Genetics of carcass condemnations and relationships with growth, backfat and uniformity in pigs

Han Mulder, Pramod Mathur, Roos Vogelzang, Egiel Hanenberg, Egbert Knol
Selection to increase uniformity of finisher pigs

- Uniform pigs are advantageous
  - No price penalties by slaughterhouse
  - Less/no sorting by farmer
  - More efficient growth, better welfare

- Indications for genetic variation in uniformity
Are there trade-offs when selecting on increased uniformity?

- Are uniform animals enough responsive to diseases or other environmental perturbations?

- A favourable relationship could be expected as well:
  - Uniform pigs are more resilient/robust
  - Families with higher uniformity have fewer runts
Objectives

- Estimate genetic variation in uniformity for finisher traits
- Estimate genetic relationships between uniformity and carcass condemnations
- Estimate improvement in profit when sorting boars on uniformity
Data

Pietrain terminal crosses

- 56319 records
- 3 farms
- 701 sires
- 28 and 220 offspring/sire
Traits

- Growth: birth weight to carcass weight
- Backfat
- Carcass weight

- Bursitis: inflammation of bursae in joints
- Pneumonia: inflammation of lungs
- Pleuritis: inflammation of pleura around lungs
- Pericarditis: inflammation of pericardium around heart
Method

- Double hierarchical generalized linear model (Asreml4)
  - Model on trait level and on residual variance
  - Sire-dam model

- Random effects:
  sire-dam additive genetic effects and litter

- Fixed effects
  finisher traits: farm, sex, farm.sex.line, hysbirth
  carcass condemnation: slaughter date (extra)
Genetic variation in residual variance

<table>
<thead>
<tr>
<th>trait</th>
<th>Genetic variance uniformity</th>
<th>Genetic correlation mean-var</th>
</tr>
</thead>
<tbody>
<tr>
<td>growth</td>
<td>0.049 (0.013)</td>
<td>0.182 (0.094)</td>
</tr>
<tr>
<td>backfat</td>
<td>0.199 (0.011)</td>
<td>0.779 (0.035)</td>
</tr>
<tr>
<td>carcass weight</td>
<td>0.044 (0.010)</td>
<td>0.405 (0.085)</td>
</tr>
</tbody>
</table>

- High genetic variance in uniformity
- Positive genetic correlations: scaling
  - Higher mean, higher variance
### Heritabilities carcass condemnations

<table>
<thead>
<tr>
<th>Condition</th>
<th>(h^2)</th>
<th>se (h^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bursitis</td>
<td>0.073</td>
<td>0.006</td>
</tr>
<tr>
<td>pneumonia</td>
<td>0.025</td>
<td>0.004</td>
</tr>
<tr>
<td>pleuritis</td>
<td>0.014</td>
<td>0.003</td>
</tr>
<tr>
<td>pericarditis</td>
<td>0.022</td>
<td>0.004</td>
</tr>
</tbody>
</table>
Genetic correlations between carcass condemnations and uniformity of growth

<table>
<thead>
<tr>
<th>Condition</th>
<th>Uniformity of growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>bursitis</td>
<td>-0.133 (0.107)</td>
</tr>
<tr>
<td>pneumonia</td>
<td>-0.035 (0.152)</td>
</tr>
<tr>
<td>pleuritis</td>
<td>-0.155 (0.184)</td>
</tr>
<tr>
<td>pericarditis</td>
<td>-0.143 (0.157)</td>
</tr>
</tbody>
</table>
Genetic correlation between carcass condemnations and uniformity of backfat

<table>
<thead>
<tr>
<th>Condition</th>
<th>Uniformity of backfat</th>
</tr>
</thead>
<tbody>
<tr>
<td>bursitis</td>
<td>-0.12 (0.07)</td>
</tr>
<tr>
<td>pneumonia</td>
<td>0.10 (0.10)</td>
</tr>
<tr>
<td>pleuritis</td>
<td>-0.10 (0.11)</td>
</tr>
<tr>
<td>pericarditis</td>
<td>0.03 (0.10)</td>
</tr>
</tbody>
</table>
Sorting boars on uniformity and effect on profit

Boars selected 1 genetic sd
- Selection intensity = 2
- Accuracy = 0.5
- No correlated effect on mean

Dams are unselected
Sorting boars on uniformity and effect on profit

Uniformity of growth rate

Increase in profit
€ 0.30/boar
€ 0.09/gilt
Sorting boars on uniformity and effect on profit

Uniformity of backfat

- Increase in profit: € 0.12/boar
- Increase in profit: € 0.04/gilt
Conclusion

- Substantial genetic variation in uniformity for growth, carcass weight and backfat
- No significant genetic correlations between uniformity and carcass condemnations
- Sorting boars on uniformity of growth rate and backfat improves profit by € 0.05 – 0.20 per pig