Intensive production units and welfare: domestic fowl

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Summary: Major specialisation and intensification of the poultry industry in recent years have led to widespread public concern regarding the welfare of the animals involved. The debate originated some 25 years ago in Western Europe, resulting in regulations at both the national and European Union (Community) level.

Animal welfare is ensured when the individual animal is coping successfully with the environment and is free from pain (e.g. due to injury or disease). The welfare of an animal is jeopardised when its regulatory action, in relation to relevant internal and external factors, is impossible or chronically hampered.

Ample information is now available on housing requirements with regard to welfare. For poultry, these requirements relate to space, laying nests, litter and perches.

The welfare of laying hens is compromised in highly intensive systems such as battery cages. Alternative housing systems, taking into account the housing requirements mentioned above, may considerably improve the welfare of these birds.

Welfare problems in broilers and broiler breeders may best be alleviated by alternative selection programmes which take into account parameters related not only to economic efficiency but also to health and welfare.


INTRODUCTION

Major specialisation and intensification has occurred within the poultry industry over the last three decades. In the Netherlands, until 1960, poultry were kept almost exclusively on small farms as an additional activity. Subsequently, effective breeding programmes produced highly specialised breeds for laying and meat production (broilers), and growing numbers of farms specialised in the production of either eggs or poultry meat. This specialisation also resulted in an increase in the number of birds per farm. Thus, the average number of laying hens per farm in the Netherlands increased from approximately 200 in 1960 to 18,500 in 1992. At the same time, the number of farms with laying hens decreased from approximately 200,000 in 1960 to approximately 1,800 in 1992 (Fig. 1).
Housing conditions for poultry also changed dramatically. For laying hens, low-density deep-litter systems (generally with a large outside run) were replaced by high-density battery-cage systems in climatically controlled houses. Although the majority of broilers are still kept in floor systems, density has again greatly increased (up to 25-30 birds per m$^2$) and houses are climatically controlled.

Parallel to these developments, public concern increased in Western Europe regarding the welfare of poultry in intensive production systems. Criticism centred on the high housing densities which resulted in a very small space allowance per bird, and the barren environment in which the birds were kept. Governmental committees were established to inquire into the welfare of intensively kept livestock, such as the Brambell Committee in the United Kingdom (16) and the Husbandry and Animal Welfare Committee in the Netherlands (41). The reports of these committees discussed specific problems related to intensive husbandry and stimulated both discussion and research in this field.

In 1976, the Council of Europe drew up the "European Convention on the Protection of Animals kept for Farming Purposes" (3). In the framework of this Convention, a recommendation concerning laying hens was adopted in 1986 (4). This presents general requirements regarding the housing of hens in battery cages. Thus, the Convention specifies that: “Cages shall be of sufficient height and constructed in such a way as to allow the birds to stand normally” and “endeavours should be made to
introduce improvements in existing husbandry systems, and to develop and apply new systems which allow for the behavioural and physiological needs of the birds to be met, in particular to develop housing systems where the birds have more space, a less barren environment, and nesting and perching facilities”. A recommendation on broilers is now being prepared by the Standing Committee of this European Convention.

Legislation to implement the requirements of a European Community (EC) Council Directive, which established minimum standards for the protection of laying hens kept in battery cages, became operative in the member states of the EC in 1988. The most relevant points in this Directive are the following:

- laying hens in cages shall have at least 450 cm$^2$ of cage area
- a feed trough of at least 10 cm in length per bird shall be provided
- each battery cage shall have a continuous drinking channel of at least 10 cm per bird or, when nipple drinkers or drinking cups are provided, at least two of these shall be within reach of each cage
- battery cages shall be at least 40 cm high for over 65% of the cage area and not less than 35 cm high at any point
- floors of battery cages must be constructed in such a way that they adequately support each of the forward-facing claws of each foot
- floor slope shall not exceed 14% or 8°.

Some EC countries have unilaterally imposed additional regulations (25). European countries outside the EC have also enacted legislation regarding the housing of laying hens; Switzerland has even banned cages outright. Within the EC, proposals for adjustment of the present regulations are being prepared, based on a report of the Scientific Veterinary Committee (Animal Welfare Section) of the EC.

