SIRE SELECTION FOR YIELD OR INTRAMUSCULAR FAT AND BEEF QUALITY

Deland, M.P.B. 1, Siebert, B. 2, Graham, J.F. 3 and Hebart, M 1
Cooperative Research Centre for Cattle and Beef Quality
1SARDI, Struan Research Centre, PO Box 618, Naracoorte, South Australia, 5271
2University of Adelaide, Department of Animal Science Livestock Alliance, Roseworthy Campus, South Australia,
3Primary Industries Research Victoria, Department of Primary Industries, Private Bag 105 Hamilton, Vic 3300

SUMMARY
Angus sires were selected on estimated breeding values (EBVs) for retail beef yield (RBY), intramuscular fat percent (IMF%) or both and Wagyu sires selected to represent a high IMF% were joined to crossbred cows. Progeny were grown to approximately 550 kg post weaning to examine the effect of selection for carcass type on carcass quality and quantity. Two of the four calf crops have been slaughtered and the preliminary results indicate that selecting for IMF% or RBY did not affect carcass weight. However, carcass quality was influenced, with favourable increases in IMF% in progeny from the IMF% sires. Sire of the cow breed also influenced meat quality but not quantity, with dams from Angus sires producing progeny with significantly higher IMF% and marbling level. Selecting for carcass quality using EBVs can improve carcass attributes for specific markets.

Keywords: carcass type, selection, estimated breeding values, carcass quality

INTRODUCTION
Beef producers in southern Australia have expressed concerns that cattle from their properties produce carcasses varying in quality from year to year. The major factors affecting returns to producers for most markets are carcass weight and fatness, with marbling important for the Japanese market where a highly marbled carcass with soft fat is preferred. The melting point of carcass fat is therefore important because it determines fat softness.

The Cooperative Research Centre for Beef Quality regional combinations study was initiated to assist producers in achieving market specification by evaluating the effects of selecting for carcass traits and growth paths in different sites in southern Australia. The project design and objectives are described by McKiernan et al. (2005). Briefly, the project was designed to investigate the effect of using sires selected for extremes in intramuscular fat and retail beef yield on meat quality and quantity, market specifications and carcass value. This paper reports preliminary results on live weight and carcass quality and quantity traits from the Struan herd only.

MATERIALS AND METHODS
In the first two matings at Struan Research Centre, Angus sires of three different selection types were used:
1. 9 high accuracy (70% and above) Angus sires with EBVs in the top 1% for Retail Beef Yield (RBY).
2. 9 high accuracy (70% and above) Angus sires with EBVs in the top 1% for intramuscular Fat % (IMF).
3. 5 high accuracy (70% and above) Angus sires in the top 10% for both IMF and RBY (IMF+RBY).
4. 2 Wagyu sires were also used in the 1999 matings (Wagyu).

Dams. 180 heifers were mated in June and July of 1999 and 2000. Heifers were originally generated for a Multi-breed project (Graham et al. 2000) by mating Angus and Hereford cows to Angus, Hereford, Simmental or Limousin sires which resulted in a wide range of dam genotypes. A synchronised artificial insemination program was used involving insemination after use of controlled release intra-uterine device (CIDR) and prostaglandin with re-insertion of CIDRs and re-insemination of heifers detected in heat using KAMAR® heat detectors.

Progeny. 117 progeny were born in 2000 and 73 in 2001 where they grazed perennial pastures to an average pre-slaughter target weight of 550 kg at 22 months of age to suit the heavy domestic or EU (European Union) trade. Four calf crops have been generated two of which have been slaughtered and the data analysed for this paper.

Slaughter. Steers (70) only from the 2000 group and both sexes from 2001 were slaughtered at a commercial abattoir and carcasses assessed using MSA (Meat Standards Australia) grading, assessing marbling and eye muscle area (EMA) while P8 (fat cover at the P8 rump site) and hot standard carcass weight (HSCW) were determined on the slaughter chain. A 1 cm thick sample of meat and fat was sliced from the Longissimus dorsi muscle at the quartering site between the 11th and 12th ribs for intramuscular fat determination. Intramuscular fat was measured by chemical extraction and melting point of subcutaneous fat measured by slip point (Pitchford et al. 2002).

Data analysis. Data was analysed using Proc Mixed using SAS (1996) where sire-type, sex, cow sire breed and calf year of birth were included as fixed effects and sire nested within sire-type was fitted as a random effect. Interactions between fixed effects were fitted in the initial model but were not significant for any of the traits, consequently they were removed from the final model.

RESULTS

Growth paths. The seasonal conditions allowed calves born in 2000 to grow sufficiently to achieve the target weight (550 kg) resulting in a group average carcass weight of approximately 300 kg (Figure 1). However, during the growth phase of the calves born in 2001, the south east of South Australia experienced a cold winter followed by a very short spring growing period such that the carcass weights (228kg) achieved were more suitable for the heavy domestic trade rather than the export weight target. There were significant differences between the two years in IMF%, P8, HSCW, and EMA with the 2000-drop significantly higher than the 2001, consistent with the fact that the 2001-drop animals were not finished sufficiently for export markets.
Figure 1. Growth paths of calves born in 2000 and 2001.

