

## Density: How It Can Affect the Behavior and Health of Your Birds

Maintaining a high stocking density is a common practice for the poultry industry because it allows for an increase of economic returns per unit of floor space. However, income per bird often decreases primarily due to reduction in growth rate, increased proportion of downgraded carcasses, and greater risk of health-related problems.

To prevent or eliminate all consequences of high stocking densities is nearly impossible. Nevertheless, a better understanding of what occurs as we increase the number of birds per unit of floor space will help increase our awareness of potential problems, giving us the opportunity to take appropriate preventive actions.



This fact sheet will look at how increasing density can affect the chicken's behavior and stress levels and what the consequences could be in terms of performance.

## Environmental Aspects of Stocking Density

One of the most important consequences of increasing density is the environmental change that occurs within the chicken house. An increase in density usually results in corresponding increases in temperature, humidity, CO<sub>2</sub>, and ammonia levels. High ammonia levels (over 25 to 50 ppm) reduce growth and increase the incidence of air sac inflammation. High humidity and moist litter increase the incidence of breast blisters, hock burns, and foot pad dermatitis (among other effects).

However, the magnitude of the effect of density depends on technical factors (e.g., quality of ventilation and cooling systems) as well as management factors (e.g., litter condition and light programs). This means that increasing the number of birds in a well-prepared house can cause fewer negative effects than an increase of a similar increment in an out-of-date building with poor technical conditions.

Males in general are more sensitive to environmental stressors than females. If both males and females are in the same house, first make an assessment of the males. If there are potential problems with the management of the birds, males will probably show symptoms earlier than females.



## Social and Aggressive Behavior

When birds are kept at high stocking densities, growth rate is often reduced and feed conversion can worsen. This has been explained as a consequence of the social dominance between chickens.

Chickens have a very complex social behavior. When the birds are maintained in small groups they will usually form a stable "peck order" (or hierarchy) among themselves. The highest number of birds that can maintain a stable hierarchy is unknown, but it seems to be somewhere between 20 and 100 chickens. If the peck order system is established, some chickens will be dominants and others will be subordinates, sometimes organized in a perfect linear dominance hierarchy. Dominants have priority of access to feed and water and nearly all other resources (including mates if they are in mixed mature groups). Although subordinates will have to wait for access to resources, the benefit they receive from this social system is a dramatic reduction in aggressive interactions.

However, when we deal with large numbers of birds it seems that the establishment of such a peck order is impossible, because the birds are incapable of individually recognizing every member of the group (required for establishing a peck order). When this happens, conflict or “social tension” is created. As a consequence, dominant chickens will monopolize access to resources, while subordinate birds cannot obtain access to food or water. This has been the traditional scientific explanation for the reduction in performance seen with increasing densities.

Researchers have recently regained interest in the social consequences of increasing group size (number of birds in the house) or density (number of birds per area). Results of more recent studies suggest that chickens are able to change their social behavior when they are kept in large groups. Birds maintained in large flocks show very little aggression if food and water are available at all times without shortage of feeding or drinking space. In reality, aggressive interactions per bird are reduced in larger groups compared with small groups, contrary to what most people would think. You might *see* more aggression because the chance of observing aggressive behavior between birds increases as the number of birds in the group increases. Aggressive



behavior does not seem to occur due to birds becoming more aggressive in larger groups. In actuality, the birds simply are following the rule: “Eat as much as you can and spend as little energy in aggression as possible.”

More specifically, broiler chickens up to eight weeks of age exhibit very low levels of aggression if food and water are provided freely. They actually prefer to eat and drink when other birds are present at the feeders or drinkers (you rarely will see one bird eating or drinking by itself). This effect, called “social facilitation,” explains why chickens (as well as most social animals) perform better when maintained in groups compared to being housed individually.

The negative effects of increasing densities on the performance per bird are probably more closely related to a decline in environmental quality than to “social tension” problems.

## Feeding and Drinking Behavior

Because of the relevance of feeding and drinking behavior patterns for the poultry industry, there is extensive knowledge about this type of behavior. In general, neither the number of visits to the feeders or drinkers nor the time spent during each visit was affected



by stocking density, if the feeding and drinking space was kept constant per bird. Broilers, however, are able to change and adapt their feeding rates to different constraints. For example, if the number of birds at the feeder is too high, broilers might increase the number of particles they ingest per visit.

