How ICBF and cattle genetics are changing the sustainability game

Kevin Downing
October 11th 2018
Introduction

• ICBF – Make-up & Role
• National Cattle Breeding Database & Industry Links
• Beef Euro-Star Index
• Impact of the Euro-Star Index
• Focus areas that are driving innovation
One Database, Many Partners
less duplication and cost for farmers

Board
AI - 18%
DAFF - 1
AI - 3
MR - 18%
MR - 3
HB - 18%
HB - 3
FO - 46%
FO - 6

Stakeholders in cattle breeding control decision making
Farmer owned & controlled
Role of ICBF

• Focus on genetic improvement as a tool for improving future profit on Irish cattle farms.
• Establish & maintain a central database of performance data.
• Define a breeding goal and selection index (e.g. Euro-Star Index).
• Provide routine genetic evaluations for all breeds and traits.
• Ensure a breeding scheme of optimal design is operating in Ireland (e.g. Gene Ireland).
• Ensure continuous improvement base on science.
ICBF Database - 2018
Data in the ICBF Database

- Herds: 107k
- Live Animals: 6.2m
- Calving Records: 2.1m/yr
- Milk Recording: 2.6m/yr
- Farm Movements: 7m/yr
- AI Inseminations: 700k/yr
- Slaughter Data: 2m/yr
- BVD records: 2.1m/y
Big Data - Genotype Data

- 77.7 Billion Genotype SNP @ Sep 2018
- 62.7 Billion Genotype SNP @ Mar 2018
- 18.3 Billion Genotype SNP @ Mar 2016
- 8.6 Billion Genotype SNP @ Jan 2015
- 1.8 Billion Breeding Value Records
What is the Beef Euro-Star Index?

- **Profit Index**, e.g., €80 more per calving
  - Multi-breed evaluations.
- **Star system**; 5 star versus 1 star.
  - Across all breeds, including commercial.
- **Two main profit indexes**; (i) Replacement and (ii) Terminal
<table>
<thead>
<tr>
<th>Trait</th>
<th>Goal</th>
<th>Relative wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving Difficulty</td>
<td>Less</td>
<td>16%</td>
</tr>
<tr>
<td>Feed Intake</td>
<td>Less</td>
<td>18%</td>
</tr>
<tr>
<td>Carcass wt (for age)</td>
<td>More</td>
<td>21%</td>
</tr>
<tr>
<td>Maternal milk</td>
<td>More</td>
<td>18%</td>
</tr>
<tr>
<td>Female fertility</td>
<td>More</td>
<td>23%</td>
</tr>
<tr>
<td>Docility</td>
<td>More</td>
<td>4%</td>
</tr>
</tbody>
</table>

The ideal Irish beef cow - A weaned calf every year of good weight & quality.
## ICBF Spring Active Beef Bull List 2018

