CONSIDERATIONS ON EXPERIMENTAL DESIGN OF A LAYING HEN PERFORMANCE FIELD TEST

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International laying hen performance test results are published in company reports, capacities for independent line-comparisons are limited. Possible genotype-environment-interactions must be taken into account when interpreting station data. Therefore field tests are discussed for evaluating the suitability of layer lines for egg production, particularly in non-cage housing systems such as organic farms (Glawatz et al., 2007).

We consider some options for experimental field test designs with regard to practical limitations. Statistical power is analysed in order to find the most suitable design.

A block design with farm as a block effect seems to be adequate. Taking the usual size of organic farms and other organisational aspects into account, a block size of two different origins in two or four groups seems to be feasible.

The model used for the calculations is the following:

$$Y_{ijk} = \mu + hybrid_i + farm_j + e_{ijk}$$

where i=hybrid (i=1,…,v); j=farm (j=1,…,b) and k=group with hybrid i in farm j (k=1,…,N_{ij}). The experimental hypothesis H_0 states that all lines are equal but one differs.

Several experimental designs were constructed in simulated X-Matrices using the IML procedure of the SAS software package (SAS 9.1, 2002-2003). The noncentrality parameter and the F-Value were calculated for each of the designs, assuming α=5%.

For several experimental designs including three or four lines on 26 to 33 farms the statistical power reaches about 50 %. The test on stations with three lines in 42 groups or four lines in 44 groups leads to a power of 40-45 %. Only the summarised test on farms and stations has a power of 75 to 80 % assuring one standard deviation σ difference (see Graph 1).

As there seem to be no data for the size of one σ under organic farming conditions, station data from floor-housing experiments with non-beak-trimmed hens may be comparable. For mortality, egg number per hen and egg mass one σ can be regarded equivalent to 10 %, 20 eggs, and 0.73g, respectively (Flock et al., 2003).

In conclusion field tests require a substantial organisational effort in order to reach a satisfactory level of statistical power and should be supplemented by station tests. This system may be complicated by different variances between stations and farms. Some traits can only be considered on stations, for example egg quality and feed conversion.

FLOCK, D.K., G. HEIL und K. DAMME (2003): Wither random sample testing for laying hens in Europe. Proceedings of the 3rd European Poultry Genetics Symposium Wageningen, Niederlande, 27-36.

GLAWATZ, H., KJAER, J., SCHRADER, L., REINSCH, N. (2007): Herkunftsvergleiche von Legehennen in Station und Feld unter besonderer Berücksichtigung ökologischer Haltungsverfahren. Züchtungskunde 79 (3), 198 - 208.

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Graph 1: Power of different experimental designs for a laying hen performance test, variation in number of lines tested, number of participating farms and stations and block sizes