# Genetic improvement of nesting behaviour in floor housed chickens

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In many developed countries, there is a movement away from housing of layers in standard cages, with placement instead into alternative types of facilities. These include:

- Free range operations.
- Barn egg facilities, where the birds are on the floor, but not allowed to go outside.
- Aviaries, set up as multiple-tiered floor houses.
- Furnished (enriched) cages, which include nests, dust bathing areas and perches.

The increased use of alternative housing is primarily motivated by consumer preferences for less intensive systems of food production in the belief that hens are healthier and 'happier' in such facilities.

Concerns that birds in standard cages cannot dust bathe, stretch their wings or move about as they can in alternative housing has helped fuel this change.

In addition, it is known that birds housed in standard cages are prone to calcium loss from their bones and subsequent increase in fractures due to lower physical activity of the hens when compared to being housed in alternative systems.

In the USA, some food service institutions, responding to pressure from customers, are now specifying that the eggs they purchase come from 'cage-free' chickens. It is less expensive to produce eggs in standard cages than in alternative housing because of better labour efficiency and lower feed costs.

***A free range system.***

The European Union (EU) is scheduled to ban all standard cages in 2012. The EU currently prohibits placement of hens in new facilities using standard cages. The additional space per bird provided in alternative housing systems meeting the EU standards generally results in more eggs per hen alive, but hens in these facilities also tend to have higher mortality than in standard cages, due to cannibalism, exposure to more accidental hazards, and bird pathogens and parasites.

## Genetic types

Some genetic types of layers are significantly better in livability, and these tend to be the favoured varieties in alternative housing. Birds on litter floors are exposed to more bacterial and parasitic infections than those in cages, and free range hens are subject to predators as well. Managers must take these risks into account and deal with them as best they can.

Birds in alternative housing also tend to produce more soiled and cracked eggs. This is mainly due to the failure of some hens to go to the nest to lay their egg. Eggs laid outside the nest are more likely to be downgraded, and are also more likely to be contaminated with bacteria, including salmonella. In addition, floor laying increases the labour required to collect the eggs.

***A barn egg system.***

Various management practices can help to reduce the incidence of laying outside of the nest. These include rearing on the floor rather than in cages, the use of perches in the growing house, reduced housing density, improved nest design and carefully planned nest placement.

Training of the hens to go to the nest in the laying environment is critical as is housing the birds with sufficient light levels to permit them to explore their new environment.

Genetics plays a role in the regulation of many behavioural traits, including aggressiveness, cannibalism, and flightiness, so it is logical to expect that nesting behaviour may be influenced by genetics as well.

Undomesticated chickens and other birds seek nesting spots when they lay their eggs. There is natural selection for this trait.

However, commercially used strains of chickens have been domesticated for thousands of years. Commercial stocks have been hatched in artificial incubators for many generations.

Natural selection is no longer a factor in promoting nesting behaviour. When any trait is unselected over a period of many generations, there can be 'drift' away from that characteristic; that is, genes that promote the trait may slip to a lower frequency in the population. This may be the case for

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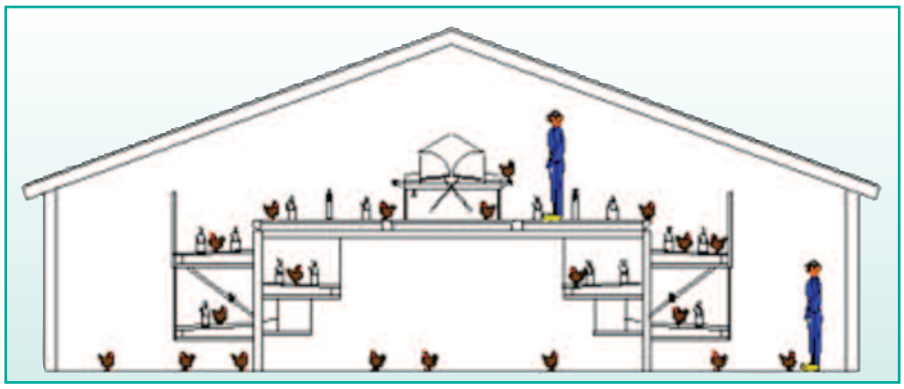
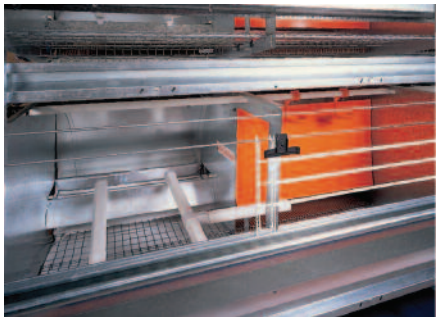
***An aviary system (picture courtesy of Vencomatic).***





***An enriched cage, approved for use in the European Union (picture courtesy of Big Dutchman).***

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nesting behaviour in domestic chickens. There is, however, a lack of research on the genetics of nest-egg laying.

