IT-Solutions for Animal Production
Two years of experience with genomics - how well does it work?

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Introduction

Genomics:
- Completely new breeding technology

- High impact on breeding schemes
  - Organizations
  - Farmers

- Farmers have to believe
  - No historical experience i.e. ‘public’ validation
  - Animal proofs are not based on own/daughter performances
    - No ‘real’ individual measures
    - No animal with performance seen


➔ comprehensible validation essential
Validation of genomics

Method before introduction:
- Reduce reference population and verify on the excluded bulls
  - Difficult/un-reliable with small reference populations
- National: for all traits?
- International (ICAR/Interbull): official only for production traits
  - Totally 21 country*breed genomic systems validated
    - 12 already since Aug. 2010 (thereof 8 HOL)

Method after official introduction:
- Compare earlier published ‘pure’ genomics with later published daughter based gEBV
- Advantage: reality
- Disadvantage:
  - needs time for late-occurring/low-heritable traits
  - Includes model changes
German Holstein genomics

- gEBV for Holsteins officially published since August 2010
  - EuroGenomics reference population >23,000 bulls (>6,500 with German daughters)

<table>
<thead>
<tr>
<th>Rel. % young candidates</th>
<th>sire-P.I.</th>
<th>gEBV</th>
<th>daughter equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>31%</td>
<td>73%</td>
<td>ca. 50 with 3 tests</td>
</tr>
<tr>
<td>Somatic Cell Score</td>
<td>31%</td>
<td>76%</td>
<td>ca. 85 with 3 tests</td>
</tr>
<tr>
<td>Conformation</td>
<td>28%</td>
<td>57%</td>
<td>ca. 25</td>
</tr>
<tr>
<td>Herd Life</td>
<td>26%</td>
<td>52%</td>
<td>ca. 100 1st +70 2nd La</td>
</tr>
<tr>
<td>Daughter Fertility</td>
<td>25%</td>
<td>43%</td>
<td>ca. 80 in 1st La</td>
</tr>
<tr>
<td>Calving Ease</td>
<td>33%</td>
<td>53%</td>
<td>ca. 40 calvings</td>
</tr>
<tr>
<td>Milking Speed</td>
<td>24%</td>
<td>61%</td>
<td>ca. 30</td>
</tr>
<tr>
<td>Total Merit RZG</td>
<td>29%</td>
<td>65%</td>
<td></td>
</tr>
</tbody>
</table>

- Realistic reliabilities
  - No international harmonization how to calculate reliabilities for gEBV
  - National reliabilities for gEBV of young bulls not always correspond with quality of reference population
Validation of gEBV in practice

- 199 Holstein bulls with genomic proofs in 12-2010 (and first daughter proof in 04-2011)
- have in 04-2012 their 4th daughter proof i.e. with high reliability

<table>
<thead>
<tr>
<th>n=199</th>
<th>gEBV 1012*</th>
<th>gEBV 1204</th>
<th>Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>rel. (daug.) milk/SCS</td>
<td>73.9% (0)</td>
<td>93.2% (114.3)</td>
<td></td>
</tr>
<tr>
<td>Prododuction index RZM</td>
<td>0.52</td>
<td>0.47</td>
<td>-0.06</td>
</tr>
<tr>
<td>RZS (SCS)</td>
<td>0.39</td>
<td>0.34</td>
<td>-0.05</td>
</tr>
<tr>
<td>Total conformation RZE</td>
<td>0.80</td>
<td>0.78</td>
<td>-0.02</td>
</tr>
<tr>
<td>Herd life RZN</td>
<td>0.79</td>
<td>0.71</td>
<td>-0.07</td>
</tr>
<tr>
<td>Daughter fertility RZR</td>
<td>0.18</td>
<td>0.10</td>
<td>-0.09</td>
</tr>
<tr>
<td>rel. total merit index RZG</td>
<td>68.7%</td>
<td>83.0%</td>
<td></td>
</tr>
<tr>
<td>Total Merit RZG</td>
<td>1.04</td>
<td>0.91</td>
<td>-0.13</td>
</tr>
</tbody>
</table>

