

Promising management measures to solve welfare problems in Broiler Breeders

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Summary

The commercial broiler breeder business nowadays is related to serious welfare issues. Rough mating behaviour of broiler breeders is a big problem what provides damage to the hens, fearfulness of the females to the males and decreased fertility. Therefore mutilations (beak trimming, despurring and toe clipping) is used in practice as a standard procedure to prevent serious damage to the hens during mating. It has been reported that broiler breeder males show rough mating behaviour during mating, which can cause severe injuries to the hens. This problem may also occur by over-mating hens especially in the beginning of the laying period what leads to avoiding of the males by females. A promising management measurement is to decrease stocking density or to use the innovative Quality Time® Concept for housing the birds. The increased potential of broiler breeders due to selection on growth of the offspring resulted in an increased feed intake requirement, but also in a decreased reproduction and increased mortality. To prevent these serious problems, especially during rearing, the degree of feed restriction for maintaining broiler breeder BW targets had to be continuously increased during the last decades. It is clear that this severe feed restriction has negative effect on bird welfare due to chronic stress resulting in stereotypic pecking behaviour. Recent research has focused on feed measurements to diminish the effects of this severe feed restriction. Using a more fibrous feed and an appetite suppressant seems promising. Also the use of a low protein feed can help to alleviate the negative effects of feed restriction. Recently, there is some positive information about non beak trimmed females from field studies available. Feather cover of the birds is a relative new problem with serious effects on welfare and reproduction. Information from practice showed that factors such as feeding space and behaviour of males and females during feeding time seems to be highly relevant. The solution for the future is a combination of management strategies which can reduce the negative effects of the problems on welfare and reproduction.

Introduction

The commercial broiler breeder business nowadays has to deal with serious welfare issues. In this paper the four most important welfare problems in broiler breeders in Europe are summarised. The first welfare problem in broiler breeders is rough mating behaviour of the males and in aggressive male behaviour to females. It has been reported that aggressive male behaviour (1) but also over-mating of hens may cause injuries and fearfulness of the females to males (2,3). Besides this welfare problem in broiler breeders, the very severe feed restriction during the rearing phase, which leads to chronic hunger, has a clear negative effect on broiler breeder welfare. Feed restriction of the broiler breeder is caused by the selection for faster growth and better feed efficiency broiler breeders. When broiler breeders were fed ad libitum, birds become overweight and this causes severe health and reproduction dysfunction (lameness, premature death, poor laying performance and poor fertility) during the laying period. The feed restriction is particularly severe during the rearing phase before the birds reach sexual maturity (4). In many European countries mutilations like beak trimming, despurring and toe clipping are carried out as a standard commercial procedure to prevent excessive damage to the hens (5). During the last decade feather cover of broiler breeders is decreasing with serious negative effects on welfare (Van Krimpen, personal communication). Especially the problem of feed restriction during rearing and the sexual behaviour during the laying phase were important issues in recent research related to broiler breeder welfare.

Sexual behaviour

Because males and females under natural conditions have separate social hierarchies, and males dominate females passively, aggressive behaviour to hens by mature males is uncommon (6,7,8). In contrast, in commercial housing it has been shown that male broiler breeders may demonstrate high levels of aggression towards females, mainly during the performance of mating behaviour, whereas courtship behaviour was virtually absent before mating (1,2,9,10,11,12,13,14). This is possible one of the major reasons why females tend to remain on the slatted area or hide in the nests instead of being in the litter area (where the majority of males are present) at the end of the light period. Birds showed often severe wounds on the back, the back of the head and along the torso beneath the wings which was related to the aggressive mating behaviour (1). Sexual behaviour of male broiler breeders has been described as rough, the males pecking or chasing females and forcing copulations (1,2,12). This phenomenon of forced copulations is also reported in another study (3). They found that females stayed on the slatted area instead of the litter area, and found injuries in female broiler breeders during lay. However, they suggested that the cause of the rough mating behaviour may be that males reach sexual maturity at a younger age as females. It is highly plausible that both aggressive or rough mating behaviour and too early maturation of males play an important role in injuries, fear and stress of the females. In a field study on eight Dutch broiler breeder farms the behaviour of males as well as females had been studied in more detail. It was concluded that male behaviour towards females could be described as 'rough', but also female courtship behaviour appeared to be incomplete. It was remarkable that females in general did not show crouching behaviour in response to male approach. Females often showed struggling behaviour during mating or tried to escape from the male. This incomplete mating behaviour of the males and females may explain the low percentage succeeded matings (44% between 20-28 weeks of age) and why at least 80% of the matings was forced (14). They also found that courtship behaviour was almost absent before mating, confirming earlier experiments (1,12). Because females do not recognise male signals the behaviour of the females may thus seem to be incomplete. In the opposite, it has recently been shown in different female broiler breeder lines that female behaviour evoked aggressive male behaviour (15). Feed restriction did not play a role in the rough mating behaviour (10) but genetics may have an effect (9). It was suggested that factors like separate rearing of males and females, large group sizes and high stocking density may also play a role by the development and recognition of courtship behaviour and proper responses to signals of the other sex (14).

