Genetic parameters for health traits in a multi-breed sheep population

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Sheep industry in Ireland

• 2.4 million breeding sheep
  • Majority are crossbreds
• 58,000 tonnes meat produced in 2015
  • 80% was exported
  • Exports worth >€230 million
Sheep Health

Welfare implications

Dagginess
- Lambs penalised at slaughter

Lameness
- Cost €5 m per year

Mastitis
- Largest single reason for culling ewes
Phenotypes

Dagginess

Lameness

Mastitis

- 0 = no evidence of mastitis
- 1 = evidence of (historic) mastitis
Data

49,493 observations

402 flocks

2009 → 2015

5 main breeds

Vendeen

Charollais

Texel

Suffolk

Belclare
Major data edits

- Rams and ET ewes
- Breed proportion
- No repeated records
- Age at first lambing
- Age of animal
- Known sire
- Ewe parity
- Contemporary group

≥5 animals per contemporary group
- Type of animal
- Flock of inspection
- Date of inspection

The Irish Agriculture and Food Development Authority
After edits

39 315 observations

264 flocks

Ewes
n = 8,046

Lambs
n = 31,269
Model

\[ Y = \text{contemporary group} + \sum_{i=1}^{5} \text{Breed} + \text{heterosis} + \text{recombination} + \text{age} + \text{gender} + \text{parity} + \text{additive genetic effect} + \text{residual effect} \]

Maternal model:

- Random maternal genetic effect
- Within-litter permanent environmental effect
- Across litter, within ewe permanent environmental effect
Results
### Heritability

<table>
<thead>
<tr>
<th></th>
<th>Direct heritability ($h^2$)</th>
<th>$r_g$ - lambs and ewes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lambs</td>
<td>Ewes</td>
</tr>
<tr>
<td>Dagginess</td>
<td>0.14 (0.02)</td>
<td>0.15 (0.03)</td>
</tr>
<tr>
<td>Lameness</td>
<td>0.12 (0.02)</td>
<td>0.06 (0.02)</td>
</tr>
<tr>
<td>Mastitis</td>
<td>0.04 (0.03)</td>
<td></td>
</tr>
</tbody>
</table>

*Dagginess in lambs had a maternal heritability of 0.05 (0.02).*
Genetic correlations

<table>
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<tr>
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</tr>
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<tbody>
<tr>
<td><strong>Dagginess</strong></td>
<td></td>
<td>0.14 (0.09)</td>
</tr>
<tr>
<td><strong>Lameness</strong></td>
<td>0.35 (0.22)</td>
<td></td>
</tr>
<tr>
<td><strong>Mastitis</strong></td>
<td>-0.19 (0.28)</td>
<td>0.25 (0.25)</td>
</tr>
</tbody>
</table>

A correlation of -0.70 (0.11) existed between maternal lamb dagginess and direct lamb dagginess.
Breed effects

Belclaire
- Ewes - least risk of dagginess

Charollais
- Intermediate for all traits

Texel
- Lambs - least risk of dagginess
- Ewes - greatest risk of mastitis

Suffolk
- Lambs - greatest risk of dagginess

Vendeen
- Lambs - greatest risk of lameness
Conclusions and implications

• Dagginess, lameness and mastitis
  • Displayed genetic variation

• Each trait should be included in a breeding goal as they each fulfil the criteria
  1. Exhibit genetic variation
  2. Socially or economically important
  3. Measurable on a large scale
Acknowledgements

Thank you for your attention