Combining Ethological Thinking and Epidemiological Knowledge to Enhance the Naturalness of Organic Livestock Systems

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ABSTRACT
Organic livestock farming places strong emphasis on conditions that allow animals to exhibit behavioural needs. This involves the provision of a natural environment and, in particular, outdoor conditions and a reliance on natural forages. Such environments also allow animals to be effectively integrated into crop production. However, there are potential disease risks associated with these conditions, with control options being partly limited by restrictions on chemoprophylactic measures. Examples from dairy and poultry production demonstrate how a basic understanding of ethology and a knowledge of disease epidemiology can enhance the welfare of animals whilst satisfying the ecological objectives of organic farming. Existing epidemiological models and published data can be used to examine the potential ensuing health hazards and control possibilities and to suggest alternatives.

INTRODUCTION
The concept of naturalness underpins the special philosophy of organic livestock farming. This includes the idea that farm animals should live in an environment corresponding to that which they are adapted to through evolution, and that they should be allowed to perform species-specific behaviour and be fed according to their physiological needs. In Northern Europe, animals have increasingly been confined in artificial environments that do not allow them to exhibit their physiological and behavioural needs. Also, the time the farmer has available for each animal has dramatically decreased. As a result, many farmers have lost a good understanding of animal behaviour, e.g. herding, controlling natural breeding, and identifying sick animals for treatment. This becomes particularly detrimental in organic farming, where management should be based on understanding of animal behaviour and where preventive health care is vital. This involves a certain freedom of choice. 'Care' is understood as the counterpart of naturalness, expressing humans' special responsibility towards domestic animals (Alroe *et al*., 2001).

Organic farming puts greater emphasis on animal needs and integration with the environment. However, naturalness has not always been embodied in practice. For example, organic dairy production tends to differ from conventional systems in provision of feeds and disease controls. If naturalness is taken seriously, management will be based more on insights into animal behaviour, would involve more consideration of the animal as a part of a herd and would offer greater provision of a natural environment.

Since the overall goal in organic farming is to create sustainable systems, this philosophical framework can create several dilemmas, particularly in relation to

integrating naturalness into the systems of production as well as the other animal health, economic and environmental objectives of organic farming. In this paper, we focus on the basic understanding of ethology and knowledge of disease epidemiology, and how the combination of knowledge in these two areas can help deal with this problem whilst satisfying the ecological objectives of organic farming.

APPLYING ETHOLOGICAL THINKING

Improved knowledge of animal behaviour can be viewed as important in organic farming for at least three reasons: 1) to solve immediate challenges in animal care and production; 2) to understand what is required for animals to express their natural behaviour; and 3) to improve the animals' welfare in the long term.

With few exceptions, all farm animal species are social. In the wild, group living can provide many advantages for the individual, such as increased efficiency in detecting and acquiring food and better protection against predators, but there can also be disadvantages, such as increased exposure to parasites and pathogens. Thus, natural populations have optimal group sizes, adapted to their communication and recognition abilities, season and developmental stage. When these more natural group structures are introduced on the farm, animals are allowed a greater opportunity to express their social behaviour. However, the structure that best suits the animal may be uneconomical. For example, under wild conditions groups of mixed sexes and ages are most likely, yet under commercial conditions would increase costs and cause management difficulties. Studies of animals living under wild or semi-wild conditions can be used when developing alternative and more 'natural' systems. In organic farming this idea is being applied more to pig and poultry production than to dairy farming.

DISEASE EPIDEMIOLOGY AND 'NATURAL LIVING'

Conversion to organic production may result in changes in disease epidemiology, possibly as a consequence of changing farmers' attitudes and perception, treatment thresholds or prohibition of preventive medication, changes in cost-benefit relationships, new feeding strategies or change in disease factors associated with greater outdoor access. Although focusing on natural living potentially gives many welfare benefits and reduces many of the behavioural and bacterial disease problems in crowded and poorly ventilated indoor systems, free-range organic animal husbandry has raised the question of whether the animals' welfare is at risk. There may be specific diseases that justify this concern, and the few studies published so far indicate that the major health concerns are related to parasitic and other infections connected with outdoor rearing (Thamsborg *et al*., 2003).

Organic animal husbandry places particular emphasis on health promotion and disease prevention, including breed selection, animal husbandry practice, feeding natural forages, free-range conditions and appropriate stocking densities (CEC, 1999). Patterns of disease are influenced by biological, economic, cultural and environmental factors. Epidemiological studies that include such factors can enhance our understanding of how to promote health and manage disease organically.

The aim in organic farming is co-operation with nature, including improving the animals' ability to deal with disease challenges. One can debate whether outdoor and free-range systems enable a more balanced immune response or present an animal welfare issue. The animals need to build up their ability to handle infections, e.g. through

low stress levels and low dosage exposure to infective agents in cases where immune response can develop. However, we also need to discuss what disease levels are 'tolerable' in organic farming, since the aim is not to eradicate diseases at any price. Ultimately, the organic farmer can intervene with treatment or other forms of care. It is not relevant to raise concern about 'suffering' of organic animals, and the emphasis on animal health and welfare in organic production should not be ignored. With correct feeding, stocking, breeding, and care, the risk of disease need not be a major concern.