Although discussions in countries outside Europe (e.g. Australia, Canada, New Zealand and the United States of America) seem to concentrate primarily on the welfare of animals in biomedical research, there is also growing public debate on the welfare of animals in intensive husbandry systems (18). However, the research effort related to farm animal welfare is much greater in Europe than elsewhere (22). In general, outside Europe, animal welfare regulations are not specifically related to farm animals, although codes of practice are published (e.g. 1).

**WELFARE**

In recent years, ample scientific knowledge has been gathered regarding the effects of housing factors on the behaviour and physiology of farm animals, including poultry (mainly laying hens) (5, 6, 39). General theories have also been developed, relating observational data to the welfare of the animals (e.g. 17, 53). A common starting point of these theories is that, in the course of evolution, every animal species has adapted to a specific environment in which it is able to maintain homeostasis, to survive and to reproduce. To keep internal and external conditions on an optimal level, the animal actively reacts with a variety of physiological and behavioural regulatory responses to changes in the environment. When these coping responses are not successful or when they are thwarted, typical behavioural and/or physiological stress symptoms occur, such
as abnormal behaviour or stomach wall lesions (15, 49, 52, 53). This may also result in pre-pathological or even pathological states (38) which clearly threaten the welfare of the animal.

Thus, animal welfare is ensured when the individual is coping successfully with the environment and is free from pain (e.g. due to injury or disease). The welfare of an animal is jeopardised when its physiological and behavioural regulatory responses in relation to relevant internal and external factors are not successful or, in the case of behaviour, are chronically hampered by housing conditions. The effects of lack of control and the extent of efforts to cope can be measured in terms of behaviour, physiology and health.

**HOUSING REQUIREMENTS**

To identify the housing requirements of poultry in relation to welfare requires studying whether a bird can cope with a specific environment or specific environmental factor (or the absence of such factors). These studies are of several types, as follows (21):

- **a)** Birds are placed in the environment under investigation and compared with birds which are either under feral conditions or in an environment which is assumed to be ideal. Studies of this type conducted with hens in battery cages indicate that some behaviour patterns are observed which are not observed in more extensive conditions, or that the frequency of some behaviour patterns is different. It is not always obvious whether these changes indicate a relevant welfare disturbance or an appropriate adaptation to a change in environment.

- **b)** Birds are given access to more than one environment and a score is kept of which environment they prefer. Closely related to these choice experiments are “operant conditioning” techniques. In the latter type of study the animal has to pay (in terms of work or unpleasant stimuli) to gain access to a reward. These tests indicate the degree to which hens value a resource or an environmental factor.

- **c)** Birds are observed in experimental situations which are known or expected to be detrimental to their welfare. The observed phenomena are considered to be indicative of disturbed welfare and are used to evaluate the environment under study.

- **d)** The effects of housing conditions on health and possible injury are usually studied in large-scale comparative experiments in which measures are made of morbidity, mortality and occurrence of feather damage or fractures.

**HOUSING OF LAYING HENS**

Studies such as that which is described above provide more specific information on the housing requirements relevant to the welfare of laying hens.

**Space**

The influence of space as such is very difficult to evaluate, as the structure and quality of space are also essential factors. Moreover, space per bird has a different meaning in large groups compared to small groups. When given the choice, single hens usually prefer a larger cage (29, 42). Hens in groups work to enlarge a cage in an operant conditioning situation, but they do not work intensively for space and seem to have a
preference for an area of approximately 1,000 cm² (27). The Farm Animal Welfare Council in the United Kingdom recommended an area of 1,425 cm² per hen in colony systems (26).

Laying nests

Hens which are deprived of a laying nest often show disturbed pre-laying behaviour, eventually developing into stereotyped pacing (54). This stereotyped pacing also occurs during a clearly aversive situation: thwarting of feeding behaviour (23). Recordings of heart rate during laying in hens with and without a laying nest (33) showed a higher and irregular frequency in hens without a laying nest. Plasma corticosterone levels increase before the egg is laid, regardless of whether the hens have access to a laying nest. However, removal of the laying nest initially caused a much stronger corticosterone rise (8). These data suggest that hens kept without laying nests may have difficulties in coping with this situation. It has also been shown (24) that hens are willing to “work” (e.g. push through a door or walk long distances) to obtain access to a nest. Convincing evidence is now available of the need for nests for egg laying (30).

