Genetic evaluation of female reproduction traits

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Overview
- Importance of reproduction
- Days to calving EBV (=EPD)
  - definition
  - recording
  - models and example EBVs
- Success and current challenges
- Alternative traits

Importance of reproduction
- Key profit driver in beef
- Low and slow compared to other species
- But often not 100%
  - Genetic basis but lots of environmental effects
- Mostly primary trait in genetic indexes
- Cow costs biggest cost...must wean a calf

Days to calving calculation
- Bull-in date
- Date of birth
- Non-calver
- Days to calving = 340 days
  - Calving success = 1
- Cow B: days to calving = 395 days & calving success = 0

Days to calving records
- Natural mating only (currently)
- Repeat records (6 per cow)
- 1st record before given age (avoid selected)
- Contemporary group =
  - Herd
  - Bull-in date + bull id
  - Current lactation status
- Record culled not-pregnant (or transferred etc)
- Birth date, sex of calf
- Key is whole herd inventory system...all females mated
  - Not just recorded calves...non-calvers

Number of DC records*
- Angus = 158,126
- Hereford = 106,838
- Brahman = 26,018
- Santa = 15,280

Also Simmental, Belmonts, Murray Grey

* Valid records in the analysis
Days to calving EBV

- heritability 5-10%
- repeat records (6 per cow)
- multi-trait ...correlations
  - fat, scrotal size, weights (milk?)
- lower (more negative EBV) desirable
- cow EBV accuracy very low
- key is sires with 25-50+ daughters
- high economic value (% $Index)

- importance depends on current reproduction levels

Angus sires: range DC EBVs

Hereford sires: range DC EBVs

Brahman sires: range DC EBVs

Santa sires: range DC EBV

do days to calving EBV work?
Results
Heifer pregnancy rates was significantly higher in SEL heifers

....but there are issues

Recording
- natural mating only – but need better records
- too passive, too easy.. need active recording
- breeds high AI & ET low records (herds)
- inventory linked to fees (good data?)

Industry
- low heritability .. “can’t change” perception
- all nutrition!
- waiting for promised genomics ...but little data

Collecting better data
...including artificial breeding

other possible traits

* Excel template
* On farm recording packages
Ovarian scanning

Corpus Luteum (CL)

First observed CL

AGE AT PUBERTY

Post calving recycle

• 2,200 cows BRAH & TCOMP
• 4-8 wks from 14 months to 9 yrs

Brahman sires

heifer age at puberty

EBVs (days)

h² = 0.55

impact on maiden calving rate, many not pubertal at 1st mating

5.6 month difference daughter’s age at puberty

Belmont SW 96
Lancaster 68M
Belmont SW 95
Lancaster Destiny
Tartrus Abel Manso
Newcastle Waters Toby
Cona Creek 2662
Lancaster 4061
Waverley Quartz De Manso
Tartrus Cruz Manso
Lancaster Ambition
Joan Margue Manso
Tartrus 256
Carrick Male
Allanah 677
Allanah 88
Cona Creek Eddie
Cona Creek 2662

Belmar 79/96
MK3/840

wer

Heritability = 50%

Wet 1st calf cow resumption of cycling

48% wet 1st calf BRAH cows only resumed cycling after calf weaned
Calving rate: wets 41% vs dries 81%

Heritability of bull traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>BRAH</th>
<th>TCOMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>LH 4m</td>
<td>0.30</td>
<td>0.45</td>
</tr>
<tr>
<td>Inhibin 4m</td>
<td>0.70</td>
<td>0.65</td>
</tr>
<tr>
<td>IGF-1 6m</td>
<td>0.45</td>
<td>0.35</td>
</tr>
<tr>
<td>Scrotal 6m</td>
<td>0.45</td>
<td>0.40</td>
</tr>
<tr>
<td>Scrotal 12m</td>
<td>0.65</td>
<td>0.50</td>
</tr>
<tr>
<td>Sperm 12m</td>
<td>0.35</td>
<td>0.20</td>
</tr>
<tr>
<td>%Normal 24m</td>
<td>0.20</td>
<td>0.25</td>
</tr>
</tbody>
</table>

EXAMPLE

MALE REPRODUCTION TRAITS

Tropical breeds

N=3,500
Genetic correlations key bull traits

<table>
<thead>
<tr>
<th>Bull Trait</th>
<th>Sperm12m</th>
<th>%Normal 24m</th>
<th>Female AP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRAH</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhibin 4m</td>
<td>-0.05</td>
<td>-0.40</td>
<td>0.30</td>
</tr>
<tr>
<td>IGF-I 6m</td>
<td>0.20</td>
<td>0.35</td>
<td>-0.60</td>
</tr>
<tr>
<td>Scrotal 12m</td>
<td><strong>0.65</strong></td>
<td>0.30</td>
<td><strong>-0.45</strong></td>
</tr>
</tbody>
</table>

- Males traits correlated with early female reproductive performance
- currently analyzing with cow re-cycling traits
- then with female lifetime reproduction

Genomics studies (50K & 800k)

- low $h^2$ traits need 10’s thousands of records (+ genotypes)
- found SNP affecting AGECL in Brahman
- significant SNP in one region of one chromosome

Improving reproduction

- days to calving EBV
  - easy to record
  - large differences if you record (Tropicals)
  - can improve GE (split mating 1 & 2)
  - captures AP and PPAI in tropical expt.
  - maybe we can AI matings (better data)

- alternate measures
  - ultrasound scanning e.g. age at puberty
  - lactation anoestrous measures (Tropicals)
  - new correlated male measures
  - weaning success (capture calf loss)
  - gene markers ..no data ..no genomic predictions

For you to consider

- Is reproduction a profit driver in your herd
- How big are the difference in your breed and herd?
- Is there an opportunity to improve through genetics?
- Can commercial breeders find better genetics?
- Is it possible to record these traits in your breed?