The use of carcass traits collected in the abattoir using video image analysis to improve beef yield

Dr Kirsty Moore, R Mrode & M Coffey
Overview

- Current Genetic evaluations
- UK beef genetic evaluation developments
  - EUROP carcase trait evaluations
  - Genomic evaluations for VIA carcase traits
Current carcase trait evaluations

- Traditional BLUP EBVs for proxy traits
- Limousin Pedigree sector (~20,000/year)
  - 400 day weight (~5,000/year; 25%)
  - Ultrasound fat and muscle depth (~1,500/year; 7.5%)
In the age of the genotype......

PHENOTYPE IS KING!
Why are we interested in abattoir records?

**Answer:** the quantity of extra information available

e.g. Limousin

- ~1,500 animals / year ultrasonically scanned
- In 2011 abattoir records on ~93,000 animals Limousin/Limousin cross
- Of these ~20,000 had Limousin sire recorded
- The addition of this extra information should increase the accuracy (reliability) of genetic evaluations
Valuing carcases

• Commercial farmers paid using EUROP grid
• Paid per kg deadweight
• + penalty/premium based on
  – Conformation class
  – Fat class

• VIA provides carcass component traits
  – Multiplied by retail value
<table>
<thead>
<tr>
<th>Carcase weight</th>
<th>Conformation</th>
<th>Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>279kg</td>
<td>P-</td>
<td>3+</td>
</tr>
<tr>
<td>370kg</td>
<td>O-</td>
<td>2+</td>
</tr>
<tr>
<td>314kg</td>
<td>R=</td>
<td>1=</td>
</tr>
<tr>
<td>306kg</td>
<td>R=</td>
<td>3=</td>
</tr>
<tr>
<td>497kg</td>
<td>E=</td>
<td>2+</td>
</tr>
</tbody>
</table>

**Limousin Cross steers**

![Image of Limousin Cross steers]
Utilising data from multiple sources

- UK eartag
  - Carcase traits
  - Dates of birth & slaughter, sex, breed

- British Cattle Movement Service
  - UK eartag Dates of birth & death, sex, breed, pedigree (sire and dam), full movement information

- SRUC PED
  - UK eartag Dates of birth, sex, breed, pedigree (sire and dam)

Carcase trait EBVs
Combined data – June 2014

- 3.5m carcase records
  - 6 processors, multiple sites
- 89% carcase records matched to BCMS (3.1 million animal records)
- 23% had sire recorded in BCMS (~0.71 million animal records)
  - 28% for 2012+ born animals
Breeds

• **Dairy genetics** are a **major** component of beef carcases
  – Holstein Friesian the most common dam breed of the slaughter generation (accounting for 46%)

**Ten most common dam breed types**

<table>
<thead>
<tr>
<th>Breed code</th>
<th>Progeny Count</th>
<th>%</th>
<th>Breed code</th>
<th>Progeny Count</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Holstein Friesian</td>
<td>1,078,469</td>
<td>45.7</td>
<td>6 Belgian Blue</td>
<td>90,459</td>
<td>3.8</td>
</tr>
<tr>
<td>2 Limousin</td>
<td>341,457</td>
<td>14.5</td>
<td>7 Charolais</td>
<td>85,118</td>
<td>3.6</td>
</tr>
<tr>
<td>3 Aberdeen Angus</td>
<td>225,330</td>
<td>9.6</td>
<td>8 Blonde d’Aquitaine</td>
<td>31,778</td>
<td>1.4</td>
</tr>
<tr>
<td>4 Simmental</td>
<td>175,326</td>
<td>7.4</td>
<td>9 Shorthorn</td>
<td>29,526</td>
<td>1.3</td>
</tr>
<tr>
<td>5 Hereford</td>
<td>117,247</td>
<td>5.0</td>
<td>10 Saler</td>
<td>26,363</td>
<td>1.1</td>
</tr>
</tbody>
</table>
VIA genomic breeding values

