The suitability of test-day models for genetic evaluation of dairy cattle in South Africa

by

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Submitted in partial fulfillment of the requirements for the degree
Philosophiae Doctor
in the Faculty of Natural & Agricultural Science
University of Pretoria

Pretoria

January 2007

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DECLARATION

I declare that the thesis, which I hereby submit for the degree Philosophae Doctor at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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ABSTRACT

In this study the possibility to change to test-day models for genetic evaluation of production traits and somatic cell score of South African dairy breeds (*i.e.* Ayrshires, Guernseys, Holsteins and Jerseys) was investigated. Fixed Regression BLUP Animal Models were therefore developed, using test-day records of the first three lactations as repeated measures of the same trait. Milk, butterfat and protein yields were included in multitrait evaluations. A permanent environmental effect was fitted across lactations. Heritabilities estimated were comparable with other yield and somatic cell score estimates obtained from test-day models. Breeding values of qualifying sires were presented to INTERBULL for participation in the March 2005 test-runs. Genetic correlations between South Africa and other participating countries compared well with those amongst other countries, participating in these international evaluations. Trend validation tests were successful for all traits and breeds except for somatic cell score of the Guernsey breed, due to insufficient data for this trait. South Africa is now participating in routine INTERBULL evaluations in order to obtain MACE (multiple across country evaluation) breeding values, using this methodology. Further refinement of the model was tested, *i.e.* inclusion of a fixed calving year effect in the model and pre-adjusting records for heterogeneous variances due to days in milk and parity. This was investigated for the Jersey breed and recommended for implementation in the other South African breeds. South Africa's methodology is now more comparable to that of the leading dairy producing countries of the world.

SAMEVATTING

Die moontlikheid om toetsdag modelle te implementeer vir genetiese evaluering van produksie eienskappe en somatiese seltelling van Suid-Afrikaanse melkrasse (*i.e*. Ayrshires, Guernseys, Holsteins en Jerseys), is in hierdie studie ondersoek. Vaste Regressie BLOB Dieremodelle is gevolglik ontwikkel, waar toetsdag rekords van die eerste drie laktasies as herhaalde metings van dieselfde eienskap gebruik is. Melk, bottervet en proteïen toetsdagproduksies is in meereienskap analises ingesluit. `n Permanente omgewingseffek is oor laktasies gepas. Oorefbaarhede is beraam wat vergelykbaar is met beramings verkry vanuit ander toetsdag modelle. Teelwaardes van kwalifiserende vaders is aan INTERBULL (Internasionale Bul Evaluarings Diens) verskaf vir deelname aan die Maart 2005 toetslopies. Genetiese korrelasies tussen Suid-Afrika en ander deelnemende lande het goed vergelyk met genetiese korrelasies wat tussen lande, wat aan hierdie internasionale ontledings deelneem, bestaan. Die internasionale toetse was suksesvol vir al die rasse en eienskappe, behalwe vir somatiese seltelling van die Guernsey ras as gevolg van onvoldoende data. Suid-Afrika neem tans deel aan roetine INTERBULL ontledings vir die verkryging van MACE ("Multiple Across Country Evaluation") teelwaardes, met toepassing van hierdie metodologie. Verdere verfyning van die model is getoets, naamlik die insluiting van `n vaste kalwingsjaar effek, asook aanpassing van toetsdag rekords vir heterogene variansie as gevolg van dae in melk en laktasie effekte. Dit is getoets op die Jersey ras en aanbeveel om in die ander Suid-Afrikaanse rasontledings geïmplementeer te word. Suid-Afrika se metodologie is nou vergelykbaar met dié van die voorloper melk produserende lande van die wêreld.

ACKNOWLEDGEMENTS

- My promoters, Drs Esté van Marle-Köster, Frans Kanfer and especially Helena Theron for their encouragement, support and advice during this study.
- The ARC – Livestock Business Division for granting me the opportunity to undertake and financially support this study.
- Dr Eildert Groeneveld of FAL, Germany, as well as Prof Dr Milena Kovac and Dr Spela Malovrh of the University of Ljubljana, Slovenia, for their valuable inputs.
- Dr Bobbie van der Westhuizen for his keen interest and dedicated programming of pre- and post-BLUP procedures, without which this study could not be completed.
- Gaby Warren, my technician, who never complained if jobs had to be redone and for her support in preparing the articles and thesis.
- Frans Jordaan, of whom I often demanded immediate help in programming and who never failed me.
- The personnel of the ARC-LBD and Studbook, especially Dr Japie van der Westhuizen and Graham Hallowell for their guidance and support in understanding IRIS and the dairy industry.
- The SA Jersey Society, especially Poena van Niekerk, for constructive criticism and support with regards to, amongst others, presentation of the "new" breeding values to the industry.
- INTERBULL for their patience and support during participation in test-runs.
- My family and friends for their encouragement, support and love through the years.
- My husband, Pieter, who always believed in me.
- And above all my Heavenly Father, who gave me the ability and means to undertake and complete this study.

"WHAT YOU ARE, IS GOD'S GIFT TO YOU.

WHAT YOU BECOME, IS YOUR GIFT TO GOD."

Author : V. Mclellan

DEDICATION

VIR DIE LIEFDES IN MY LEWE :

MOSSIE, WYNAND EN NADIA

LIST OF PUBLICATIONS

Scientific Publications

Mostert, B.E., Banga, C., Groeneveld, E. & Kanfer, F.H.J., 2004. Breeding value estimation for somatic cell score in South African dairy cattle. S. Afr. J. Anim. Sci. 34, 32-34.

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