BreedObject: Breeding for Future Profitability

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Introduction

• BreedObject
  • Selection Indexing system for BREEDPLAN

• BREEDPLAN
  • Multi-trait BLUP evaluation
Introduction

• BreedObject
  • Selection Indexing system for BREEDPLAN

• BREEDPLAN
  • Multi-trait BLUP evaluation

• Large impact on profit (index)
  • $1.79 / cow / year (1999-2004)
  • ~$5.00 in leading herds

Banks 2005 Australian Journal of Experimental Agriculture
Introduction

- BreedObject
  - Selection Indexing system for BREEDPLAN

- BREEDPLAN
  - Multi-trait BLUP evaluation

- Large impact on profit (index)
  - $1.79 / cow / year (1999-2004)
  - ~$5.00 in leading herds

Best herds over $5.00 / cow / yr

Value of Genetic Improvement - South

- ~$4.00 / cow / yr
- ~$2.83 / cow / yr

Profitability Trend ($/cow/yr)

Year of Birth

• Banks 2015 Association for the Advancement of Animal Breeding and Genetics
Introduction

• Change is constant
  • Markets & production systems evolve
  • Genetic change
  • Priorities move
  • New traits important
  • Etc ....

Always room for improvement
Objectives

• Brief BreedObject History

• BreedObject Developments

• Plans for the Future
Brief BreedObject History

- Research began during 1980’s, released 1990’s
whole commercial production system
(birth to slaughter including cow herd)
Profit = Income – Costs

- Influenced by numerous traits to varying degrees
  - Can change between systems
What Impacts Profit?

whole commercial production system
(birth to slaughter including cow herd)

Calf:
- calving ease
- growth
- feed intake

Cow:
- fertility
- milk
- survival
- calving ease
- feed intake
- weight

Genes

Cow-calf Growout Finishing

meat % marbling
carcass specs
dressing %

Barwick & Fuchs 1992 Animal Breeding – A modern approach
Barwick 2002 World Congress on Genetics Applied to Livestock Production
Predicting Feed Requirement

Corbett et al 1990

Freer et al 2007
Commercial Production Environment
## Diversity in Beef Industry

<table>
<thead>
<tr>
<th>Trait</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility (weaning rate)</td>
<td>50% - 98%</td>
</tr>
<tr>
<td>Calving Difficulties</td>
<td>0% - 40%</td>
</tr>
<tr>
<td>Age @ 400kg</td>
<td>10 months - 2 years</td>
</tr>
<tr>
<td>Cow Weight</td>
<td>400 kg - 900 kg</td>
</tr>
<tr>
<td>Annual Death Rate</td>
<td>1% - 20%</td>
</tr>
<tr>
<td>Heifer Retention Rate</td>
<td>20% - 100%</td>
</tr>
<tr>
<td>Carcass Weight</td>
<td>150 kg - 500 kg</td>
</tr>
<tr>
<td>Fat Non-compliance</td>
<td>0% - 25%</td>
</tr>
<tr>
<td>Marble Score</td>
<td>0 - 10</td>
</tr>
<tr>
<td>Feed Costs</td>
<td>&lt;$100/t - &gt;$300/t</td>
</tr>
<tr>
<td>Objective Traits</td>
<td>Selection Criteria</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Desirable to improve, impact profit</td>
<td>Measurable and related to objective</td>
</tr>
</tbody>
</table>

Barwick 1992 Animal Breeding – A modern approach
Objective Traits

Cow Weaning Rate

Selection Criteria

Days to Calving

Scrotal Size

Barwick 1992 Animal Breeding – A modern approach
Economics of Traits

• Not everything is linear

• Some prices have optima’s
  • Fat specifications

• Other pricings structures
  • Marble Score

Barwick & Henzell 2003 Association for the Advancement of Animal Breeding and Genetics
Brief BreedObject History

• Developed in the early 1980’s, released 1990’s

• Approach:
  • Whole commercial production system
  • Driven by Profit – always included costs
  • Breeding Objective – Desired to be improved, impact profit
  • Selection Criteria – Can be measured and related to objective
  • Non-linear economic values
Todays Objectives

• Brief BreedObject History

• BreedObject Developments

• Plans for the Future
New Features: BreedObject Version 6

• Inclusion of all feed costs – NFI in objective (all breeds)
• NFI EBVs in Indexes (where available)
• Enhanced feedlot phase modelling for pasture-feedlot systems
• Enhanced cow weight valuing
• Cow condition score valuing

Barwick et al 2018 Journal of Animal Science
Growth curve - Previously

Liveweight (kg)

birth (calving ease)

Age

Example: feedlot-finished system
Growth curve - Previously

Example: feedlot-finished system

Liveweight (kg)

birth (calving ease)

Age

finished sale weight

cow weight

Prepared by: AGBU
Growth curve - Now

Liveweight (kg) vs. Age

- Weaning weight
- Entry weight
- Finished sale weight
- Cow weight

Example: Feedlot-finished system

Birth (calving ease)
Growth curve - Now

Liveweight (kg) vs. Age

- Birth (calving ease)
- Weaning weight
- Entry weight
- Finished sale weight
- Cow weight

