification.
- The paragraph is difficult to understand. Problems arise, as some treatments might not be recorded, in order to avoid loss of organic status- especially a problem in pigs. In some countries, for some species, this article is not regarded as a problem. A productive life cycle needs definition, as some countries regard piglets and finishing pigs as separate life cycles.

The participants suggested:

Paragraph 5.9: With the exception of vaccinations, treatments for parasites and any compulsory eradication schemes established by Member States, where an animal or group receive maximum of three courses of treatments with chemically-synthesised veterinary medicinal products within one year (or more than one course of treatment if their productive life cycle is less than one year) the livestock concerned or produce derived from them, may not be sold as being products produced in accordance with this Regulation.

Working Group 4: Should food safety issues be addressed in the EC regulation on organic farming?

Rapporteurs: Aize Kijlstra and Albert Sundrum

Food safety in organic livestock farming includes issues such as:

- Physical contaminants (e.g. flies, glass, wood, metals)
- Environmental contaminants (e.g. heavy metals, pesticides, dioxins, PCB's)
- Residues of synthetic chemicals (e.g. veterinary medicines, growth promoters)
- Microbiological contaminants (e.g. *Toxoplasma gondii, Campylobacter, Salmonella, M. paratuberculosis, E.coli VTEC 0157, Listeria*)
- Small scale (food quality control; on farm processing expertise; on farm marketing/farm markets).

Many of these issues have been covered during the SAFO workshops and detailed reports have been published in the various proceedings. The current regulation on organic farming touches a number of aspects that relate to food safety and mainly addresses specific provisions to avoid the presence of certain residues of synthetic chemicals from sources other than agriculture (environmental contamination) in the products obtained by such production methods (Table 1).

Table 1 Articles in EU regulation 1804/1999 relating to possible food safety issues.

4.1.7. (…) Antibiotics, coccidiostatics, medical substances, growth promoters or any other substance intended to stimulate growth or production shall not be used in animal feeding.
5.4. (c) The use of chemically-synthesised allopathic veterinary medicinal products or antibiotics for preventive treatment is forbidden.

5.5. In addition to the above principles, the following rules apply:
(a) the use of substances to promote growth or production and the use of hormones or similar substances to control reproduction, or for other purposes, is prohibited. Hormones may be administered to an individual animal as a therapeutic veterinary treatment,
(b) veterinary treatments to animals, or treatments to buildings, equipment and facilities which are compulsory under national or Community legislation shall be authorised (...) when a disease has been recognized (...).
5.7. The withdrawal period is to be twice the legal withdrawal period or, in case in which the period is not specified, 48 hours.
5.8. With the exception of vaccinations, treatments for parasites and any compulsory eradication schemes established by Member States, where an animal or group receive more than two or a maximum of three courses of treatments with chemically-synthesised allopathic veterinary medicinal products or antibiotics within one year (or more than one course of treatment if their productive life cycle is less than one year) the livestock concerned or produce derived from them, may not be sold as being products produced in accordance with this Regulation (...).

Since the current EC-Regulation only deals with means of avoiding possible food safety issues, it is the question whether specific regulations are needed to ensure the food quality of organic livestock products. The group attempted to answer the following explicit questions:

- Is there a need for addressing food safety directly in articles?
- If so, what are your arguments to strengthen the necessity for additional articles?
- Which concrete formulation do you suggest ?

The working group concluded that there is a need to address food safety issues directly in separate articles. Arguments in favour or against the necessity for extra articles are listed below:

- In favour:
  - Consumers expect a high quality of organic feed products and expect that food safety is controlled.
  - EU expects a high quality product from organic farms.
  - There are specific food safety problems associated with organic livestock farming, most notably due to the outdoor access of the animals.
  - Food safety issues in organic farming possibly not completely covered in existing regulations on food safety.
  - Responsibility for food safety is at the producer level.
  - Special attention may be positive for the image of organic farming and shows awareness of possible food safety issues.
- Against:
  - Why put so much attention to this issue, since it may disturb economic development of the market for organic products.
  - Separate implementation and inspection may be difficult. Who is going to take the responsibility?
  - Food safety is already covered by other EU regulations (General Food Law EC178/2002).

Since many details concerning food safety are already covered by the general food law (EC178/2002), it was felt that the EU regulations on organic farming should only include a general statement on food safety. Therefore the following text proposal was formulated:

All organic farms must comply with the requirement to exert all due diligence concerning food safety and take all reasonable precautions to ensure food safety. This should include awareness of emerging risks and precautions to manage them.

Conclusions

It is clear that a considerable gap exists between expectations of consumers towards organic animal products and the current situation on organic farms. However, production standards are, by their nature, not well-suited to solve animal health or food safety problems, caused by multiple factors. Nevertheless, a modification of the standards can be expected to reduce the gap between expectation and the *status quo*. This is essential to improve the credibility of organic products in the eyes of the consumers.

As part of the previous work in the SAFO-work package on ‘standard development’ and the subsequent discussions at the different SAFO-workshops, a comprehensive overview of the problems, with regard to animal health and food safety standard of organic livestock production, has been elaborated. Furthermore, detailed suggestions for the modification of the standards have been provided by the above described working groups. In a further step, the current state of the art and the various suggestions will be summarized in a final report and supplemented by concrete recommendations for the EU-Commission. The final report will be available on the SAFO web-site at the end of 2005.

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