• 4 year project (2012-2015)
• Limousin genomic breeding values for abattoir VIA carcase traits
  – Available 2015
• First UK genomic breeding values
Video Image Analysis (VIA)

- VBS2000
  - E+V
- Calibrated images (2D and 3D)
- Carcase weight and sex
- Mechanically grades the carcase
  - EUROP conformation and fat classes
  - 7 primal cut yields
Heritability of carcass cuts

Forequarter

- Ribs & Flank : 0.03
- Brisket : 0.25
- Shoulder : 0.79
- Chuck : 0.83

[0.15 ≤ s.e. ≤ 0.24]

Hindquarter

- Round : 0.86
- Sirloin : 0.67
- Strip-Loin : 0.49
- Rib-Roast : 0.14

[0.16 ≤ s.e. ≤ 0.23]

Striploin - steers
Opportunities to better differentiate carcasses

£750

£300

£100
Genetic Parameters

- 81,785 VIA records, 1 site
- Basic Data Edits
  - Heifers and steers aged 450 to 900 days
  - Kill dates with large amount of missing data
  - Outliers
- 30,530 record remained
  - 63% steers, 37% heifers
  - 72% cross bred, 28% purebred
  - Breed types 22% Limousin, 19% Continental beef, 42% dairy, 8% native beef and 9% other
- 5 generation pedigree
  - 98,505
  - 31% of VIA animals had sire recorded
## Genetic Parameters

<table>
<thead>
<tr>
<th></th>
<th>Phenotypic Variance</th>
<th>$h^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcase weight</td>
<td>43.48 (1.15)</td>
<td>0.25 (0.04)</td>
</tr>
<tr>
<td>Conformation</td>
<td>15.63 (0.35)</td>
<td>0.50 (0.04)</td>
</tr>
<tr>
<td>Fat</td>
<td>43.48 (1.15)</td>
<td>0.25 (0.04)</td>
</tr>
<tr>
<td>Fillet</td>
<td>0.03 (0.001)</td>
<td>0.19 (0.05)</td>
</tr>
<tr>
<td>Striploin</td>
<td>0.11 (0.002)</td>
<td>0.37 (0.05)</td>
</tr>
<tr>
<td>Topside</td>
<td>0.35 (0.01)</td>
<td>0.29 (0.04)</td>
</tr>
<tr>
<td>Rump</td>
<td>0.16 (0.003)</td>
<td>0.29 (0.05)</td>
</tr>
<tr>
<td>Silverside</td>
<td>0.48 (0.01)</td>
<td>0.28 (0.05)</td>
</tr>
<tr>
<td>Knuckle</td>
<td>0.15 (0.003)</td>
<td>0.33 (0.05)</td>
</tr>
<tr>
<td>Flank</td>
<td>2.57 (0.06)</td>
<td>0.28 (0.05)</td>
</tr>
</tbody>
</table>
30 Limousin sires EBVs

£447 vs £910 (£463 difference in raw retail value)
Building the Limousin reference population

- Aiming for 2,000 Limousin’s
  - VIA phenotype (accuracy of preliminary VIA EBVs)
  - medium density (50k) chip type
  - Project genotypes
    - Currently 662 genotypes
    - ~300 sampled
    - 716 HD Limousin
- 48 Limousin Sequences
Implications

• Massive benefit to the industry
  – Large numbers of records – thousands not hundreds
  – Traits of importance £
  – Stronger links in the supply chain
  – Increase efficiency ~ greenhouse gas emissions
  – Selection for dairy-beef
  – First EBVs of their kind in the UK
    • Genetic improvement
    • Stimulate the industry
Conclusions

• Developments Industry focused
• Large scale with big data sets
• Carcase traits and genomics
  – projects that are the first of their kind in the UK
• Provides a solid platform to expand and address further areas for improvement
  – Feed efficiency
  – Female fertility traits
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