Litter

Hens greatly prefer litter floors to wire floors (19, 20). If litter is not provided, dust-bathing behaviour is disturbed (9) and hens are unable to control the lipid content and fluffiness of the feathers (35). Without litter, feather pecking is stimulated as a form of re-directed ground pecking (11, 12). The quality of the litter is also important. Wet litter is less suitable for the performance of dust-bathing and pecking and scratching, and the plumage of the birds can become dirty. Although the presence of litter implies a higher risk of contamination with pathogens, the health risks in properly-managed modern units with litter do not seem to be much higher than in battery cages.

Perches

When perches are provided, these are generally used for resting and sleeping. In groups of domestic medium hybrids, all birds perched during most of the night (10), but only rarely during the day (10% of the perching was recorded during the day). When perches are provided in battery cages, they are also intensively used (50, 51) and may lead to better feathering and fewer foot lesions. In general, the availability of perches provides hens with more exercise and results in stronger leg bones, leading to fewer broken bones during handling and transport (32, 37).

Space, litter, laying nests and perches can therefore be considered as important requirements for laying hens.

Over the last fifteen years, a lot of research and effort has been devoted to the development of alternative housing systems for laying hens. The first goal was to develop a system covering the needs of the birds as well as demands in the field of hygiene, mechanisation, labour conditions, productivity and cost price. Low NH₃ volatilisation has recently been added to this list of requirements, as NH₃ emission from animal husbandry is a major source of acidification in some countries.

In the Netherlands, research in this area was carried out by the Agricultural Research Department (DLO) at the “Spelderholt” Centre for Poultry Research, in close co-operation with the DLO Institute for Agricultural Engineering. In the early phase of this research, the possibility of developing an alternative cage system was
evaluated. Later, the possibility of improving the traditional deep litter system was studied. Both lines of research followed a similar strategy (14):

- Prototype housing systems were developed, with laying nests, litter and more space for the hens than in battery cages. These were tested in small-scale, short-term experiments and repeatedly adapted. During this phase of trial and error research, few systematic observations were carried out.

- Promising prototypes were developed a step further. Behavioural studies were carried out and prototypes were checked for zootechnical viability over a longer period, but still on a small scale. Studies were also performed on construction parameters, labour conditions and possibilities for mechanisation.

- The best prototype was selected on the basis of an evaluation of the data from the foregoing phase (behaviour, zootechnics, construction, labour and mechanisation). This was tested on a semi-practical scale with systematic studies of labour conditions, production and health, etc. In this step, comparisons with the battery cage were made, including an economic evaluation.

- Finally, the system must be tested on a practical scale. This involves the cooperation of farmers who are installing and running the system.

In view of the prospects for commercial application, in comparison with aviary systems, it was decided to stop the development of an alternative cage system in 1984 and to concentrate on aviary systems. From this line of research, the tiered wire floor system (Fig. 2) was developed (14). In 1990, the first such system was installed on a working farm with 20,000 hens. At present, this type of system or comparable systems are being tested under practical conditions.

It may be concluded that the welfare of laying hens is compromised in highly intensive systems such as battery cages. Alternative housing systems which take into account the above housing requirements may considerably improve the welfare of the birds. However, there are a number of serious drawbacks – in terms of labour requirements and conditions, disease control, risk of cannibalism, and economics – which still need to be solved (14).

**HOUSING OF BROILERS**

For broilers, there have been much fewer welfare-related studies than for laying hens. There are indications that the activity level of broilers has decreased due to genetic selection for high body weight gain (7, 40). However, broiler chicks were observed to be active throughout the day, travelling an average distance of 212 m per day (34) and showing pecking, scratching, preening and dust-bathing behaviour (13). Reduction of available space resulted in disturbance of behavioural patterns (13, 34) and reduced feather quality (48). Density effects on behaviour became increasingly apparent with increasing age (from 3 weeks onwards).

As most broilers are kept in solid floor systems, litter is generally available and allows normal dust-bathing, pecking and scratching. However, especially with high densities and older animals, the quality of the litter may become a serious welfare problem. This may even lead to breast blisters and other damage to the skin. Perches are generally not available in broiler houses. When these are provided, perching starts
FIG. 2

A view inside the tiered wire floor system
at five days of age and is well developed at four weeks (31). As with laying hens, perches may help to strengthen leg bones and decrease fractures.

The strong selection pressure for high weight gain and low feed conversion ratio results in specific welfare problems for broilers, as well as their parent stock (broiler breeders). Broilers with a low feed conversion ratio show less flexibility in metabolic adaptation to a changing environment, which can account for the development of metabolic disorders such as heart failure syndrome and ascites (47), which are a serious threat to the welfare of the birds.