Example: Feedlot-finished system
Growth curve - Now

Liveweight (kg)

- birth (calving ease)
- weaning weight
- entry weight
- finished sale weight
- cow weight

Example: feedlot-finished system
Growth curve - Now

Liveweight (kg)

- birth (calving ease)
- weaning weight
- entry weight
- finished sale weight

Age

- cow weight

Example: feedlot-finished system
Growth curve - Now

Liveweight (kg)

Age

Example: feedlot-finished system
Growth curve - Now

- Liveweight (kg)
- Age

- Birth (calving ease)
- Weaning weight
- Entry weight
- Finished sale weight
- Cow weight

Example: Feedlot-finished system
Economic value encompasses:
- feed for maintaining wt.
- feed for change in wt.
- return from surpl. cows (at const. other performance)

Cow feed costs have to be considered over:
- **whole year** (effect isn’t constant)
- **whole lifetime** (a multiplier is involved)

Walmsley et al 2015 Association for the Advancement of Animal Breeding and Genetics
Cow weight change constant **throughout** the annual cycle.
Cow weight change varies **throughout** the annual cycle.

Temperate or Tropical Systems

Differenc
Cow Weight - Now

Cow Liveweight (kg)

Cow Body Condition Score

12 months

Cow Liveweight (kg)

Time (months in annual cycle)

Cow A
Cow B

Cow A
Cow B

1540 lbs
1100 lbs

12 months
Cow Weight - Now

Cow Liveweight (kg)

Cow Body Condition Score

3 4 5 6 3 4

Cow A
Cow B

12 months

380 lbs
1100 lbs
1540 lbs
Cow Weight - Now

Cow Body Condition Score

Cow A
Cow B

Cow Liveweight (kg)

Time (months in annual cycle)
Cow Weight - Now

Cow Body Condition Score

Cow Liveweight (kg)

Time (months in annual cycle)

Cow A
Cow B

Cow B
- **100 lbs more** weight than cow A
- From BCS 3 to BCS 6
Age at Lowest Cow Condition Score

Frequency (number of cows)

Age when cows recorded their lowest lifetime condition score (months)

BRAH (N = 1030)
TCOMP (N = 1130)
Cow Condition Score

Welfare Issue

- critically low condition
- lower condition than needed
- higher condition than needed

Wasted feed = cow NFI

Requires extra supplementary feed

Barwick et al 2018 Journal of Animal Science
Cow Feed Requirement

EBV (MJ)

Year

Cow Feed Requirement

~ 0.88 kg DM/day

Walmsley et al 2017 Association for the Advancement of Animal Breeding and Genetics
Cow/calf Feed Requirement

Cow & Calf Feed Requirement

~ 1.52 kg DM/day

Walmsley et al 2017 Association for the Advancement of Animal Breeding and Genetics
Growth responses – Feed price

Birth Wt  200D Wt  400D Wt  600D Wt  MCWt

$160  $100  $40  $160

Increasing

0

Decreasing
Growth responses – Feed price

- Birth Wt
- 200D Wt
- 400D Wt
- 600D Wt
- MCWt

$100

Increasing

Decreasing
Growth responses – Feed price

- Birth Wt
- 200D Wt
- 400D Wt
- 600D Wt
- MCWt

Increasing

$100

Decreasing

$40
Growth responses – Feed price

<table>
<thead>
<tr>
<th></th>
<th>200D Wt</th>
<th>400D Wt</th>
<th>600D Wt</th>
<th>MCWt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth Wt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200D Wt</td>
<td>$160</td>
<td>$100</td>
<td>$40</td>
<td></td>
</tr>
<tr>
<td>400D Wt</td>
<td>$160</td>
<td>$100</td>
<td>$40</td>
<td></td>
</tr>
<tr>
<td>600D Wt</td>
<td>$160</td>
<td>$100</td>
<td>$40</td>
<td></td>
</tr>
<tr>
<td>MCWt</td>
<td>$160</td>
<td>$100</td>
<td>$40</td>
<td></td>
</tr>
</tbody>
</table>
Growth responses – Feed price

<table>
<thead>
<tr>
<th>Year</th>
<th>MCWt</th>
<th>600D Wt</th>
<th>400D Wt</th>
<th>200D Wt</th>
<th>Birth Wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>$160</td>
<td></td>
<td>$40</td>
<td>$100</td>
<td>$160</td>
<td>$160</td>
</tr>
</tbody>
</table>

Increasing

Decreasing

Legend:
- Red: $160
- Green: $100
- Orange: $40
- Blue: Old $160
Walmsley et al. 2018 World Congress on Genetics Applied to Livestock Production
Hereford Expected EBV Changes

-1.5
-1
-0.5
0
0.5
1
1.5

CE-d
CE-m
BWT
200D
400D
600D
MCW
DTC
EMA
IMF

Trait Change

Southern Hereford
Northern Hereford
Continued...

