Estimates of parameters for scan records of Australian beef cattle treating records on males and females as different traits

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Introduction

- Distinct differences in growth pattern
  - bulls grow faster & remain leaner

- Are traits measured on males & females ‘genetically’ the same?
  - important for traits related to carcass composition
  - to be treated as different in genetic evaluation?

- Examine genetic correlation between sexes for ultrasound scan records
Data

- Real-time ultrasound scan records taken in the field
  - accredited scanners
  - 300 to 700 days of age
- 4 breeds
  - A: Angus
  - H: Hereford
  - PH: Polled Hereford
  - SG: Santa Gertrudis
Traits

- **P8** : P8 fat depth (mm)
- **RIB** : fat depth at 12th/13th rib (mm)
- **EMA** : eye muscle area (cm²)
- **SWT** : scanning weight (kg)
<table>
<thead>
<tr>
<th></th>
<th>Angus</th>
<th>Hereford</th>
<th>Polled Hereford</th>
<th>Santa Gertrudis</th>
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<tbody>
<tr>
<td>H/S</td>
<td>14,124</td>
<td>10,499</td>
<td>4385</td>
<td>3165</td>
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<tr>
<td>B</td>
<td>18,583</td>
<td>15,064</td>
<td>4824</td>
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Means & standard deviations

EMA (cm$^2$)  

H/S  
B

SWT (kg)

A  H  PH  SG

A  H  PH  SG
Means & standard deviations -2

P8 (mm)

RIB (mm)
Means & no. of records for ages
Angus, P8 fat depth
Analysis

- **Bivariate REML analyses**
  - treat records on heifers+steers & bulls as two separate traits
  - no error covariance

- **Fixed effects**
  - herd-date of scanning-management group subclasses (contemporary groups)
  - 60 day ‘age slicing’ within CG
  - birth type (single vs twin)
Analysis - continued

- ‘heifer factor’
  - dam age class (<29, 29+ mon)
- dam age
- age at scanning

Random effects
- animals’ additive genetic effects
  - include pedigree information
- sire x herd interaction
Phenotypic variances

- Distinct differences between sexes & breeds (SG)
  - largely attributable to scale effects
    - CVs for a trait similar across sexes & breeds
    - CVs highest for SG

- Fat depths highly variable
  - CV : 32-46%

- EMA & SWT less variable
  - CV : 7-11%
## CV (%) - fat depth

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<tbody>
<tr>
<td>P8</td>
<td>34.4</td>
<td>35.3</td>
<td>33.7</td>
<td>38.0</td>
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<tr>
<td>B</td>
<td>38.2</td>
<td>36.0</td>
<td>34.3</td>
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<tr>
<td>RIB</td>
<td>31.7</td>
<td>31.7</td>
<td>31.3</td>
<td>37.5</td>
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<tr>
<td>B</td>
<td>33.0</td>
<td>30.5</td>
<td>30.1</td>
<td>37.7</td>
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### CV (%) - other traits

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<tr>
<td><strong>EMA</strong></td>
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<td>H/S</td>
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<td>10.9</td>
<td>10.6</td>
<td>9.2</td>
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<tr>
<td>B</td>
<td>8.9</td>
<td>9.4</td>
<td>9.1</td>
<td>8.7</td>
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<td><strong>SWT</strong></td>
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Heritability estimates -1

EMA

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SWT

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Heritability estimates -2

P8

RIB

A  H  PH  SG  A  H  PH  SG

H/S  B

0.4  0.3  0.2  0.1  0.0
Results -1

- Heritabilities for fat depth consistently higher in heifers/steers than in bulls
  - P8 : 0.38 vs 0.24
  - RIB : 0.30 vs 0.19

- Less consistent results for other traits
  - EMA : 0.29 vs 0.23
  - SWT : 0.37 vs 0.32

- Problems : records for SG bulls

Average over breeds
### Genetic correlation between sexes

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Results -2

- Genetic correlation between sexes
  - close to unity for ‘size’ traits
    - SWT : 0.93
    - EMA : 0.92
  - considerably lower for fat depths
    - P8 : 0.69
    - RIB : 0.77

Average over breeds
Conclusions

- Fat depth measurements on females are more informative than on males.
  - Higher mean (at same age)
  - More variable
  - More heritable

- Scan males at sufficient fat level to ensure genetic variability is expressed.
  - Older ages
Conclusions - continued

- Treat fat depth measurements on males & females (+steers) as different traits
  - now implemented in BREEDPLAN