Separate rearing of males and females may hamper correct learning of sexual behaviour as the behaviour already begins to develop during rearing (7). In a field experiment vertical panels (of 70 x 70 cm) were placed in a staggered pattern every 4.5 m in the central litter area and found that this improved reproductive performance in broiler breeders (3). These panels attracted females to the litter floor, thereby decreasing the competition for females. Technical performance improved, but no behavioural observations were done thus it remains to be questioned whether mating behaviour was positively affected with the use of these panels. Large group sizes and high stocking density may negatively affect the recognition of male behaviour by the females. In a recent research from (16) broiler breeders were housed at a high (8.8 birds/m²) or low (5.2 birds/m²) stocking density during two subsequent production cycles of 60 weeks. During the rearing period the reduction of the stocking density had a small but significant effect on general behaviour of the birds. At a lower stocking density, more hens were foraging and fewer hens were standing, and more males were walking. More successful matings were observed at a lower stocking density during production. Mating behaviour improved at a lower stocking density: more matings were preceded by courtship behaviour, more matings were performed in which the hens showed crouching behaviour (thus less matings were forced), and less hens struggled during mating. During production, hens at a reduced stocking density produced more hatching eggs. In addition, fertility was higher in eggs from hens housed at a reduced stocking density and the number of day-old chicks per hen was higher for hens at a reduced stocking density. In conclusion: lowering the stocking density improved behaviour and reproduction of broiler breeders.

Recently a new housing system for broiler breeders called the Quality Time® Concept (QTC) is developed to improve sexual behaviour and reproduction (17). Males were separated from females during 5 hours a day using a separate feeding system and a moving fence. After a successful pilot experiment, two on-farm experiments were carried out in a new broiler breeder house with 15,000 birds. The house was divided in six compartments. In the QTC compartments more voluntary and successful matings were observed. Also, improved appropriate sexual behaviour resulted in a better feather coverage between 37 and 48 weeks of age. Separating males from females did not increase aggressive behaviour between the males. In the first flock no effect on fertility was found, however in the second flock fertility was improved with 1.5%.

Feed restriction

During the last 20-30 years broiler breeders showed an increased growth potential due to selection on growth of the offspring (18,19,20,21). During the last 50 years the growing period of broilers decreased from 84 to 36 days to produce a broiler weighing 1.8 kg (22). Its feed conversion ratio (kg feed over kg BW gain) decreased in the same period from 3.25 to 1.55 and the daily growth increased from 21 to 50 g. Nowadays broiler strains grow 4.6 times the rate of a 1957 strain (19). The 6 fold increase in carcass yield in 2001 stocks fed a 2001 diet compared to 1957 stocks fed a 1957 diet is 85-90% due to genetics, and 10-15% due to nutritional changes (18). This enormous increase in carcass yield and growth of broilers is the result of increased selection in breeders. Although over the past 30 years broiler breeder BW targets have undergone change, the degree of change is small compared to the large increases in growth potential. As a consequence, the ratio in BW between broiler breeders to broilers at 6 wk of age in female Hubbard birds decreased over the period from 1979 to 2005 from 52% to 27% (20). To realize target weights, the degree of feed restriction for maintaining broiler breeder BW targets had to be continuously increased. Broiler breeders that were fed ad libitum during particularly the rearing period reached heavy bodyweights before lay, resulting in excessive mortality (23) and decreased reproduction (24,25).

