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A SEMI-STOCHASTIC SIMULATION MODEL OF THE NEW ZEALAND DAIRY
CATTLE ARTIFICIAL INSEMINATION INDUSTRY

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Abstract

A univariate semi-stochastic simulation model was written with the objective of economically evaluating a range of breeding programmes from the perspective of a privately owned artificial insemination company.

To test the validity of the model four breeding programmes were evaluated. Three of the options were variants of the first which considered the progeny testing of 35 young sires sourced from the New Zealand and United States registered populations. Modifications to the initial programme centred around increasing the number of young sires sampled and the use of the New Zealand recorded, but unregistered, cow population as a source of bull dams.

Stochastic simulation was used for the male sub-populations of sires-to-breed-sires and sires-to-breed-dams, simulating each animal individually by drawing them from a univariate normal distribution. Cow populations, because of size, were simulated deterministically using expectations based on existing dairy industry structure.

Selection was imposed on the population for a single production trait with a heritability of 0.25. Selection intensities and generation intervals depended on user defined inputs such as which populations were available for selection, how many sires of sons were to be used, and how many young sires were to be sampled.

The genetic simulation was replicated ten times for each of the four options, covering a twenty year time frame. Economic analysis was undertaken by modelling two companies. One company maintained a stable breeding programme throughout the simulation so that the changing fortunes of the other could be measured as its breeding programme altered. Gross profit was estimated from semen sales and the costs associated with each programme subtracted. The resulting pre-tax profit was adjusted for tax and discounted to a net present value.

The effect of planning horizon on profitability was examined by extracting data at five year intervals, coefficients of variation were used to analyse risk and all options were contrasted with the base in percentage terms to overcome the need to account for fixed capital costs, which were assumed to remain constant across breeding programs.

For the programmes modelled it was found that cost structure played a bigger part in determining net profit than rate of genetic gain. Secondly, expanding the base population in which selection was carried out was more important than increasing the number of young sires sampled.

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