COMBINING ORGANIC THINKING

The aim of organic farming is to develop viable agro-ecosystems whose parts support each other to create a better and more productive whole (Lund *et al*., 2004). Integration of more than one livestock species and of livestock with cropping can be the basis of a balanced and sustainable farming system, allowing nutrient recycling and effective resource use. Due consideration must be taken of the whole system. For example, if not managed properly, natural animal behaviour can cause problems. Under natural conditions pigs and chickens spend most of the day looking for food. Restricted foraging (e.g. where animals are fed concentrated diets from a feeder) can lead to behavioural disturbances, and it has been suggested as a cause of feather pecking in chickens (Blokhuis, 1986). The organic requirement to provide animals with roughage and give them access to grass helps to mitigate some problems related to foraging behaviour, but a challenge remains for production systems to use animal behaviour as an asset, and not simply solve behavioural problems. This must be done as an integrated part of the whole organic system. However, some conflicts are difficult to avoid and care must be taken to solve these in a constructive way, still including the animal welfare objectives.

Example 1: Group living in dairy calves

Given the choice, most farm animals would live in groups for at least part of their lives, and this is a requirement in housed organic animals. This is contrary to how most young dairy calves are reared in North-west Europe, where individual housing is most common. If learning from how a 'natural' system works, there would be a calving season, cows would naturally bond with their own calves and there would be a small but stable grouping of calves of the same age within the herd. The advantages of being in a group like this is the learning element: the calves will gradually move from playing to forming a hierarchy, which will be supported by the stability of the group. How can this be brought into daily practice in large European dairy herds?

The argument for single-calf housing often refers to disease risk (e.g. pasteurellosis), suckling on other calves in the group, and that single penned calves are less demanding to manage, and disease is easier to monitor. The ease of disease surveillance may, in part, explain why disease incidence is higher in group-housed calves: they are more time-consuming to observe and manage. Yet, from an ethological and natural perspective group-housing would be most beneficial. Solutions are required that enable calves to live within groups and yet remain healthy. One key could be the emphasis on stability, allowing calves to build up a common immunity, as well as gradually forming a group structure and hierarchy without being disturbed by new animals and new infections. Stable groups, reared together, will assist in promoting good health and supporting the calves' needs for developing social behaviour. The next step could be groups of dairy

cows with calves, thus facilitating the learning process through adult contact. Good examples of such systems exist, but are still more complex, e.g. in larger herds on limited space and with no distinct calving season.

Example 2: Integration of poultry in the crop rotation

Free-range systems are required in organic poultry production, and these systems do provide an opportunity for group living, albeit in single-age groups. However, this system could present increased parasite and predation risk. In large-scale poultry production, all-in / all-out systems will typically be introduced as a necessary means to prevent diseases, which implies single-age groups. The inclusion of cockerels in poultry flocks can, however, improve group dynamics. Group size is another feature that for economic reasons usually deviates greatly from what is considered the optimum in natural habitats. Mobile houses offer opportunities for smaller groups and are better suited to integrating poultry into the farming system.

A mobile poultry system that fits into a crop rotation builds soil fertility and uses farm resources more efficiently, including 'wastes'. There also are natural parasite control benefits from pasture rotation, which could extend to benefit ruminants within the crop rotation. However, annual cropping does not allow the establishment of trees and bushes that resemble the natural environment of the species (i.e. jungle shrub) and which satisfy the animals' basic instinct to escape predation. One way to grow annual crops and still provide a more natural environment for poultry could be to grow tall crops such as maize, although this may be difficult to combine with mobile systems. A trade-off must be made between the poultry's need for a natural environment, and the epidemiological requirements of parasite control. Integration of animals with orchards or fruit plantations appears to suit organic systems better than integration with annual crops; a good example of layer birds both benefiting from, and contributing to, a raspberry crop is provided by Reid (2002).

CONCLUSIONS

In organic farming, naturalness and a natural life are considered important for animal welfare. This paper has highlighted the significant difficulties associated with combining these with the other objectives of organic farming, particularly high standards of animal health and the requirement for economic efficiency. However, the paper has also illustrated that, with a basic understanding of behavioural needs and knowledge of disease risks and patterns, combined with an innovative approach, sustainable, functional and mutually beneficial animal and crop system are feasible. This knowledge must be supported by the practical implementation of appropriate housing facilities and grazing arrangements, disease surveillance and good human-animal relationships. Existing epidemiological models and published data can be used to examine the potential ensuing health hazards and control possibilities and to suggest alternatives. Finally, whilst the principles of naturalness are embedded within the legal framework for organic farming, it is imperative that producers not only fulfil these legal requirements, but also embrace the underlying principles when developing and managing organic livestock systems.

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