Leg weakness is also a major welfare problem in broilers. Gregory and Kestin (28) demonstrated a 26% prevalence of impaired walking ability which was sufficient to compromise the welfare of slaughter-weight, commercially-grown broilers. The prevalence increased between the ages of four and seven weeks, and rose in proportion to stocking density.

Broiler breeders are routinely fed on quantitatively restricted rations. This leads to better overall performance and lower mortality than when birds are fed ad libitum (43, 44). This restricted feeding may result in increased activity and stereotyped pecking at non-food objects (45). A feed restriction programme in which birds are fed only every other day ("skip-a-day"), resulted in higher levels of aggression and corticosterone than with ad libitum feeding (36). As stated by Savory et al. (46), modern broiler breeder stock are caught in a welfare dilemma: on the one hand, the level of food restriction imposed commercially may cause suffering through chronic hunger; on the other hand, less severe restriction leads to reduced fertility, while ad libitum feeding leads to further problems.

In conclusion, welfare problems in broilers and broiler breeders may best be alleviated by alternative selection programmes which take into account parameters related not only to economic efficiency but also to animal health and welfare.

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Résumé : La spécialisation et l'intensification poussées de l'aviculture industrielle au cours des dernières années ont largement sensibilisé l'opinion publique au bien-être des animaux dans ce type d'élevage. Le débat, qui remonte à quelque 25 années en Europe occidentale, a abouti à l'adoption de réglementations au niveau de l'Union (Communauté) européenne et de chacun des pays qui la composent.

Le bien-être des animaux est garanti lorsque chaque individu peut s'adapter à son milieu et vivre sans souffrir (par exemple de blessures ou de maladie). Ce bien-être est menacé lorsque l'action régulatrice de l'animal lui-même à l'égard des principaux facteurs internes et externes est rendue impossible ou est durablement compromise.

L'information existante sur les conditions à respecter en matière de logement s'est considérablement enrichie. Pour les volailles, ces conditions ont notamment trait à l'espace disponible, aux nids, aux litières et aux perchoirs.
Dans les systèmes de production hyper-intensifs tels que les élevages en batterie, le bien-être des poules pondeuses est compromis. Il pourrait être nettement amélioré par l'introduction de nouveaux types de poulailleurs répondant aux conditions énoncées ci-dessus.

On pourrait, par ailleurs, remédier aux problèmes du bien-être des poulets de chair et de leurs reproducteurs par la mise en œuvre de nouveaux programmes de sélection qui tiendraient compte des critères de santé et de bien-être en plus de ceux concernant la rentabilité économique.


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UNIDADES DE PRODUCCIÓN INTENSIVA Y BIENESTAR DE LOS ANIMALES: LAS AVES DE CORRAL. – H. J. Blokhuis.

Resumen: El gran incremento de la especialización y la intensificación de la avicultura industrial en los últimos años contribuyeron a una amplia sensibilización de la opinión pública con respecto al bienestar de los animales en este tipo de crianza. La discusión, que data de hace unos veinticinco años en Europa occidental, dio lugar a la adopción de reglamentaciones tanto a nivel nacional como de la Unión (Comunidad) Europea.

Se puede decir que el bienestar de los animales está garantizado cuando cada animal puede adaptarse al medio ambiente respectivo y vivir sin sufrimiento (resultado, por ejemplo, de heridas o enfermedad). Este bienestar se ve amenazado cuando la actividad reguladora del animal con respecto a los principales factores internos y externos resulta imposible o se ve afectada por un largo período.

La información sobre las condiciones que se deben respetar en materia de alojamiento es hoy mucho más completa. En el caso de las aves, estas condiciones tienen que ver en particular con el espacio disponible, los nidos, los lechos y las varas.

Los sistemas de producción hiperintensivos, tales como la crianza en batería, afectan el bienestar de las gallinas ponedoras. Esta situación se podría mejorar considerablemente con la introducción de nuevos tipos de gallineros que tuvieran en cuenta las condiciones apuntadas.

Por otra parte, podrían solucionarse muchos problemas causados al bienestar de los pollos para consumo y de los reproductores, desarrollando nuevos programas de selección que respondieran a criterios de salud y bienestar que se sumarían a los criterios de rentabilidad.

PALABRAS CLAVE: Alojamiento – Aves – Bienestar de los animales – Producción intensiva.
REFERENCES


