ESTIMATES OF COVARIANCE FUNCTIONS FOR GROWTH OF ANGUS CATTLE FROM RANDOM REGRESSION ANALYSES FITTING B-SPLINE FUNCTIONS

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SUMMARY

Estimates of variance components and genetic parameters for growth of Angus cattle from birth to 820 days of age were obtained from a random regression analysis. Trajectories were modelled through quadratic B-spline functions with 7 random regression coefficients for direct genetic and permanent environmental effects, and 5 coefficients for the corresponding maternal effects. Data comprised a large set of field records, selecting only animals with at least 4 weights recorded. Results showed smooth estimates of variances, increasing with weight and age, with good interpolation for early ages with few records and little end-of-range problems at the highest ages. On the whole, estimates of genetic parameters were consistent with literature results. However, estimates of heritabilities for weaning weight were higher for direct and lower for maternal effects than usually found, indicating a different partitioning between direct and maternal variances in random regression analyses than in standard multivariate analyses.
Keywords : Genetic parameters, beef cattle, growth, random regression, B-splines

INTRODUCTION

Random regression (RR) analyses have become a standard procedure for analyses of longitudinal data from livestock recording schemes, such as weights of animals recorded at different ages. However, applications to field data for beef cattle so far have suffered from sparsity of records, and numerical problems inherent in the use of orthogonal polynomials to model trajectories. This paper presents a RR analysis for a large set of fields records of Angus cattle, severely edited to include only animals with at least four weights recorded, i.e., as good a structure as might be obtained. As suggested by Rice and Wu (2001) regression on B-spline basis functions of age at recording is used to model trajectories. These are expected to be more robust to problems often encountered in RR analyses of sparse data than high order polynomials; see Meyer (2005a) for a brief review.

MATERIAL AND METHODS

Data. Records consisted of weights of Angus cattle from birth to 820 days of age, extracted from the National Beef Recording Scheme data base in July 2004. Raw data comprised close to 2 million weight and 1 million pedigree records. Initial edits eliminated implausible records, records more than 3 standard deviations from the respective weekly mean, and records clearly 'out of sequence'. Subsequently, all records in contemporary groups (CG) with less than 3 observations and for all animals with less than four weights were disregarded recursively. This left $284,330$ records on $64,307$ animals, i.e., an average of 4.43 records per animal, with a mean weight of 293.4 kg and mean age of 302.2 days. Birth weight was available for $58,161$ animals. Figure 1 shows the distribution of weights for other ages at recording, together with corresponding means.