During the rearing period feed intake is restricted between 25-33% compared to ad libitum fed pullets of the same age (26,27) and it is restricted to 50-90% of ad libitum intake of hens at the same age when they are in lay (28). The most severe restriction usually occurs between 7 and 16 weeks of age (29). There is a lot of evidence that feed restricted broiler breeders show behavioural disorders that are indicative of hunger and frustration, such as stereotypic object pecking, over-drinking and pacing (27,30,31,32,33,34,35). Besides these effects it has also been reported that feeding competition caused aggressive pecking in commercial flocks of broiler breeders which reduced bird welfare (36). Feed restricted broiler breeders also may show physiological signs of stress. Broiler breeders fed at commercially applied restriction levels show elevated plasma corticosterone levels. However, due to the biological roles of the corticosteroids (37), it is not clear yet whether these elevated plasma corticosterone levels reflect psychological stress, metabolic effects resulting from feed restriction or both (38). In some studies increased H/L ratios were found in restricted fed birds (31,33,39), which are possible indicative of chronic stress in chickens (40).

To reduce the negative effects of feed restriction on bird welfare research has focused on practically applicable management strategies while maintaining the desired growth rate. Environmental enrichment during rearing may alleviate frustration of the feeding motivation but did not reduce aggression due to competition for food (41). Increasing the 'foraging' time by scattering the feed in the litter also did not have any positive effects on indicators of stress and hunger (42). More promising is diluting the feed (also called as 'qualitative restriction'), which resulted in an increased feeding time (43,44). Diets with 50 g/kg sugar beet pulp or 200 g/kg oat hulls reduced stereotypic object pecking, indicating that welfare of birds fed these diets might be improved (44). However, these birds spent more time feeding than birds fed a standard commercial restriction ration, leaving less time available for stereotypic behaviour which may also explain these results (e.g. 45). Four different diets during the rearing and laying period and the diet with the lowest density (8.4 MJ/kg) appeared to reduce hunger and frustration in the first half of the rearing period, which was indicated by reduced stereotypic pecking behaviour (43). However, it was

concluded that for substantial improvement of broiler breeder welfare, more extreme diet modifications using higher fibre concentrations were required. Others researchers did not find any positive effects at all of high fibre contents in broiler breeding diets (up to 6.6 MJ/kg) on behavioural and physiological indicators of welfare (36,46). On the other hand, a combination of calcium propionate (an appetite suppressant) and oat hulls appeared to be a viable alternative to commercial quantitative feed restriction, which was indicated by a change in a couple of parameters indicative of hunger (47). In addition, stereotypic pecking was virtually absent in this treatment group, the time spent sitting significantly increased and feeding motivation (by measuring rate of eating) was reduced as compared to broiler breeders fed a quantitative restricted diet, suggesting improved welfare due to reduced hunger in these birds (47,48,49,50). However, appetite suppressants may have their effect by causing the bird to feel ill and, as a consequence, have a reduced appetite (51). It can thus be questioned if bird welfare is indeed improved when these suppressants are used. Recently Van Emous et al. (submitted) changed the energy to protein of the diets of rearing birds and found some promising results on reduced stereotypic pecking behaviour.

Another possibility to improve the welfare of broiler breeders is the use of other genotypes of broilers, i.e. slower growing and dwarf breeds (29,36,52). The dwarf genotypes only concern one sex (females), but numerically the problem of feed restriction concerns many more females than males and it thus may be a solution for a large part of the broiler breeder population. However, they will correspond only to a specific market demand, because their use is approximately 20% across Europe (Guémené, personal communication), and the use of dwarf or other slower growing genotypes is unacceptable for economic reasons in many cases.

