Variance adjustments and Mendelian Sampling tests

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Topics

• Quick review of variance adjustment methods
• Traits using variance adjustments in USA
• Examples of breed-sex-traits not passing Mendelian Sampling variance test
• Review of USA results for MS variance test
• Comparison of new vs. previous MS test software
Variance adjustment methods

- Simple scaling such as mature equivalent (phenotypic mean and SD are proportional by age)
- Pre-adjustment for phenotypic and/or genetic var
  - Time group, breed, region, herd, heritability
- Simultaneous variance adjustments within model
- Nonlinear (threshold) models for categorical data
References on variance adjustment

- Gianola and Foulley, 1983, Harville and Mee, 1984
- Wiggans and VanRaden, 1991
  - \( y^* = \mu + (y - \mu) \frac{\sigma_{\text{base}}}{\sigma_{\text{herd.year}}} \)
- Meuwissen et al., 1996, Gengler et al., 1999
**Adjustment of U.S. traits**

<table>
<thead>
<tr>
<th>Trait group</th>
<th>Adjusted since:</th>
<th>Variance adjustment method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>1941</td>
<td>Mature equivalent (multiplicative)</td>
</tr>
<tr>
<td>Production</td>
<td>1992</td>
<td>Pre-adjust for herd variance</td>
</tr>
<tr>
<td>Somatic cell score</td>
<td>2009</td>
<td>Pre-adjust for herd variance</td>
</tr>
<tr>
<td>Calving traits</td>
<td>1985</td>
<td>Sire-MGS threshold model</td>
</tr>
<tr>
<td>Conformation (minor breeds)</td>
<td>1998</td>
<td>Adjusted in model until 2016, now pre-adjusted for better convergence</td>
</tr>
<tr>
<td>Cow livability</td>
<td>2016</td>
<td>Pre-adjust</td>
</tr>
<tr>
<td>Health traits</td>
<td>????</td>
<td>Pre-adjustments being tested</td>
</tr>
</tbody>
</table>

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**CDCB**

**USDA**
Example of USA test results

• 60 breed-sex-trait tests conducted, 53 tests passed
  • 5 breeds x 8 traits for males, 4 traits for females
• Variance adjustments designed to stabilize cow MS:
  • HOL MS trend tests: -0.1 milk, +0.1 fat, -0.7 protein
• But a few bull trends exceeded the +-2.0 limit
  • HOL bull tests: +2.5 milk, +1.3 fat, +1.2 protein
• Why the difference? Perhaps bull preselection
# MS trends outside limits

<table>
<thead>
<tr>
<th>Breed</th>
<th>Sex</th>
<th>Trait</th>
<th>Adjusted Trait?</th>
<th>MS trend limit</th>
<th>MS trend</th>
<th>Failed(^1)</th>
<th>Failed(^1) revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOL</td>
<td>Male</td>
<td>milk</td>
<td>Yes</td>
<td>+2.0</td>
<td>2.5</td>
<td>1</td>
<td>n/a</td>
</tr>
<tr>
<td>HOL</td>
<td>Male</td>
<td>int</td>
<td>No</td>
<td>+2.0</td>
<td>2.1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>JER</td>
<td>Male</td>
<td>fat</td>
<td>Yes</td>
<td>+2.0</td>
<td>2.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BSW</td>
<td>Male</td>
<td>scs</td>
<td>Yes</td>
<td>+2.0</td>
<td>-2.9</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>RDC</td>
<td>Female</td>
<td>milk</td>
<td>Yes</td>
<td>+2.0</td>
<td>-3.4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>RDC</td>
<td>Female</td>
<td>pro</td>
<td>Yes</td>
<td>+2.0</td>
<td>-2.9</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>RDC</td>
<td>Female</td>
<td>scs</td>
<td>Yes</td>
<td>+2.0</td>
<td>-2.2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

\(^1\)Number of individual year tests that failed. For HOL milk the last year deviated from the trend.
Interbull verify output for bull SD (U.S. HOL milk yield)
Interbull verify vs. MS validation (U.S. HOL milk yield)
Conclusions

• About 10% of USA breed-sex-trait tests failed
• All but 1 were for variance-adjusted traits
• Difficult to change bull variance if cow variance OK
• RDC testing is difficult because of crossbreeding
• Computation was reasonable even for HOL cows
• Individual year tests are better in the new version
Acknowledgments

- Mel Tooker
- Tyrisevä *et al* provided the software
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