DEVELOPING SELECTION INDEXES & ESTIMATION OF GENETIC PARAMETERS FOR TRAITS OF ECONOMIC IMPORTANCE IN DAIRY CATTLE UNDER ONCE-A-DAY MILKING

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Abstract

Developing Selection Indexes & Estimation of Genetic Parameters for Traits of Economic Importance in Dairy Cattle under Once-a-Day Milking.
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In New Zealand, about 5% of dairy herds are milked once-a-day (OAD). The cows are inseminated using sires from the twice-a-day milking system (TAD) evaluated on breeding worth (BW) or an OAD selection index. Testing for sire-by-milking frequency (MF) interaction (S×MF) could reveal if developing an OAD-specific selection scheme is justified. In this thesis production records were analysed from herds milked OAD and an equivalent TAD population provided by Livestock Improvement Corporation. Across MF, heritabilities (h^2) and genetic correlations were similar for milk yields (h^2: 0.21-0.36), although they tended to be greater in TAD. Genetic correlations were 0.35-0.40 between milk and fat yields, 0.85 between milk and protein yields and 0.54-0.60 between fat and protein yields. Observed rank correlation between OAD and TAD EBVs of the sires were moderate to high for milk yields, being greater in Jersey (J) (0.74-0.84) sires compared to Holstein-Friesian (F) and F×J crossbred (0.55-0.77) sires. Those values were greater than their critical values of the expected correlations (5th percentile), indicating that S×MF was not significant. Data from a university herd indicated that J cows were more efficient at production of milk solids (MS; fat + protein) per 100 kg of live weight than F or F×J cows milked OAD. In comparison, data from commercial herds milked either OAD or TAD indicated that F cows milked OAD had 19%-25% lower milk yields, whilst the reduction in yields from F×J and J cows was around 15%-19%. Breed effects (F-J) were lower on OAD compared to TAD systems, but heterosis effects were similar across MF (4.1%-7.6%). Under a progeny testing selection scheme for herds milked OAD, estimated genetic gains ranged from 3.3 to 3.7 kg/year for MS. Nevertheless, genetic gain resulting from the selection of bulls generated in TAD systems and dedicated to OAD herds would results in a similar increase compared with a separate scheme (only 11%-13% less of MS), indicating that there is little advantage in the implementation of a separate selection scheme. The main conclusion was that the S×MF interaction was not significant and farmers operating under OAD milking achieve similar genetic gain using sires from the TAD milking selection scheme but ranked on an OAD-selection index.

This thesis is dedicated to my dear wife Macarena, my son Pedro Felipe, and to the memory of my late father, Jorge.

Declaration

This thesis contains no material that has been accepted for a degree or diploma by the University or any other institution. To the best of knowledge no material previously published or written by another person has been used, expect where due acknowledgement has been made in text.

This thesis has been written with chapters formatted as papers for publication. Therefore there is some repetition of introduction and methods sections. Each chapter contains a full discussion, with the final general discussion chapter providing a succinct discussion of key findings of this thesis.

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MF = Milking frequency

OAD = Once-a-day

TAD = Twice-a-day

F = Holstein-Friesian

J = Jersey

F×J = Holstein-Friesian × Jersey crossbred

MY = Milk yield

FY = Fat yield

PY = Protein yield

SCS = Somatic cell score

MS = Milk solids

PL = Production level

BW = Breeding Worth

EBVs = Estimated breeding values

G×E = Genotype by environment interaction

S×MF = Sire by milking frequency interaction