



THE POTENTIAL OF EGG SHELL CRYSTAL SIZE AND CUTICLE COVERAGE FOR GENETIC SELECTION IN LAYING HENS

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In an attempt to improve selection for egg shell quality traits linked to prevention of bacterial ingress, we wished to better define aspects of egg quality. Two new measurements were evaluated, cuticle coverage and CaCO₃ crystal size. The cuticle is a protein layer deposited on the surface of the eggshell which prevents bacterial ingress. Although stains have been available to stain the cuticle for many years it has never been quantified before. In the case of crystal size it is generally believed that smaller crystal size is associated with stronger material properties. Methods to determine the coverage of cuticle and crystal size were developed and their potential for genetic selection evaluated.

A Rhode Island Red pedigree line was used in this study. The study population comprised between 32 and 38 sire families and around 880 female offspring. The % reflectance at 650 nm of cuticle stained eggs was measured using a spectrophotometer. For crystal size the total average intensity (TA) of diffracted X-rays which is related to calcite crystal size was measured. Heritability and genetic correlations were estimated for both traits.

The estimates of heritability for the cuticle were moderate (0.27 ± 0.13) and for TA high (0.61 ± 0.18). There was some evidence that there was genetic correlation between cuticle coverage and shell colour (0.31 ± 0.29) but with high error. TA was genetically correlated with thickness of the palisade layer (0.51 ± 0.20) and breaking strength (0.45 ± 0.25).

Initial investigation of association with markers of genes present in the cuticle or involved in shell gland physiology suggested that ovocleidin 116 and oestrogen receptor alleles had additive effects on cuticle coverage.

We conclude that measurement of cuticle quality and crystal size show considerable promise for use in genetic selection programs aimed at improving egg safety and quality either by marker assisted or traditional means.

Keywords: heritability, egg quality, cuticle, crystal size

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