<table>
<thead>
<tr>
<th>Bull Details</th>
<th>Replacement</th>
<th>Calving</th>
<th>Milk</th>
<th>Semen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bull Name</strong></td>
<td><strong>Breed</strong></td>
<td><strong>Gene Ireland</strong></td>
<td><strong>Index</strong></td>
<td><strong>Rel %</strong></td>
</tr>
<tr>
<td>Beguin</td>
<td>SA</td>
<td>No</td>
<td>€252</td>
<td>59</td>
</tr>
<tr>
<td>Ulsan</td>
<td>SA</td>
<td>No</td>
<td>€203</td>
<td>63</td>
</tr>
<tr>
<td>Derreen Declan</td>
<td>SI</td>
<td>No</td>
<td>€192</td>
<td>54</td>
</tr>
<tr>
<td>Castleview Gazelle</td>
<td>LM</td>
<td>Yes</td>
<td>€191</td>
<td>77</td>
</tr>
<tr>
<td>Du Stordeur Flaneur</td>
<td>BB</td>
<td>No</td>
<td>€183</td>
<td>96</td>
</tr>
<tr>
<td>Vaillant</td>
<td>SA</td>
<td>No</td>
<td>€179</td>
<td>54</td>
</tr>
<tr>
<td>Islavale Cracker 11</td>
<td>SI</td>
<td>No</td>
<td>€171</td>
<td>76</td>
</tr>
<tr>
<td>Lisnacrann Fifty Cent</td>
<td>SI</td>
<td>Yes</td>
<td>€170</td>
<td>57</td>
</tr>
<tr>
<td>Highfield Odran</td>
<td>SA</td>
<td>Yes</td>
<td>€166</td>
<td>54</td>
</tr>
<tr>
<td>Cloodroon Calling</td>
<td>SI</td>
<td>Yes</td>
<td>€161</td>
<td>50</td>
</tr>
<tr>
<td>Baron</td>
<td>SA</td>
<td>No</td>
<td>€161</td>
<td>54</td>
</tr>
<tr>
<td>Usse</td>
<td>LM</td>
<td>No</td>
<td>€160</td>
<td>52</td>
</tr>
<tr>
<td>Curaheen Earp</td>
<td>SI</td>
<td>Yes</td>
<td>€159</td>
<td>59</td>
</tr>
<tr>
<td>Voimo</td>
<td>CH</td>
<td>No</td>
<td>€159</td>
<td>64</td>
</tr>
<tr>
<td>Bivouac</td>
<td>CH</td>
<td>No</td>
<td>€155</td>
<td>59</td>
</tr>
<tr>
<td>Clonagh Direct Debit</td>
<td>SI</td>
<td>No</td>
<td>€155</td>
<td>60</td>
</tr>
<tr>
<td>Gordon Et Du Golard</td>
<td>BB</td>
<td>No</td>
<td>€155</td>
<td>77</td>
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<tr>
<td>Auchorachan Wizard</td>
<td>SI</td>
<td>No</td>
<td>€153</td>
<td>54</td>
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<tr>
<td>Curaheen Tyson (Et)</td>
<td>SI</td>
<td>Yes</td>
<td>€150</td>
<td>89</td>
</tr>
<tr>
<td>Lataster Eric</td>
<td>SA</td>
<td>No</td>
<td>€150</td>
<td>92</td>
</tr>
<tr>
<td>Kilbride Farm Escalop 13</td>
<td>SI</td>
<td>No</td>
<td>€149</td>
<td>51</td>
</tr>
<tr>
<td>Lanigan Red Deep Canyon Et</td>
<td>AA</td>
<td>No</td>
<td>€146</td>
<td>78</td>
</tr>
<tr>
<td>Cornamuckla Lord Hardy K222</td>
<td>AA</td>
<td>No</td>
<td>€145</td>
<td>95</td>
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<tr>
<td>Hawkley Red Zeppelin N659</td>
<td>AA</td>
<td>No</td>
<td>€143</td>
<td>50</td>
</tr>
<tr>
<td>Bonaparte</td>
<td>SA</td>
<td>No</td>
<td>€142</td>
<td>81</td>
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<tr>
<td>Drumlegagh Dennis</td>
<td>SA</td>
<td>No</td>
<td>€141</td>
<td>64</td>
</tr>
<tr>
<td>Auroch Deuter Pp</td>
<td>SI</td>
<td>Yes</td>
<td>€140</td>
<td>61</td>
</tr>
<tr>
<td>Kilbride Farm Delboy 12</td>
<td>SI</td>
<td>No</td>
<td>€138</td>
<td>64</td>
</tr>
<tr>
<td>Keltic Handsome</td>
<td>LM</td>
<td>Yes</td>
<td>€138</td>
<td>66</td>
</tr>
<tr>
<td>Clonagh Frosty King Et</td>
<td>SI</td>
<td>Yes</td>
<td>€137</td>
<td>50</td>
</tr>
</tbody>
</table>

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**Range of breeds on Top Bull Listing => Focused on promoting these bulls within the relevant breeds.**
The Irish Beef Breeding Goal

• To generate more 5-star cows (i.e., for milk, fertility, weight for age...) for Irish beef farmers...which when crossed with 5-star terminal index sires, produce progeny with better weight for age, feed efficiency, etc.
Are we making progress? => YES

Trends from National data.

