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Beef: meating the market

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Nearly half of Western Australia's beef production is consumed on the domestic market, but the scene is changing rapidly. In this article Greg Sawyer, Richard Morris and Geoff Tudor review information on production systems performance, and carcase and quality measurements that may well serve wider market opportunities in the future.

Background
The Western Australian beef industry relies heavily on domestic consumption (45 per cent), with a further 30 per cent exported as beef and 25 per cent exported as live animals. The domestic market is dominated by the supermarket sector (70 per cent) compared with 47 per cent in the eastern States.

For various reasons Western Australia has not used its bountiful resources to produce the industry growth which has occurred in other parts of Australia. These include:

- year-round production possibilities,
- quality genetic resources, especially the use of crossbreeding and European breeds: The use of European bulls runs at more than double their rate of use in the eastern States,
- freedom from serious diseases found in competitors' cattle, and
- a huge grain industry.

However, the scene is changing rapidly. From a base of only opportunity feedlotting for the domestic market, in the past 12 months at least three feedlots...
Using quick growing cattle of European origin means that larger, leaner carcases can be produced which will meet minimum requirements for fatness.

Retail meat sales are dominated by supermarkets.

In a recent and large New Zealand study, 11 breeds of European sire were mated to Angus or Hereford cows in a pasture-based system. Limousin and Blonde d’Aquitaine breeds were rated very highly for production of carcase weight between 16 and 20 months of age.

These two breeds, while gaining in popularity, have still not been extensively studied in Australia, especially in typical Western Australian conditions with a birth to weaning phase of approximately eight months.

**Fit not fat**

Fat levels on many animals presented for slaughter don’t reflect the growing pressure by consumers for leaner beef. Extra fat on smaller carcases represents a waste in the industry.

Fat, and the slaughter of smaller animals, add substantially to processing costs. Increasing the average carcase weight from 200 to 250 kilograms would reduce the cost of slaughtering and boning out by about 18 per cent.

Using quick growing cattle of European origin means that larger, leaner carcases can be produced which will meet minimum requirements for fatness (4 millimetres, p8 site, standard AUSMEAT assessment site) in order to prevent cold toughening.

In addition, leaner carcases are likely to be increasingly demanded by South-East Asian markets, for example, Indonesia and the Philippines, which traditionally have consumed lean meat.

**Western Australia’s production system**

In Western Australia’s Mediterranean climate, dry pasture feed decreases in quantity and quality in late-summer-autumn, which may lead to nutritional problems. For a successful beef production program to operate we need:

a) **Choice of the time of calving.**

Calving later in the year, after seasonal pasture growth has started, means that calves

Above: Crossbred weaner calves – ideal for some markets when lot-fed.
Dairy-beef crossbred cows commonly used as beef mothers.

by bulls from the Wokalup herd in 1994. These Wokalup bulls were a medium/late maturing cross with representation of Angus, Hereford, Charolais, Brahman and Friesian.

**What we found**

**Birth to weaning - calving**
The question of calving difficulty has concerned producers contemplating using European sires as ease of calving Estimated Breeding Values are not always available, especially for newly introduced or less populous ‘Euro’ breeds.

In 1993, there were no calving difficulties recorded from 180 calvings, although calves weighed up to 55 kilograms. Again in 1994, calving difficulty was not a major problem.

Overall, calves from Angus x Friesian dams were 1.4 kilograms heavier than those from Herefords (41.6 cf. 40.2 kilograms) and, as is usually found, male calves were heavier than female calves (average of 1.5 kilograms).

Calves born early (February - March) were 2 kilograms lighter (40.3 cf. 42.3 kilograms) than later-born calves (April-June). This difference was not as marked in 1994 as there was some overlap in time of calving between early and late calving groups.

**Calf growth to 100 and 200 days of age**
In this demonstration there were three main effects on calf growth other than sex (male calves are born heavier, grow faster and weigh about 25 kilograms more at 200 days):

- Breed of dam (includes milk production)
- Breed of sire
- Time when calves were born

Angus x Friesian dams raised heavier (average of 20 kg at 200 days) calves in both years, due in part to their superior milking ability. Each additional litre of milk produced an extra 2.2 kilograms and 3.0 kilograms of calf liveweight at 100 and 200 days respectively.

