60th EAAP meeting Barcelona, Spain 2009

Session 53, Free communication Genetics (Methodology), Abstract No. 4254, Presentation No. 24

Combining co-variance components from different models using iterative summing of expanded part matrices: Udder health traits

Negussie, E.[1*], Lidauer, M.[1], Stranden, I.[1], Aamand, G.P.[2], Nielsen, U.S.[2], Pösö, J.[3], Johansson, K.[4], Eriksson, J.-Å.[4] and Mäntysaari, E.A.[1]

[1*]MTT Agrifood Research Finland, 31600 Jokioinen, [2]Nordic Cattle Genetic Evaluation, Udkærsvej 15, Skejby, DK-8200 Århus N, Denmark, [3]Faba Breeding, Box 40, 01301 Vantaa, Finland, [4]Svensk Mjölk, Box 210, S-101 24 Stockholm, Sweden.

*enyew.negussie@mtt.fi

Background

Genetic evaluation of udder health by a meta-model combines longitudinal test-day somatic cell score (TDSCS) and non-longitudinal traits such as clinical mastitis (CM) and udder type traits (UA & UD). This requires reliable estimates of co-variance (VCV) components. However, direct estimation of VCV fitting multi-trait random regression model (mt-RRM) is time consuming and convergence may not be guaranteed.

Objectives

♦ **Estimate genetic correlations between TDSCS, CM & two udder type traits involving later lactations**

♦ **Compare two approaches of estimating co-variance components fitting mt-RRM**

Methods

Data - 17,500 Danish Holsteins

Traits - First three lactations TDSCS & CM traits and two first lactation udder type traits, UA & UD

Two methods of estimating VCV components for a meta-model BLUP

Direct estimate fitting mtRRM REML

$$\begin{bmatrix} \text{TDSCS1} \\ \text{TDSCS2} \\ \text{TDSCS3} \\ \text{CM11} \\ \text{CM12} \\ \text{CM2} \\ \text{CM3} \\ \text{UA} \\ \text{UD} \end{bmatrix} = \underbrace{\text{hy3} + \text{ym} + \text{age} + \begin{bmatrix} \sum_{r=0}^{1} \phi(d)_r b \\ 0 \\ . \\ 0 \end{bmatrix}}_{\text{fixed}} + \underbrace{\begin{bmatrix} \text{htd} \\ \text{hy1} \\ . \\ \text{hy1} \end{bmatrix} + \begin{bmatrix} \sum_{r=0}^{1} \phi(d)_r \text{pe} \\ \text{pe} \\ . \\ \text{pe} \end{bmatrix} + \begin{bmatrix} \sum_{r=0}^{1} \phi(d)_r a \\ a \\ . \\ a \end{bmatrix}}_{\text{random}} + \text{e}$$

1000 rounds of iteration ~6-8 wks

$$\mathbf{K}a_{m_{15x15}} = \begin{bmatrix} \Phi_{TDSCS1} & & & & & & & & \\ & \Phi_{TDSCS2} & & & & & symm. & & \\ & & \Phi_{TDSCS3} & & & & & & \\ & & & CM_{11} & & & & & \\ & & & & CM_{12} & & & & \\ & & & & & CM_{2} & & & \\ & symm. & & & & & CM_{3} & & \\ & & & & & & & UA & \\ & & & & & & & & UD \end{bmatrix}$$

Combining estimates from non-longitudinal model with mtRRM (using Iterative summing of expanded part matrices)

$$\begin{bmatrix} \text{CM11} \\ \text{CM12} \\ \text{CM2} \\ \text{CM3} \\ \text{UA} \\ \text{UD} \end{bmatrix} = \underbrace{\text{hy3} + \text{ym} + \text{age}}_{\text{fixed}} + \underbrace{\text{hy1} + pe + a}_{\text{random}} + \text{e}$$

$$\begin{bmatrix} \text{TDSCS1} \\ \text{TDSCS2} \\ \text{TDSCS3} \\ \text{CM11} \\ \text{CM12} \\ \text{CM2} \\ \text{CM3} \\ \text{UA} \\ \text{UD} \end{bmatrix} = \underbrace{\text{hy3} + \text{ym} + \text{age} + \begin{bmatrix} \sum_{r=0}^{1} \phi(d)_r b \\ 0 \\ . \\ 0 \end{bmatrix}}_{\text{fixed}} + \underbrace{\begin{bmatrix} \text{htd} \\ \text{hy1} \\ . \\ \text{hy1} \end{bmatrix} + \begin{bmatrix} \sum_{r=0}^{1} \phi(d)_r \text{pe} \\ \text{pe} \\ . \\ \text{pe} \end{bmatrix} + \begin{bmatrix} \sum_{r=0}^{1} \phi(d)_r a \\ a \\ . \\ a \end{bmatrix}}_{\text{random}} + \text{e}$$

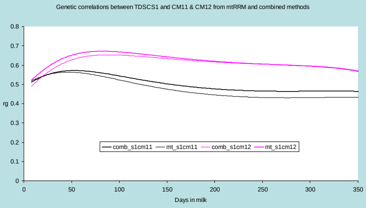
$$\mathbf{G}_{15x15} = \begin{bmatrix} 0 & & & & & & & & \\ & 0 & & & & & symm. & & \\ & & 0 & & & & & & \\ & & & \text{CM11} & & & & & \\ & & & & \text{CM12} & & & & \\ & & & & & \text{CM2} & & & \\ & symm. & & & & & \text{CM2} & & \\ & & & & & & & \text{UA} & \\ & & & & & & & & \text{UD} \end{bmatrix}$$

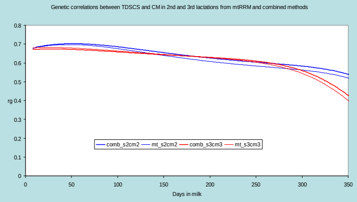
$$\mathbf{K}\mathbf{a}_{15x15} = \begin{bmatrix} \Phi_{TDSCS\ 1} & & & & & & & & \\ & \Phi_{TDSCS\ 2} & & & & & symm & & \\ & & \Phi_{TDSCS\ 3} & & & & & & \\ & & & \text{CM11} & & & & & \\ & & & & \text{CM12} & & & & \\ & cov_{TDSCS,cm,udd} & & & & \text{CM2} & & & \\ & & & & & & \text{CM3} & & \\ & & & & & & & \text{UA} & \\ & & & & & & & & \text{UD} \end{bmatrix}$$

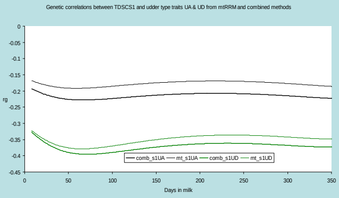
Iterative summing of expanded part matrices approach

Results

a) Genetic correlations between TDSCS & CM and udder type traits







b) Comparison between two approaches (mtRRM *Vs.* combined) of estimating VCV for a meta-model BLUP

	Comparison between parameters estimated by the two approaches (mtRRM *Vs.* combined) in terms of		
Method	Corr. between EBVs (~50 daughters)		Computational time
mtRRM	0.98 - 0.99		6-8 wks
Combined			1 wk

Conclusions

Combining co-variance components estimated by different models using iterative summing of expanded part matrices offer a quick and reliable method to estimate parameters for a meta-model udder health genetic evaluation.