Description of total merit index for bulls and cows of Holstein breed

Index for bulls (SIH)

SIH is calculated for bulls:
- that have at least 75 % of Holstein or Red Holstein breed
- born since 1992
- with at least 6 herds for production traits and conformation

Rules for inclusion of RBV for somatic cells, fertility, conformation, longevity:

Female fertility
- if sum of effective number of inseminations for cows and heifers ($SW_{cows} + SW_{heifers}$) is at least 50, $RBV_{cows+heifers}$ is used; otherwise average RBV of population is used

Somatic cells
- average RBV of population for somatic cells is used if bull doesn’t have RBV for somatic cells or number of herds is lower than 20

Conformation
- average RBV of population is used if bull doesn’t have RBV for relevant trait or effective number of daughters is less than 15

Longevity
- average RBV of population is used if bull doesn’t have RBV for longevity or number of culled daughters is less than 10

Traits included in SIH

<table>
<thead>
<tr>
<th>Trait</th>
<th>Code</th>
<th>Trait</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBV fat kg</td>
<td>RBVfatkg</td>
<td>RBV locomotion</td>
<td>RBVloc</td>
</tr>
<tr>
<td>RBV protein kg</td>
<td>RBVprotk</td>
<td>RBV udder depth</td>
<td>RBVud</td>
</tr>
<tr>
<td>RBV fat %</td>
<td>RBVfat%</td>
<td>RBV fore udder attachment</td>
<td>RBVfua</td>
</tr>
<tr>
<td>RBV protein %</td>
<td>RBVprot%</td>
<td>RBV central ligament</td>
<td>RBVcl</td>
</tr>
<tr>
<td>RBV somatic cells</td>
<td>RBVsc</td>
<td>RBV rear teat placement</td>
<td>RBVrtp</td>
</tr>
<tr>
<td>RBV female fertility</td>
<td>RBVff</td>
<td>RBV rear udder height</td>
<td>RBVruh</td>
</tr>
<tr>
<td>RBV feet and legs</td>
<td>RBVfl</td>
<td>RBV teat length</td>
<td>RBVtl</td>
</tr>
<tr>
<td>RBV foot angle</td>
<td>RBVfa</td>
<td>RBV longevity</td>
<td>RBVlon</td>
</tr>
<tr>
<td>RBV rear leg rear view</td>
<td>RBVrlr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SIH calculation:

\[
SIH = 0.225 \times RBV_{prot\,kg} + 0.115 \times RBV_{fat\,kg} + 0.11 \times RBV_{prot\%} + \\
+ 0.04 \times RBV_{fat\%} + 0.15 \times RBV_{fl} + 0.07 \times RBV_{sc} + 0.05 \times RBV_{lon} + \\
+ 0.06 \times RBV_{fl} + 0.0225 \times RBV_{fa} + 0.01 \times RBV_{rlr} + 0.0175 \times RBV_{loc} + \\
0.0375 \times RBV_{ud} + 0.025 \times RBV_{fua} + 0.0225 \times RBV_{cl} + 0.0125 \times RBV_{rtp} + \\
+ 0.01625 \times RBV_{ruh} + 0.01625 \times RBV_{tl}
\]

Milk production index

\[
I_{milk} = 0.46 \times RBV_{prot\,kg} + 0.235 \times RBV_{fat\,kg} + 0.225 \times RBV_{prot\%} + \\
+ 0.08 \times RBV_{fat\%}
\]

Feet and legs index

\[
I_{legs} = 0.5454 \times RBV_{fl} + 0.20455 \times RBV_{fa} + 0.09091 \times RBV_{rlr} + 0.15909 \times RBV_{loc}
\]

Udder index

\[
I_{udder} = 0.28846 \times RBV_{ud} + 0.19231 \times RBV_{fua} + 0.17308 \times RBV_{cl} + 0.09615 \times RBV_{rtp} \\
+ 0.125 \times RBV_{ruh} + 0.125 \times RBV_{tl}
\]

Calculated SIH and the other indexes are standardized (100; 12).

Note
From equations above it is evident that partial indexes are not used in calculation of SIH but individual RBVs are used directly.

Used groups of traits

<table>
<thead>
<tr>
<th>Production</th>
<th>Fertility</th>
<th>Udder health</th>
<th>Longevity</th>
<th>Conformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>49 %</td>
<td>12 %</td>
<td>7 %</td>
<td>7 %</td>
<td>25 %</td>
</tr>
</tbody>
</table>

Estimated genetic gain

<table>
<thead>
<tr>
<th>Production</th>
<th>Fitness traits</th>
<th>Udder health</th>
<th>Beef</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.28 %</td>
<td>35.71%</td>
<td>2.53%</td>
<td>-0.52%</td>
</tr>
</tbody>
</table>
Requirements for bulls to be included into TOP SIH:
1. Breeding values for production traits, fertility and conformation calculated in the Czech Republic.
2. Production traits: at least 30 herds for 1st lactation.
3. Conformation: at least 20 herds (Feet and legs).
4. At least 50 inseminations by the semen of bull in the (current + last) year or bull was born in the last 8 years.

Index for cows (SIH-K)

SIH-K is calculated for cows:
- that have at least 75 % of Holstein or Red Holstein breed (however sire of Red Holstein cows has to have 100 % of Red Holstein breed or has to be registered in herd book)
- that have breeding values for production traits, somatic cells and conformation (feet and legs) calculated in the Czech Republic; breeding values for production traits and somatic cells are included just since 3 test day records are known

SIH-K calculation:
Same traits and weights as for SIH are used except female fertility and longevity that are not computed for cows. Calculated SIH-K and the other indexes are standardized (100; 12).

Requirements for cow to be included into TOP SIH-K:
1. Cow is not excluded from milk recording and is registered in herd book.
2. In the TOP list there are 1500 the best cows sorted according to SIH-K.

Index for heifers (SIH-J)

SIH-J is calculated for heifers:
- that are alive
- not calved till the date of evaluation
- are not older then 3 years
- their sire has valid SIH or gSIH index
- dam has valid SIH-K
SIH-J calculation:
Heifers parent average breeding values are computed. Index formula is same like for cow index (SIH-K). Standardization is based on bull SIH parameters.

Requirements for heifer to be included into TOP SIH-J:
Best 1000 heifers by SIH-J are included.