**Cow sire breed.** Progeny from dams with Angus sires had the highest IMF% and marbling and the lowest EMA whilst the Limousin crosses resulted in the lowest IMF% and marbling and the highest EMA (Table 1). Melting point, P8 and HSCW were not significantly different between sire breeds.

Table 1. Least squares means (±SEM) and levels of significance between means

<table>
<thead>
<tr>
<th>Item</th>
<th>IMF (%)</th>
<th>Melting Pt. (°)</th>
<th>Marbling (score)</th>
<th>P8 fat (mm)</th>
<th>HSCW (kg)</th>
<th>EMA (cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sire-type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMF</td>
<td>4.98 ± 0.22&lt;sup&gt;a&lt;/sup&gt;</td>
<td>39.6 ± 0.7</td>
<td>0.99 ± 0.12</td>
<td>11.2 ± 0.6&lt;sup&gt;x&lt;/sup&gt;</td>
<td>263 ± 4</td>
<td>66.5 ± 1.2&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>IMF+RBY</td>
<td>4.70 ± 0.22&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>39.1 ± 0.7</td>
<td>1.04 ± 0.12</td>
<td>8.9 ± 0.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>263 ± 4</td>
<td>71.5 ± 1.2&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Wagyu</td>
<td>3.47 ± 0.32&lt;sup&gt;c&lt;/sup&gt;</td>
<td>39.9 ± 1.2</td>
<td>0.87 ± 0.17</td>
<td>9.4 ± 0.8&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>254 ± 6</td>
<td>70.7 ± 1.6&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>RBY</td>
<td>4.17 ± 0.21&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>40.1 ± 0.7</td>
<td>0.68 ± 0.12</td>
<td>9.3 ± 0.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>272 ± 4</td>
<td>71.3 ± 1.2&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Cow sire breed** | *** | *** | *** | *** | *** |
| Angus       | 5.34 ± 0.20<sup>x</sup> | 38.9 ± 0.6 | 1.30 ± 0.11<sup>x</sup> | 10.0 ± 0.5 | 262 ± 4 | 68.6 ± 1.1<sup>x</sup> |
| Hereford    | 4.26 ± 0.23<sup>y</sup> | 40.3 ± 0.6 | 0.76 ± 0.12<sup>x</sup> | 10.2 ± 0.6 | 267 ± 5 | 68.1 ± 1.3<sup>y</sup> |
| Limousin    | 3.50 ± 0.25<sup>z</sup> | 40.2 ± 0.7 | 0.66 ± 0.13<sup>y</sup> | 9.5 ± 0.6 | 261 ± 5 | 72.5 ± 1.4<sup>y</sup> |
| Simmental   | 4.22 ± 0.20<sup>x</sup> | 39.2 ± 0.6 | 0.86 ± 0.11<sup>x</sup> | 9.0 ± 0.5 | 262 ± 4 | 70.7 ± 1.1<sup>x</sup> |

**Drop** | *** | *** | *** | *** |
| 2000        | 5.81 ± 0.22 | 39.6 ± 0.7 | 0.95 ± 0.12 | 13.5 ± 0.5 | 298 ± 4 | 72.8 ± 1.2 |
| 2001        | 2.85 ± 0.17 | 39.8 ± 0.6 | 0.84 ± 0.09 | 5.9 ± 0.4 | 228 ± 3 | 67.2 ± 0.9 |

P < 0.05; ** P < 0.01; *** P < 0.001; <sup>a</sup>Means with the same superscript are not significantly different
**Sire-type effects.** As expected the Angus carcass types differed in IMF% with the progeny of those bulls selected for increased IMF% having the highest IMF%. Surprisingly, the Wagyu had the lowest IMF%, which may be a result of their low slaughter weight or sires chosen. Wagyu in Japan are normally slaughtered to achieve carcass weights greater than 300kg and are noted for high IMF percentages. Also, the IMF% group had the highest P8 fat depth and the lowest EMA, which is consistent with the findings of Graham et al. (2005). Melting point and HSCW were not significantly different between sire-types. Therefore, selecting for high IMF% has increased the amount of IMF but did not affect the composition of the fat.

**CONCLUSIONS**

Currently, Australian beef cattle producers are paid based on carcass weight. The environment appeared to produce the largest influence on carcass weight, with selection based on carcass type not significant. To avoid seasonal fluctuations negatively impacting carcass weight, many beef producers in South Australia have changed their marketing strategies and now sell cattle to specialist finishers in other states. Selection based on RBY and/or IMF% does not appear to increase carcass weight but increases carcass quality, which influences its suitability for particular markets. Therefore, early indications suggest that carcass EBVs can be used to improve carcass quality attributes for specific markets.

**REFERENCES**


