Evidence of Genetic Variability for Floor and Nest Egg Laying Behavior in Floor Pens

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INTRODUCTION

We can define animal welfare by different parameters such as birds' health, behavior or production. Due to new animal welfare regulations, alternative management systems or cage free environments has becoming a common practice in egg production. There are few alternative systems introduced to the layer industry. It is clear that cost of egg production is much higher in cage free systems because of high number of downgrade eggs (Appleby et al., 2002, Gueston and Faure, 2004). Studies are addressing the management side of the problem such as different cage densities, effect of rearing factors, and different cage or nest types (Appleby et al., 2002, Gunnarsson et al., 1999, Guesdon and Faure, 2004). Cooper and Appleby (1996) were the first who studied individual bird differences on floor laid behavior, and showed that incidence of floor eggs declines with age.

OBJECTIVE

The objectives of this study were to evaluate one of our experimental brown egg layer lines under extreme floor laying conditions and also determine the genetic background of birds' nesting behavior.

MATERIAL & HOUSING

The test line chosen for this study was previously identified in an internal survey for floor laid egg incidence. It was the most problematic line within all brown egg pure lines. All birds were wing banded at the hatch by sire code, were reared in wire cages, and transferred to the experimental house at seventeen weeks of age. The experimental house was environmentally controlled and designed for multiple bird floor pens. Pens were made of wood with a dimension as 1.1m*1.96m*1.51m. Each pen had nipple water system and metal nest box at the back side of the pen.

DATA

Data collection started with egg production and continued for eleven weeks. Eighteen full and half sib sisters were placed in each pen, and pens were marked with their sire code. There were at least two replicates for each sire code. Egg production was recorded daily 7 days of the week, by sire code. Two different data structure were created and daily and weekly productions were tested as both for floor- and nest-laid eggs recorded by sire code. In this work we are presenting two consecutive generation incidence of floor- and nest-laid eggs. Summary of the data used in this work is presented in Table 1.

TABLE 1

Test	2004	2005
Number of birds	5505	8753
Number of sires	69	69
Number of pens	138	155

METHODS

Correlations calculated on percent floor and nest laid eggs by daily and weekly production for each and overall generation. The eleven weeks of data recording was divided into three periods, and linear regression coefficients were calculated for each time period and also for overall test.

Variance components were estimated using a simplified sire model, using restricted maximum likelihood (REML) implemented with expectation-maximization (EM-REML). Variance components and "BLUP/BLUE" solutions were predicted/ estimated for different data sets. In the model, sire code was identified as random, and pen was identified as fixed effect. Three generations of pedigree information were incorporated into the pedigree matrix.

RESULTS

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

CORRELATIONS & REGRESSIONS

Phenotypic correlations between percent of floor laid eggs and daily (-0.37) or weekly (-0.38) egg production were significant. These numbers are good indicators of learning behavior of nest laying over time. Nest laying learning behavior trend is presented in Table 2 as regression coefficients of incidence (%) of floor laid eggs on time. In general, weekly and daily percent floor eggs decreased -3.6 percent a week. This value indicates 3.6% less floor eggs for each week during test. The results show that floor laid egg incidence mostly occurs at the beginning of the egg production period. After five weeks of production floor laid eggs incidence slows down rapidly.

TABLE 2

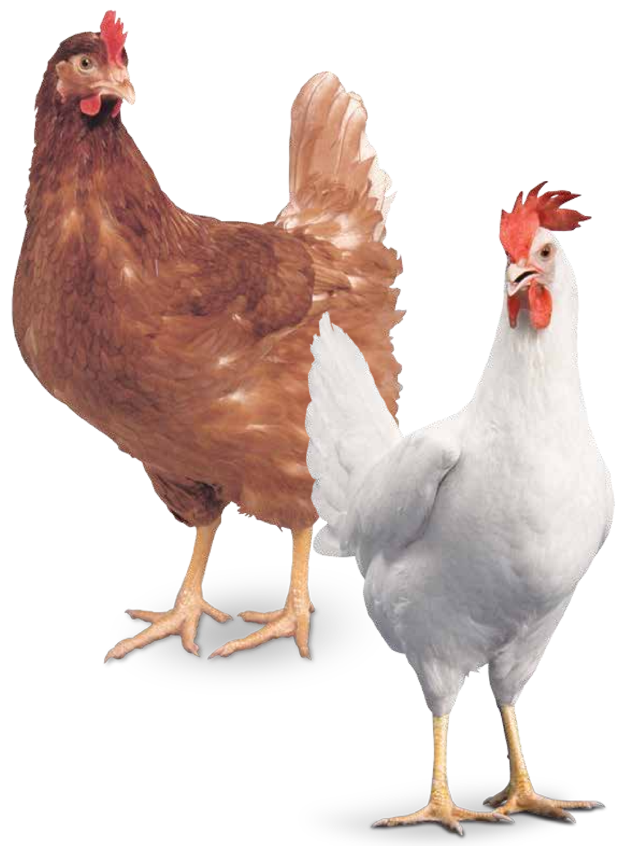
Weeks in test	Weekly (%)	Daily (%)
1–4	-5.5 ± 0.34	-5.5 ± 0.66
5–8	-4.0 ± 0.27	-3.8 ± 0.61
8–11	-1.0 ± 0.56	-1.0 ± 1.17
Overall	-3.6 ± 0.07	-3.6 ± 0.15

HERITABILITIES

There was a large additive genetic variance in daily and weekly floor laid egg production (Table 3). Moderate to higher heritabilities estimated for daily and weekly percent floor laid eggs. Heritability from weekly production data was higher than that from daily production data. No study was found reporting the genetic variation for floor laid eggs incidence.

TABLE 3

Data Set	σ^2_a	σ^2_e	h^2
Daily	176.3	272.8	0.39
Weekly	166.8	210.2	0.44



CONCLUSION

According to the results of the present study, nesting behavior is learnt by the birds. In addition, there is a significant additive genetic variance for the traits involved. There was a difference as 70.2 of sire breeding values for percentage floor laid eggs between the best and the worst sires from pooled data. It may be concluded that nesting behavior, as a welfare trait, can be successfully introduced in selection programs to increase productivity in cage free systems.