This means that time spent at the feeder or drinker is not a good “estimator” of feeding abilities to determine if the birds are eating enough food. On average, visits to the drinkers usually last no longer than one minute, whereas visits to the feeders last about three minutes. A chicken will spend 5 percent of its total daytime at the feeder. In comparison, a chicken in the wild would have to spend a minimum of 85 percent of its daytime feeding to meet its nutritional demands.

To avoid the negative effects of density it is important to disperse the feeders and drinkers within the house and maintain them at the proper heights. It

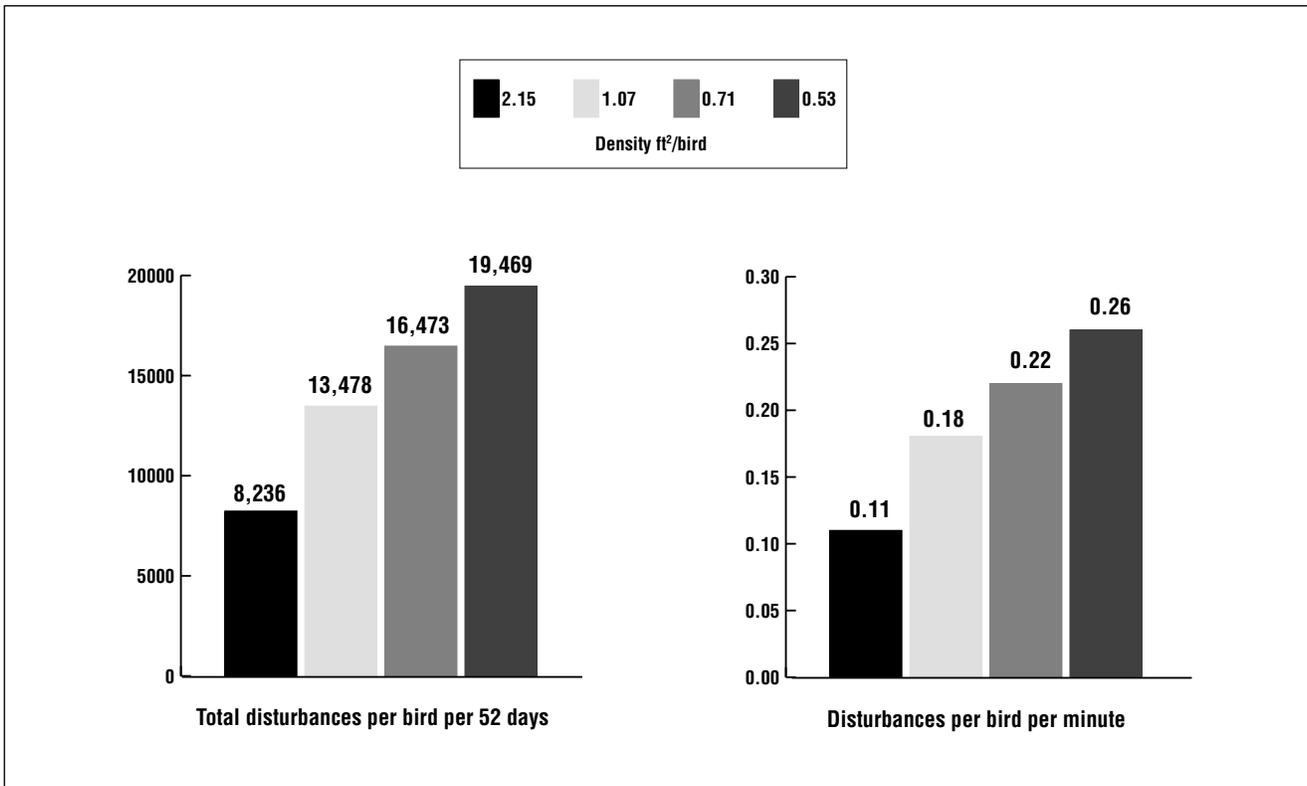
is also very important to carefully follow the cleaning and maintenance program of the feeders. Chickens usually choose particles that contrast strongly in color with their background. Any strange particle in the feed will get their attention and will be pecked instead of the feed.

## Chicken Movements within the House

Movement patterns of chickens have a big influence on the consumption of feed and water and thus might affect the birds’ subsequent health and meat quality. Distances traveled by the chickens over the course of one day considerably exceed movements required to simply reach the feed and water, although there is a large variation in locomotion patterns between individual chickens.