*) shift of base in 04-2011 corrected

Scale: genetic standard deviations

Base 2012: bulls born 2002-2004

- German HOL genomics approve with many daughters in average very good
  - Difference < 0.1 genetic standard deviation
12-2010 genomic proofs ↔ 04-2012 daughter based proofs

- 04-2012: 4th daughter based proof incl. $\bar{\sigma} = 114.3$ daughters ($\bar{\sigma}$ rel. 93.2%)
- Difference $\bar{\sigma} = -0.06 \sigma_g$; deviation of individual bulls $\bar{\sigma} \pm 0.63 \sigma_g$

Top 10%
12-2010 genomic proofs ↔ 04-2012 daughter based proofs

- 04-2012: 4th daughter based proof incl. Ø 59.6 daughters (Ø rel. 81.0%)
- Difference Ø -0.02 s_g; deviation of individual bulls Ø ± 0.57 s_g
12-2010 genomic proofs ↔ 04-2012 daughter based proofs

- **04-2012**: 4th daughter based proof incl. \( \bar{\Omega} \) 114.3 daughters (\( \bar{\Omega} \) rel. 86.8%)
- **Difference** \( \bar{\Omega} -0.05 \) \( s_g \); deviation of individual bulls \( \bar{\Omega} \pm 0.42 \) \( s_g \)

Top 10%
12-2010 genomic proofs ↔ 04-2012 daughter based proofs

- **04-2012**: 4th daughter based proof, $\bar{\theta}$ rel. 49.6%
- Difference $\bar{\theta} -0.09$ $s_g$; deviation of individual bulls $\bar{\theta} \pm 0.32$ $s_g$
12-2010 genomic proofs ↔ 04-2012 daughter based proofs

- 04-2012: 4th daughter based proof, \( \varnothing \) rel. 56.0%
- Difference \( \varnothing -0.07 \ s_g \); deviation of individual bulls \( \varnothing \pm 0.30 \ s_g \)

Top 10%
12-2010 genomic proofs ↔ 04-2012 daughter based proofs

- 04-2012: 4th daughter based proof, $\bar{\sigma}$ rel. 83.0%
- Difference $\bar{\sigma}$ -0.13 $s_g$; deviation of individual bulls $\bar{\sigma} \pm 0.59 s_g$
Validation of genomics in practice

- Validation of genomics in practice:
  - Is simple and comprehensible
    - Latest one year after official introduction
    - Should focus not only on average of all bulls, but on validation of top bulls
  - why not published in more countries?

- Validation of German Holstein genomics in practice:
  - German gEBV of young Holstein bulls are realistic and unbiased
    - For all traits
    - For top genomic bulls

Guarini
(Goldwin x O-Man)
12-2010 = 0 daug.: RZG 143
04-2012 = 151 daug.: RZG 145
Conclusions

- German gEBV for young bulls are fully comparable to daughter proofs
- selection can/should be done across young and daughter proven bulls
- young bulls should take big market share
  - Because they offer much higher overall genetic level
    - Selected 1 out of 50-100 (10,000 bull calves tested per year in Germany)
    - instead of 1 out of 10-15 (1,000 bulls daughter proven per year in Germany)
  - Because they are more complete
    - less ‘compromises’ when A.I. studs buy a bull
    - especially for functional traits

**Laron P**
(Lawn Boy x Shottle)
born 2008
RZG 137
RZM 116 RZE127
RZS 116 RZN 128
RZR 112

**Pioneer**
(Planet x Shottle)
born 2009
RZG 143
RZM 120 RZE 127
RZS 119 RZN 134
RZR 111
Conclusions

- Selection can/should be done across young and daughter proven bulls
- Young bulls should take big market share
  - The key is that farmers (can) believe in genomics!
  - Validation of genomics in practice are therefore crucial

In Germany significant increase of market share young bulls

after validation in practice i.e. one year after first release
2014
IDF/ISO Analytical Week and ICAR/INTERBULL Conference

Germany | Berlin
IDF/ISO  15–20 May
ICAR     19–23 May
Interbull 20–21 May

www.icar2014.de