<table>
<thead>
<tr>
<th>Year</th>
<th>Calves per cow per year</th>
<th>Calving Interval (days)</th>
<th>Calving at 2 years age (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.80</td>
<td>407</td>
<td>0.17</td>
</tr>
<tr>
<td>2017</td>
<td>0.87</td>
<td>393</td>
<td>0.26</td>
</tr>
</tbody>
</table>

* Based on data from 24k herds involved in Beef Data and Genomics Program.

- Past focus on terminal traits => decline in maternal traits & no gain in replacement index. Beef genomics scheme introduced (2014), replacement index has turned around => Major gains in calves/cow/year and carcass traits.
- Clear evidence that commercial beef farmers are responding positively to new technologies such as Euro-Stars & beef genomics.
Are we making progress? => **YES.**

**Trends from Teagasc-ICBF validation.**

<table>
<thead>
<tr>
<th>Star Rating</th>
<th>No. Animals</th>
<th>Replacement Index/parity</th>
<th>Lifetime CO2e*</th>
<th>AFC (days)</th>
<th>CIV (days)</th>
<th>Cow Wt (kg)</th>
<th>Wean Wt (kg)</th>
<th>Progeny Carc Wt (kg)</th>
<th>Progeny Carc Age (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Star</td>
<td>2,183</td>
<td>€130</td>
<td>17,085</td>
<td>860</td>
<td>375</td>
<td>664</td>
<td>311</td>
<td>374</td>
<td>604</td>
</tr>
<tr>
<td>4 Star</td>
<td>1,881</td>
<td>€87</td>
<td>17,260</td>
<td>862</td>
<td>376</td>
<td>672</td>
<td>305</td>
<td>373</td>
<td>606</td>
</tr>
<tr>
<td>3 Star</td>
<td>1,984</td>
<td>€58</td>
<td>17,378</td>
<td>881</td>
<td>377</td>
<td>684</td>
<td>299</td>
<td>370</td>
<td>605</td>
</tr>
<tr>
<td>2 Star</td>
<td>120</td>
<td>€31</td>
<td>17,484</td>
<td>887</td>
<td>377</td>
<td>689</td>
<td>296</td>
<td>364</td>
<td>605</td>
</tr>
<tr>
<td>1 Star</td>
<td>724</td>
<td>-€6</td>
<td>17,635</td>
<td>896</td>
<td>383</td>
<td>737</td>
<td>285</td>
<td>361</td>
<td>610</td>
</tr>
<tr>
<td>Diff 1 v 5 star</td>
<td>€136</td>
<td>-550</td>
<td>36</td>
<td>8</td>
<td>73</td>
<td>26</td>
<td>13</td>
<td>-6</td>
<td></td>
</tr>
</tbody>
</table>

*Pvalue*  
*** *** *** *** NS

* Based on Gross Emissions Output over the cows lifetime. Includes emissions from the cow and her progeny.

- Validation study based on 46 suckler herds & ~7k cows. All cows & calves weighed for last 3 years on participating farms.
- Initial results based on Teagasc-ICBF validation study indicate that 5 star cows are €136 more profitable per parity and produce 550 kg less CO2e in their lifetime.
- **Breeding for profit & breeding for sustainability are effectively same.**
Are we making progress? => **YES**

*Trends from Bord Bia-ICBF validation*
Increasing Profitability & Carbon Efficiency

- Moving National Herd from €82 to €200 => a reduction in carbon emissions (CO2 eq) per kg beef from 11.6 kg to 10 kg (-14%).

How quickly can we move our suckler herd to having a herd replacement index of €200+?

- About 15 years => Can we shorten this process?
Focus Areas - Driving Innovation

- Beef Data & Genomics Program (BDGP)
- Weight recording pilot
- GreenBreed project
- DNA based calf registration
- Health & Disease traits
- Meat Eating Quality
• 12% of global GHG emissions are from agriculture (figure is 33% for Ireland).
  • Cattle are worst offenders.
• Environmental Solution; cut our cattle herd.
• Irish Solution; Breed more sustainable animals => BDGP 2015-2020.