• Methane modelling

• Enhanced market specifications valuing
  • Non-linear for all traits, if appropriate
Wagyu Expected EBV Changes

Trait Change

-1.5
-1
-0.5
0
0.5
1
1.5

Breeder
Self-Replacing
F1 Terminal

CE-d
CE-m
BWT
200D
400D
600D
MCW
MILK
SS
DTC
CWT
EMA
Rump
RBY
MARB
Continued...

- Methane modelling
- Enhanced market specifications valuing
  - Non-linear for all traits, if appropriate
- Culling effects via specific traits
Todays Objectives

• Brief BreedObject History

• BreedObject Developments

• Plans for the Future
Future

• Redevelopment of the Feeding Standards
  • Work began 2019
  • Integration into indexes when complete

• Across-breed indexes
  • Will be driven by outputs from Repronomics and Southern Multibreed projects

Barwick et al 2020 Journal of Animal Breeding and Genetics
“Indexes are complicated. 2 animals, same index, Different EBVs”

• Alternatives:

  Whole Indexes or Sub-indexes or Something else

• Development of DeSireBull
Traditional Index

Index_W = b_1EBV_1 + b_2EBV_2 + ... + b_nEBV_n

Where:

- b is the index weight (economic importance)
- EBV is multi-trait BLUP EBVs, from traits 1 to n
Trait Sub-Groupings

Subgroup_1 = \( b_1 \)EBV_1 + \( b_2 \)EBV_2

...  

Subgroup_n = \( b_m \)EBV_m + ... + \( b_n \)EBV_n

\( Index_{SG} = Subgroup_1 + Subgroup_2 + ... + SubGroup_n \)
Sub-Grouping Example

\[ \text{Index}_W = 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55 \]

\[ \text{SG}_1 = 1 + 2 + 3 + 4 = 10 \]
\[ \text{SG}_2 = 5 + 6 + 7 = 18 \]
\[ \text{SG}_3 = 8 + 9 + 10 = 27 \]

\[ \text{Index}_{SG} = \text{SG}_1 + \text{SG}_2 + \text{SG}_3 = 55 = \text{Index}_W \]
## Sub-Grouping Options

- **Many grouping possibilities**
- **Logical Combinations**
  - On-Farm
  - Off-Farm
- **Others???

<table>
<thead>
<tr>
<th>Group</th>
<th>Trait</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Farm</td>
<td>Calving Ease (D &amp; M)</td>
</tr>
<tr>
<td></td>
<td>Weaning Weight</td>
</tr>
<tr>
<td></td>
<td>Maternal (Milk)</td>
</tr>
<tr>
<td></td>
<td>Entry Weight</td>
</tr>
<tr>
<td></td>
<td>Scrotal Size</td>
</tr>
<tr>
<td></td>
<td>Weaning Rate</td>
</tr>
<tr>
<td></td>
<td>Cow Weight</td>
</tr>
<tr>
<td></td>
<td>Efficiency - postweaning</td>
</tr>
<tr>
<td>Off-Farm</td>
<td>Sale Weight</td>
</tr>
<tr>
<td></td>
<td>Efficiency – finishing</td>
</tr>
<tr>
<td></td>
<td>Dressing %</td>
</tr>
<tr>
<td></td>
<td>Yield %</td>
</tr>
<tr>
<td></td>
<td>Fatness</td>
</tr>
<tr>
<td></td>
<td>Marbling</td>
</tr>
</tbody>
</table>
Scenario Testing

Seedstock

Commercial

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I &amp; I</td>
<td>I &amp; S</td>
<td>S &amp; S</td>
</tr>
</tbody>
</table>

I & I

I & S

S & S
Genetic Change in Profitability

Index Trend ($)

Year

I & I
I & S
S & S
Genetic Change in Profitability

Index Trend ($)

Year

I & I
I & S
S & S

17%
Genetic Change in Profitability

![Graph depicting genetic change in profitability with index trend ($) on the y-axis and year on the x-axis. The graph shows three different trends represented by different markers: I & I, I & S, and S & S.]

- I & I trend (blue diamonds) shows an increase of 17%.
- I & S trend (orange squares) shows an increase of 57%.
- S & S trend (pink triangles) shows an increase from 0 to 22 years.

The graph illustrates the genetic change in profitability over time with key markers indicating the percentage increase.
Learnings

• For profitability gains:
  • Critical seedstock selection occurs using indexes
  • Some scope for commercial bull buyers to use sub-groups
  • Best result achieved using selection indexes
Acknowledgements

• Steve Barwick
• Anthony Henzell
• David Johnston
• Rob Banks
• Matt Wolcott

• Laura Penrose
• Sam Clark
Final Remarks

• Demonstratable positive impacts on beef profitability

• Better ability to describe commercial production realities

• Future developments planned for greater utility

• Key focus on “Commercial Profitability”