Despite the considerable amount of research in this field, more research is necessary to solve this dilemma. Although restricted fed broiler breeders clearly show signs of chronic stress, there are still questions how to measure the subjective experiences of restricted fed broiler breeders as indirect indicators of hunger have thus far been used (53). As ad libitum feeding of broiler breeders also leads to impaired welfare this is not a solution to the welfare problem. It is yet unknown if a certain level of restriction or qualitatively restricted feed may represent an acceptable balance in terms of welfare, where birds do not suffer from chronic hunger and at the same time are healthy and have an acceptable level of egg production and fertility.

Mutilations

Mutilations in male broiler breeders are standard practice in several countries to prevent serious damage of the hens due to mating (5). Males are often beak trimmed to prevent injuries on the backs of the heads of the females where the males peck them and grab them with their beaks during mating (13,54). Toe clipping and sometimes despurring on the males is common practice to prevent the females for injuries on the torsos and beneath the wings where the inside claws and spurs of the males damaged the skin during mating (13). Although mutilations may thus have a positive effect on female broiler breeder welfare, the procedures itself may lead to stress due to handling and to acute and chronic pain because the tissues are well innervated (55,56) and compromise bird welfare. If broiler breeder mating behaviour can be significantly improved by changing housing conditions, management and/or genetic solutions, broiler breeders can possibly be housed without mutilations. But at present, not mutilating the males likely leads to higher mortality and severely injured females, as we found in a small scale pilot experiment (De Jong, 2006, unpublished observations).

Female broiler breeders are beak trimmed for other reasons, i.e. to prevent injuries due to feather pecking and cannibalism (57). However, there is no literature stating that feather pecking is a problem in broiler breeder flocks. In some EU countries males and females are not beak trimmed without major problems on skin damage and reproduction (De Jong, non-published data). In the UK and Poland, for example, broiler breeders have already been housed non-beak trimmed for many years. Results of an inventory in these countries showed that production and skin damage are almost the same compared with countries with

beak trimmed broiler breeders. Average mortality of the females in these countries is even lower compared with countries with beak trimmed birds. As a follow up of this inventory an on farm study with non-beak and beak trimmed birds (day old IR beak trimming) was carried out in the Netherlands in 2012. Results suggest that non-beak trimmed birds are more uniform, have a reduced mortality and bird uniformity (De Jong, personal communication).

Feather cover

When the quality of the feather cover is decreased welfare of the broiler breeders will be negatively affected (Van Krimpen, personal communication). First of all, feathers play an important role to protect broiler breeders for skin damage caused by sharp objects in the house and for damage during rough mating behaviour of the male (14). Besides the important role as protection for the female, feathers are very important for thermoregulation of the birds. Birds are losing heat by the absence of the insulation layer of feathers. In a study with laying hens (58) was found that 50% bald hens need 9% more feed through an increased energy requirement for maintenance. The third major issue in feather cover is the function in preventing feather damage. A good feather cover can also help as grip for the male during mating behaviour and is furthermore a good indicator for the health status of the birds (Van Krimpen, personal communication). The quality of feather cover of broiler breeders has decreased over the last decade (17). The cause for this poor plumage condition is not yet clear. Nevertheless, a farm inventory of Van Emous (non-published data) showed that factors such as feeding space and behaviour of males and females during feeding time seems to be highly relevant. Furthermore, in that inventory a breed effect was found on the quality of feather cover of broiler breeders. In an on farm study Van Emous (non-published data) found that a worst feather cover in the beginning of the laying period (30 wk of age) negatively affected the hatchability of the total laying period. In the literature, only a few studies have been conducted to the effects of dietary energy and protein on plumage condition. A study with broiler showed that a dietary protein content >16% should be sufficient at an early age to ensure plumage development (59). It is questionable whether the results of this dated study still apply for the modern broiler breeder. A recent study showed that lowering the protein level of the diet during the rearing period negatively affected feather cover during the first 10 weeks of rearing (60). More research is necessary to the relation between feeding and feather cover.

Conclusions

There are several serious welfare problems in broiler breeders (61) which we discussed in the present paper. Many studies focused on alternative management or feeding strategies to solve these welfare problems, but no clear solutions have been found yet although some seem to be promising. More research is necessary on feeding, housing, management, and genetic aspects of the modern broiler breeder to work towards an acceptable way of broiler breeder housing and management with respect to welfare.

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