Livestock greenhouse gas emissions per species (Lifecycle Analysis, Gerber et al., 2013)
Beef Data and Genomics Program (BDGP)

- Breed more profitable, sustainable & carbon efficient cows.
- €300m total funding 6 years (2015-2020).
  - Farmers paid ~€90/cow/year to complete key actions re: the scheme, e.g., targets for 4/5 star cows & bulls
  - Data recording x 14 e.g. Scour & Pneumonia, Calf Vigour & Quality
  - ~23k suckler herds & ~550k cows
  - ~1.4m animals genotyped to-date
  - Genotyping costs €22/animal
- Other countries now looking at introducing similar schemes.
Budget 2019: suckler scheme worth €20m confirmed

Further details of the suckler support scheme, revealed by the Irish Farmers Journal on Monday night, were confirmed as part of Budget 2019.

- New €20 million Beef Environmental Efficiency Pilot (BEEP) scheme launched by DAFM
- Weights from up to 500k Suckler cows and their calves!
- Payment of €40 per Suckler cow for providing weight data on both cows and calves.
Greenbreed Project

- €3m DAFM funded project
- Aims to develop tools & resources to improve the environmental footprint.
- For same meat or milk output, there still is a ~15-20% in GHG output between individual animals.
- Opportunity to breed even more climate efficient cows for the future.
DNA Calf Registration

Database predicts
- Sire
- Dam
- Sex
- Breed

- Very successful pilot project undertaken this Spring.
- 18 herds & ~2,000 calves DNA registered.
- Further pilot for this Autumn - App

Output (by day 14)
- EU Registration
- Parentage
- Genomic Evaluation
- Major Genes
- Herdbook (optional)
- Quality Assurance
Health & Disease Traits

- Farmer Recorded
  - Lameness & Mastitis
  - Pneumonia & Scour
- Factory Data
  - Liver Fluke
  - TB
Predicting TB prevalence from EBV

(FR sires with reliability ≥90%)

Scenario: Bull has an EBV of -0.05 or +0.05 for TB

What will be the expected prevalence of TB in his progeny if my herd gets infected?

\[(66.692 \times -0.05) + 6.6432 = 3\%

\[(66.692 \times +0.05) + 6.6432 = 10\%

Intercept = 6.6432
Slope = 66.692
Progeny Prevalence Per Sire

- ≥ 50 daughters
- ≥ 10 herds

Mean prevalence of TB in progeny (%) vs Number of sires
New Traits - Meat Eating Quality

- ~2,000 animals analysed to date, based on “trained panel” data (~14k records).
- Initial parameters indicate significant opportunity to increase meat eating quality through genetics.
  - High genetic correlations (>0.8).
- Test EBV’s generated and validation work undertaken.
- Target for release through MTI & ICBF later this year.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenderness</td>
<td>0.16</td>
</tr>
<tr>
<td>Juiciness</td>
<td>0.10</td>
</tr>
<tr>
<td>Flavour</td>
<td>0.09</td>
</tr>
</tbody>
</table>
Genomics for Meat Eating Quality

<table>
<thead>
<tr>
<th>Breed</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE</td>
<td>111</td>
<td>0.16</td>
<td>0.07</td>
</tr>
<tr>
<td>BB</td>
<td>122</td>
<td>0.13</td>
<td>0.09</td>
</tr>
<tr>
<td>AA</td>
<td>148</td>
<td>0.12</td>
<td>0.06</td>
</tr>
<tr>
<td>LM</td>
<td>234</td>
<td>-0.00</td>
<td>0.09</td>
</tr>
<tr>
<td>CH</td>
<td>257</td>
<td>-0.03</td>
<td>0.07</td>
</tr>
<tr>
<td>SA</td>
<td>26</td>
<td>-0.13</td>
<td>0.08</td>
</tr>
<tr>
<td>SI</td>
<td>142</td>
<td>-0.25</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Graph limited to 1040 A.I. sires of AA, BB, CH, HE, LM, SA, and SI breeds
Summary

- Beef breeding is delivering. Goal is to now increase gain & deliver herd target of €200+. These cows are also more climate efficient.
  - Current and future programs will help to deliver on this opportunity (e.g. BEEP).
- DNA calf registration a major opportunity.
- GHG/weanling efficiency a key focus trait.
- ICBF is driving change in the beef industry. Not always popular, but “high level” industry metrics are now moving in right direction.