Of all the factors that affect the movements of chickens within the house, the age of the birds is very important to consider, especially when the birds are kept at high densities. As age increases (or as they gain weight) the birds move less for shorter distances and spend less time in activities such as pecking or scratching in the litter, which are important for body maintenance.

Light intensity is also an important factor affecting a chicken’s level of exercise. In general, chickens exposed to a high intensity light (such as natural sunlight) are more active and have fewer leg injuries. Available data seem to indicate that mortality is lower compared with chickens exposed to a weak light intensity (of six lux or below).



**Figure 1.** Number of mean disturbances per chicken during 52 days of rearing period. Comparison across different densities (ft<sup>2</sup> per bird). Data from “Effects of Density and Available Space on the Behavior and Use of Space by Broiler Chickens.” (Ph.D. Thesis: 1994. I. Estevez, University of Cordoba, Spain.)

The reduction of activity in broiler chickens is probably a consequence of both heavy body weight and less available space within the house by the end of the rearing period. Many producers might think this is advantageous in that it improves the efficiency of the birds (all feed would be invested in growth rather than movement). However, the reduction in movement can have some negative consequences for production.

Restriction in available space might increase the risk of physical injuries and inflammatory process in chickens, because, in order to get a resting place (especially around the walls of the house), they literally walk on top of other birds and scratch their backs with their claws. This can impact not only

the proportion of downgraded carcasses, but also increase the risk of infections. The performance of the birds could also be affected because they must invest energy in immunological responses and in regenerating the damaged skin.

The overall performance of the birds might also be reduced as density increases due to the high number of disturbances between birds. Disturbances occur when a resting bird is pushed, walked on, or interrupted by another bird and result in a change in the first bird’s position or activity. As stocking density increases, disturbance frequency and severity can increase (Figure 1). As a result, more energy is utilized by the disturbed bird and performance might be reduced.

Lack of exercise has been proven to increase the chances of leg disorders. If the birds rest for extended periods of time the risk of breast blisters can also increase. Feather condition might worsen; this also can affect production because the birds are unable to efficiently maintain the correct body temperature. Chances of heatstroke in inactive birds during summer are higher in comparison with more active birds, probably due to a decrease in water consumption (among other factors), which is essential to overcome the effects of heat stress.

Therefore, it is important to encourage activity in the birds during the summer when lack of flock activity might have more dramatic consequences. It is always a good practice to move slowly within the chicken house three to five times a day in order to make the birds walk around, especially as a routine during the summer months and when maintaining high bird densities. Movement will also help increase body heat loss during very hot periods. It has been reported that incidence of leg problems rises during the summer; it is possible that this higher incidence is connected to a reduction in activity.

It is always recommended to “walk” the birds regardless of the time of year and housing densities. This management practice will encourage exercise (which is reduced at high densities), might allow the birds to better adjust to new stressful situations (such as unexpected noises), and will encourage feeding and drinking behavior as well. Remember to move *slowly*.



Chickens exhibiting dust-bathing behavior. Usually, other birds will surround the bird dust bathing and clean (by soft pecks) the litter from the feathers on its back. Picture taken at the Upper Marlboro Applied Poultry Research Facility.

## Dust-bathing Behavior

You have probably seen birds digging holes in the litter and tossing dirt on their backs. This behavior is called dust bathing. Its function is to keep the feathers clean and free of parasites. Stocking density seems to affect the frequency of dust bathing indirectly. Increased density affects the degree of litter caking, and birds must have loose bedding material to be able to dust bathe. This is one of the reasons why plumage condition is poor in high housing densities (usually plumage becomes dirty and feather quality deteriorates). Other factors such as type and condition of the litter and age of the birds can also affect the frequency of this important behavior.

It has been shown that depth of the litter influences the performance of dust-bathing behavior. Contrary to popular belief, birds are able to scratch, peck, and dust bathe more often in a thin layer of litter, in which they are able to “dig down” to the underlying floor. For example, breeders in Sweden use an average of 1 to 1 1/2 inches of litter.

## Good Management Practices

- Keep the feeders as free as possible of strange particles.
- Pay extra attention to how males are doing. Usually they are the first to show stress symptoms.
- During summer, “walk” the birds three to five times per day (as you check them). Walk along the periphery of the walls of both sides of the house where most of the chickens concentrate.
- Keep the litter as loose as possible to encourage dust-bathing behavior.
- Do not be afraid of using high light intensity (especially natural light). It encourages activity without increasing aggressive behavior.



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