A RANDOM REGRESSION APPROACH TO MODEL EGG WEIGHT TRAJECTORY IN TWO LAYER POPULATIONS

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Demand for egg size in the market fits into a narrow range when compared to the age related variation seen in commercial egg layers. Eggs are smaller than desired at young age; and too heavy as hens age. Traditional methods for predicting breeding values for egg weight at different ages using univariate or multivariate models seem to be insufficient to control the egg weight variation, hence genetic trend. Here, we present a random regression model (RRM) to explore the egg weight trajectory. Data were from two Hy-Line populations (a white (WL) and a brown (BL) egg line). Total 196,778 and 94,768 observations accumulated through four generations from 25,257 and 17,276 individuals were available for WL and BL. Individual egg weight (EW) was measured at different ages during three periods: (a) first three-egg laid (E3), early evaluation (EEW), and late evaluation (LEW). Single and three trait linear repeatability animal models (RAM) were implemented as basis for comparison with RRM, which used spline functions. Preliminary analyses were carried out to discover the bending points of the egg weight curve. Linear spline coefficients at each age point (d) were calculated using three knots (K) representing bending points of the trajectory, and matching ages for RAM. Models included the fixed effect of hatch:generation, and population regression defined as a quadratic polynomial on age (d). Random effects included individual additive genetic and permanent environmental RRM coefficients. Additional analyses were carried out using within hen standard deviation (SD) and within hen coefficient of variation (CV) of EW as response traits. Variance component- parameter estimation, and breeding value predictions were carried out by AIREML. Knots were defined at 140, 185 and 295 days. Heritability and repeatability estimates at each knot were 0.32, 0.42 and 0.56 and 0.66, 0.65 and 0.72 for WL. Corresponding values were 0.45, 0.55 and 0.54, and 0.71, 0.71 and 0.77 for BL. Genetic correlations were relatively high between K2 and K3 (0.74, WL and 0.77, BL); but moderate between K1 and K2 or K3 (0.33 to 0.57). Applications for selection of desirable EW trajectory included: (a) identifying benders (hens with above average BV for early EW, while below average for late EW), (b) placing different weights on BV for EW at different ages, and (c) controlling within hen EW variation using BV for CV-EW. Results from this research are being used to select for better EW trajectory.

Keywords: Random regression models, egg weight curve, egg weight trajectory.