Application of non-linear weightings in industry breeding indexes

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Introduction

• Development of a dairy beef index for use in Ireland

• Initial formulations with linear weightings lead to bulls with undesirable calving difficulty levels ranking highly

• Challenge to breed for calves that would meet the minimum processor specifications
Dairy beef index

• Developed in collaboration with ICBF and Teagasc

• Traits incorporated:
  • Gestation length
  • Calving difficulty
  • Calf mortality
  • Carcase weight, fat and conformation
  • Feed intake
  • Docility
Why non-linear approach to calving?

• A linear formulation was tested with the new calving proofs

• The top ranked bulls had undesirable levels of calving difficulty

<table>
<thead>
<tr>
<th>Component PTA</th>
<th>Calving only</th>
<th>Linear calving DBI</th>
<th>Non-linear calving DBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy heifer % difficult</td>
<td>4.8</td>
<td>12.5</td>
<td>7.8</td>
</tr>
<tr>
<td>Dairy cow % difficult</td>
<td>1.5</td>
<td>7.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Carcase weight</td>
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<td>Carcase conformation</td>
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Calving difficulty survey

- Farmers tolerate a small amount of calving difficulty for a higher calf value, but not a large amount.

*Farmer views on calving difficulty consequences on dairy and beef farms*

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Proposed non-linear calving utility

- Curve from the survey results used as a base
- 23% Dairy heifer + 77% Dairy cow
- Linear economic weighting -€6.44
- Shift from 3-4% difficult calvings in non-linear calving utility of -€6.18
Application within the dairy beef index

- Active beef bulls with greater than 50 dairy progeny
Effect of non-linear calving

- Calving difficulty values in top ranked bulls more in line with farmer preference
- Acceptable changes in other traits

Average PTAs of the top 30 ranked bulls on the DBI

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The “not in spec” sub-index

• Dairy beef tends to have a high proportion of low carcase weight and low conformation carcases

• The price per kg paid by processors drops sharply when carcases do not meet the minimum specifications
The “not in spec” sub-index

• Based on a bull’s PTA, estimate the probability of producing a carcase that falls below the minimum processor spec for carcase weight or conformation

• Create a “not in spec” sub-index:
  -€ 0.40/kg x 325kg avg CW x % out of spec conformation
  -€ 0.70/kg x 325kg avg CW x % out of spec carcase weight
Example for carcase weight component

- Bull A has cwt = -25
- 35% probability out of spec
- Penalty of €49
Example for carcase weight component

• Bull A has cwt = -25
  • 35% probability out of spec
  • Penalty of €49

• Bull B has cwt = +5
  • 16% probability out of spec
  • Penalty of €23
Trait emphasis is dependent on breed
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Where to from here?

- Currently testing these non-linear approaches in the
  - Dairy EBI
  - Beef Terminal index
  - Beef Replacement index
Conclusions

• Non-linear weightings have been key in developing a dairy beef index formulation acceptable to farmers

• AbacusBio has developed non-linear weightings for traits in a number of contexts