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Study of environmental and genetic factors the variability of litter sizes of sheep

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The litter size of sheep has increased in recent decades, due to improved breeding techniques and genetic progress, but this increase of the mean has been associated with an increased incidence of multiple births inducing higher lamb weakness and early mortality. The main objective for breeders is now to reduce the undesirable large litters (4 and more), which means canalize the litter size around the economic optimum. Litter size in sheep is a discrete ordered trait that can be analyzed by modeling the observed variable trough Poisson, binomial negative and multinomial models or modeling an underlying variable through threshold models. It can be also viewed as a continuous variable and treated by the classical linear mixed models. If several canalization models have been proposed for continuous traits by including genetic and environmental effects influencing the residual variance, nothing has been proposed for discrete traits and extensions of existing models should be done. Litter size can be also recodified in a set of exclusive binary variables attached to each litter class and associated to a vector of economic weights. According to this approach the breeder objectives is then to select for one of these class or to choose the weighing which maximizes the profit. The aim of this study is to discuss different possible models to analyze the litter size and its variability in sheep and to canalize it around the optimum value.

Responses of divergent selection for litter size residual variance in rabbit

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Selection on LS has a low response due to its low heritability, and it can be increased reducing the environmental variance of LS. Besides, homogeneity in LS reduces cross-fostering, facilitating management. Several studies suggest that residual variance can be under genetical control. However, these studies are based on models highly parameterized that are not robust. Direct selection for residual variance has the advantage of being much less model dependent. Data from 1591 does of a divergent selection experiment for residual variance of LS in rabbits were used to estimate the response of 5 generations of selection. The selection criterion was residual variance of LS (Ve), calculated as the phenotypic LS variance within doe, using LS precorrected by year-season and lactation status. Residual variance was estimated using the minimum quadratic risk estimator: $1/(n+1)\ \sum^{i=n}_{i=1}(x_i - \bar{x})^2$, where x_i is the LS of parity i of a doe and n is the number of parities of the doe (n varying from 2 to 12). Each divergent line had approximately 125 females and 25 males per generation. The traits analyzed were Ve, residual variance without precorrecting LS, and LS. Residual variances were analyzed using a model having only the mean and the additive effect. The model for LS included the effects of generation, lactation status, additive effect and permanent effect. Bayesian methods were used for all the analysis. The results showed a response in Ve for both lines in all generations. The response in residual variance without precorrection was very similar, so correcting data had little effect. This confirms that residual variance is partly under genetic control. Selection for Ve showed a negative correlated response in LS.

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