The financial benefit of increasing muscle score
There are potential gains in profitability to be made in Australian beef herds through selection for increased muscularity as a result of increased carcase value through increased retail beef yield. Muscle score has a major influence on price received for live animals at the sale yard. In 2002, across all market categories a one unit improvement in muscle score (e.g. D to C) was associated with a 14c/kg increased in price received. In 2008, each unit improvement in muscle score was associated with a 21c/kg increase in price received across all market categories. If there are no negative impacts of increased muscle score on meat quality, feed efficiency or maternal productivity traits, these increases in price received are associated with a 24% increase in gross margin. However, to date, there has been limited selection for increased muscling in females due to the perception it may have a negative effect on cow performance traits including calving rate, calving ease, calf survival, cow milk production, cow longevity and progeny growth rate.

Establishing divergent selection for muscle score
NSW DPI has been divergently selecting an Angus cow herd on muscling since the 1990s. Careful selection based on visual muscle score has resulted in the formation of Low and High muscling lines. The cows in the Low muscling line currently have an average muscle score of D, and the cows in the high muscling line an average muscle score of C. Results are now available on the relationships between this level of increased muscling and maternal productivity traits. Complementary information on how selection for muscling changes the carcass can be found in a separate fact sheet titled ‘Selection for Muscling and its Effects on Carcass Attributes.’

Research conducted by the Beef CRC has demonstrated that selection for increased muscle is not associated with negative effects on the breeding herd.

FAST FACTS
• Selection for increased muscularity resulted in cows that were the same weight, slightly smaller in frame score and with more muscle and less fat
• An increase in muscularity of one muscle score unit (D to C) did not affect calving rate
• There was no difference in calving difficulty between muscling lines
• There was no effect of muscularity on weaning rate or calf growth

Figure 1: Yearling heifers from the Low (left) and High (right) muscling lines

There was no difference between Low and High muscled heifers in calving ease or any of the other female productivity traits measured.

Bill McKiernan, founder of divergent selection lines

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**Muscling and the Breeding Herd**

Cows in the High muscling line were similar in weight, slightly smaller in frame score and had more muscle and less subcutaneous fat than cows in the Low muscling line (Table 1). These differences in body composition have not led to any differences in reproductive performance in mature cows (Table 2). The High muscling cows displayed the same levels of calving ease, days from joining to calving and birth and weaning rates as the Low muscling cows. Calf weaning weight was also similar between the two lines indicating that milk production and calf growth rate were not affected by selection for increased muscling.

**Table 1: Body composition of mature cows selected for High and Low muscling on good nutrition**

<table>
<thead>
<tr>
<th>Muscling Line</th>
<th>Low line</th>
<th>High line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>551</td>
<td>553</td>
</tr>
<tr>
<td>P8 fat (mm)*</td>
<td>13.5</td>
<td>9.6</td>
</tr>
<tr>
<td>Rib fat (mm)*</td>
<td>9.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Eye muscle (cm2)*</td>
<td>54.7</td>
<td>60.5</td>
</tr>
<tr>
<td>Muscle Score*</td>
<td>D</td>
<td>C+</td>
</tr>
<tr>
<td>Hip Height (cm)§</td>
<td>128.2</td>
<td>126.4</td>
</tr>
</tbody>
</table>

Significant difference (P<0.001) § Significant difference (P<0.05)

**Table 2: Reproductive performance of cows selected for High or Low muscling, giving birth to their second or subsequent calf from 1998 to 2009**

<table>
<thead>
<tr>
<th>Muscling Line</th>
<th>Low line (844)</th>
<th>High line (852)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving ease¹</td>
<td>1.03</td>
<td>1.01</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>35.3</td>
<td>35.5</td>
</tr>
<tr>
<td>Wean weight (kg)</td>
<td>245</td>
<td>247</td>
</tr>
<tr>
<td>Days to calving</td>
<td>315</td>
<td>309</td>
</tr>
<tr>
<td>Calving rate (%)</td>
<td>88.2</td>
<td>89.2</td>
</tr>
<tr>
<td>Weaning rate (%)</td>
<td>85.0</td>
<td>87.2</td>
</tr>
</tbody>
</table>

¹: Calving ease scale of 1-4.

Results were similar for heifers giving birth to their first calf at either two or three years of age. The heifers from both High and Low lines required more calving assistance than the mature cows, particularly when giving birth to their first calf at two years of age. However, there was no difference between Low and High muscled heifers in calving ease or any of the other female productivity traits measured.

The divergence in muscling between these lines appears to have stabilised, indicating the muscling in the High line is likely to be as high as can be achieved without the use of specific extreme muscling genes or crossing with extremely muscled breeds. The difference in muscling has been achieved by using B muscle score Angus bulls over the High muscling cows.

**Summary**

Selection for increased muscling resulted in cows of similar live weight but with more muscle and less fat. Importantly, increasing muscling from a D to a C muscle score in a line of breeding cows had no impact on calving rates, calving ease or calf growth rates to weaning.

Further Reading