In the first year of the demonstration there was no difference between the growth rates of calves sired by Blonde d’Aquitaine or Limousin bulls. In 1994, no differences between sire breeds were found by day 100 but by day 200 both the Blonde d’Aquitaine and Limousin-sired calves were significantly heavier than Wokalup-sired calves (245 and 244 kilograms cf 224 kilograms).

**b) Choice of dam breed.** The amount of milk the dam produces is an important factor driving the productivity of a vealer enterprise. Dairy beef crosses are commonly used in Western Australia to provide a rapid increase in milking ability, and hence, weaning weights. This may not necessarily reflect a higher potential for rapid growth post-weaning in a yearling turn-off system.

The demonstration
We set up a demonstration on Wokalup Research Station in 1992 to monitor the performance of progeny from Angus x Friesian crossbreds and Hereford cows sired by the European breeds - Limousin or Blonde d’Aquitaine. Both are highly ranked for growth rate, production of high meat yield carcases, and do well on pasture. We also wanted to assess the influence of time of calving and milking ability of the dam on yearling productivity.

Returns to artificial insemination were covered by backup bulls supplied by industry in 1993 and
Despite the supplementary feed offered, calves born early in the year (February-April) grew more slowly to 100 days and 200 days of age than calves born from mid April onwards. In 1993, the difference was 6 kilograms at 100 days (down from 142 kilograms in later-born calves) and 22 kilograms at 200 days (down from 259 kilograms in later-born calves). In 1994, these differences were 19 kilograms at 100 days and 25 kilograms at 200 days.

Weaning
Calves from both time of calving groups were weaned in mid December and in both years were, on average, 255 days old (early-calving) and 215 days old (late-calving). Again, calves from Angus x Friesian dams were 21 kilograms (302 cf. 281 kilograms) and 27 kilograms (291 cf. 264 kilograms) heavier than those from Herefords in each year.

Calves from Angus x Friesian dams carried 5 millimetres of fat at the P8 site compared to 4 millimetres in calves from Hereford dams. Generally P8 fat measurements were 1 - 1.5 millimetres greater in female calves compared with male calves. In 1993, 30 per cent were saleable as weaners. Angus x Friesian dams reared 75 per cent of these calves and each sire breed was equally represented.

In 1994, there was an abrupt finish to the pasture growing season which adversely affected weaning weights and less than 10 per cent were saleable as weaners, primarily due to insufficient fat cover.

The calf liveweight (or saleable product) produced by each hectare grazed by the cow/calf unit is a guide to productivity for the birth to weaning phase. In 1993, this figure was 286 kilograms liveweight per hectare and in 1994 it was 260 kilograms per hectare. These values compare favourably with recent Beef Farm data from 40 high rainfall properties (above 800 millimetres) that had an average liveweight production per hectare of 242 kilograms.

Grow-out phase – Weaning until slaughter
All of the 1993 and 1994 calves were taken through into a following year and either grain-fed for slaughter at 12-15 months of age or were provided supplements (grain, silage or hay) at pasture and slaughtered at 17-20 months of age. Steers and heifers were grain fed in separate experiments.

Grain finishing steers at pasture
Steers grazed improved dry pastures at two animals per hectare on Vasse Research Station in 1994 and were fed barley grain with virginiamycin added from 13 April (when animals started losing weight), until slaughter. Opening rains came on 22 May. The grain was fed in weather proof self-feeders once per week for ad libitum (high grain treatment - average consumption 9.5 kilograms per head per day) and three times a week for low (1.5 kilograms per head per day) and medium grain (3.0 kilograms per head per day) treatments. The growth promotants Compudose 400, implanted on 25 January, and Revalor S, implanted on 26 May, were used and promoted satisfactory liveweight gain particularly after the start of supplementation.

These animals were slaughtered for the local restaurant trade which is about 20 to 30 kilograms heavier than the local domestic market. They achieved dressing percentages of 55 to 56 per cent and average prices of $2.75 to $2.80/kg carcass weight. Feeding higher levels of grain with a self feeder enabled an earlier turnoff of large, but lean (P8 fat 6 millimetre) carcases in June and July, well before the seasonal turnoff of weaners, which is usually from September/October onwards.