Hy-Line geneticist Dr Neil O'Sullivan has observed that some genetic stocks are more likely to lay their eggs in nests than others. He found that certain pure lines and crosses of chickens are quite active in seeking out and using nests, while other types are poor, laying many of their eggs on the floor away from the nests.

Dr O'Sullivan and Dr Petek Settar conducted a study using a stock that they observed to have poor nesting behaviour.

The objective was to find if there is detectable genetic variation for the trait. The presence of such genetic variability would permit selection for the increased use of nests. Dr Jesus Arango of Hy-Line did much of the analysis of the data.

Pullets from the line under study were reared in wire cages, without perches, and then housed at 17 weeks of age. Birds reared in wire cages are less likely to seek out nests when they begin laying, so this rearing method increased the tendency of this line for floor laying.

In order to make genetic contrasts, the hens were housed by sire family, that is, all of the hens in any pen were the daughters of a single sire.

There were at least two pens of hens housed for each sire family. The pens used for the study were 5.0 x 3.6ft (1.1 x 1.5m), wooden, slat-floored pens.

Egg production was recorded for 11 weeks. The test was repeated in years 2003, 2004 and 2005. Eggs laid on the floor were counted separately from those laid in the nest. More than 20,000 hens were used in the initial test over the three year span.

Because the hens had been reared in cages, they were not conditioned to a floor environment, and the rate of laying on the floor was exceptionally high. This was desirable for the study, since it allowed a proper assessment of the genetic factors underlying this trait.

The percent of floor eggs produced was highest in the first week, averaging 95% over the three generations of the initial study. Production in the nest increased each week, and by week eleven, the percent of floor eggs had dropped to 62% (Fig. 1).

The decline in the rate of floor egg production was greatest in the early weeks of the study, averaging 5.5% per week in the first four weeks and only 1.0% in the final four weeks (Table 1).

| Week | Decline in floor eggs (%) |
|---|---|
| 1-4 | 5.5 |
| 5-8 | 4.0 |
| 8-11 | 1.0 |
| Overall | 3.6 |

***Table 1. Rate of decline in floor eggs by period in the experimental population.***

This tendency toward a more rapid decline in floor egg production in the early weeks after housing had been previously reported in the literature

There was a great deal of variation among families across the test. Approximately 11% of the families laid more than 95% of their eggs on the floor, while 5% of the families laid in nests throughout the experiment.

Analysis of the data shows that there is a significant amount of genetic variation available within the population studied. This has permitted reduction of floor egg laying by means of selection of those families that tend to use the nests.

Breeders use a statistic known as heritability to determine the proportion of total variability in a trait that is genetic. In this test, the heritability of nest egg laying was 40%. This is adequate to permit substantial reduction in the tendency of this stock to lay their eggs on the floor.

***Pens used in the Hy-Line study of the genetics of floor egg laying.***

There is evidence that the experimental population used in the study described in this article has already begun to improve.

The breeding value, or average genetic score, for floor egg production, among sire families in the line had decreased by slightly over 1% in the final year of the study as compared to the first year (Fig. 2).

Based on this information, the breeding staff at Hy-Line has already begun to select for improvement in nest egg laying in commercial parent stock. Some improvement is expected to be present in the field within two years. Rapid change in this attribute will not occur, as it is secondary to key performance qualities such as rate of lay and livability.

Care will be taken to continually monitor all traits to ensure that negative associations do not develop between this trait and other characteristics under selection. If such associations do develop, adjustments can be made in the statistical indices that are used, allowing all traits to be improved simultaneously.

Breeding for the genetic improvement of chickens for use in commercial practice must be adjusted as market demands change. The accommodation to the increased use of alternative housing systems is the latest chapter in this ongoing selection. ■

***Fig. 1. Average production of floor eggs by week of lay for the years 2003-2005 in the experimental population.***

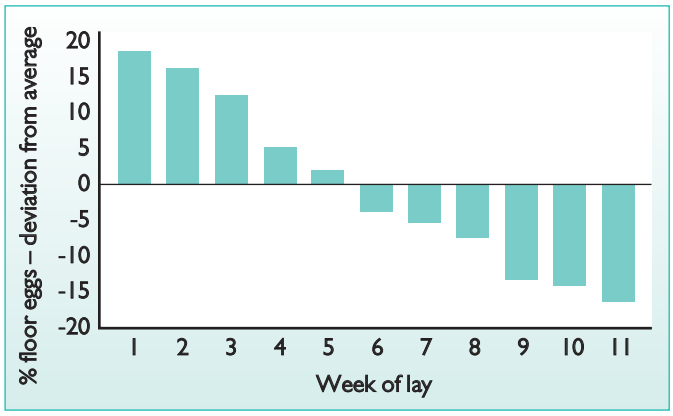


***Fig. 2. Progress in reducing the percentage of floor eggs in an experimental population.***