Grain finishing heifers on feedlot
Euro-crossbred animals are sought after for grain finishing in feedlots. Typically, weaners are fed milled and mixed or pelleted diets consisting of a high proportion of cereal grain (greater than 50 per cent) or other grains...
(lupins, peas etc.) or meals with a roughage source such as hay, straw and sometimes silage. Factors affecting the profitability and efficiency of feedlot enterprises include:

- breed and sex (this affects feed conversion efficiency, growth and deposition of fat);
- type of diet (concentrate to roughage ratio, level of starchy grains and protein, and the correct balance of nutrients);
- use of HPGs (hormonal growth promotants) and/or rumen modifying agents.

We compared growth rates and carcase characteristics of Limousin or Blonde d’Aquitaine-sired heifers (average liveweight 283 kilograms, range 233 to 344 kilograms) on barley grain diets with either non-protein nitrogen (1 per cent urea, 13.1 per cent crude protein) or a canola meal protein supplement (13 per cent of dry matter, 14 per cent crude protein).

Half the animals in each pen were implanted with the hormonal growth promotant, Revalor H. The heifers were confined in 2 hectare paddocks with a self-feeder containing the grain mixes, with virginiamycin included for the first four weeks to assist with grain adaptation, and hay fed separately to appetite (consumption was 25 per cent of the diet). On average they fed for 130 days.

The most significant result from this work was the 26 per cent increase in the growth rate of the Euro-cross heifers implanted with Revalor H (1.41 cf. 1.12 kilograms per day). These heifer carcasses were 3.5 per cent heavier than non-implanted heifers but carried marginally less fat.

Gross returns from these heifer carcasses averaged $645 per animal. This was $60 per head more than the returns on Angus heifers fed under the same regime for 94 days.

In another experiment we looked at the effect of protein level in the diet. European crossbred animals may require higher levels of protein in feedlot diets to support maximum growth of muscle tissue. Crude protein levels of 14.2 and 17.1 per cent in the grain diets produced heifer growth rates of over 1.5 kilograms per day, which were better than growth rates (average 1.4 kilograms per day) on either higher or lower protein diets.

We also found that the progeny of Blonde d’Aquitaine bulls grew 9 per cent faster than the average growth rate of Limousin or Wokalup sired heifers. Once again there was a very significant 20.4 per cent increase in the growth rate and a marginal decrease in fat depth (0.7 millimetres) of heifers treated with Revalor H.

**Measurement of saleable meat yield**

Heifers were followed individually through slaughter and chiller assessments with measurement of hot standard carcase weight, P8 fat depth, eye muscle area, eye muscle pH, meat and fat colour. One or two days after slaughter the carcases were broken down into primal cuts, fat trim, bone, chemical lean trim (Woolworths standard) and all components weighed. Samples of striploins were taken for taste-panel assessment.

The table shows the average and range of values for all meat yield measurements. Although 80 per cent of heifers were slaughtered at a relatively narrow range of P8 fat depth of 5-8 millimetres considerable variation is apparent in measures of the components of meat yield. This translates to differences in wholesale meat yield of up to 9.2 per cent (highest minus lowest).

| Carcase and meat yield measurements for all heifers across breeds and treatments |
|-------------------------------|---------|---------|
| Measurement                        | Average | Min     | Max     |
| Age at kill (days)                | 390     | 335     | 450     |
| Fat Depth (P8) (mm)               | 6.8     | 4.0     | 10.0    |
| Hot Standard Carcase Weight (kg)  | 224.0   | 173.6   | 266.6   |
| Cold Carcase Weight (kg)          | 221.4   | 172.2   | 266     |
| Eye Muscle Area (cm²)             | 73.1    | 52.8    | 100.5   |
| Total meat yield %                | 75.8    | 70.0    | 79.2    |
| Total primal %                    | 53.5    | 49.9    | 56.4    |
| Total fat trim %                  | 6.5     | 4.0     | 11.1    |
| Total bone %                      | 17.1    | 15.2    | 21.0    |
| Total trim %                      | 22.4    | 17.4    | 25.4    |

Revalor H marginally increased overall meat yield by 0.6 per cent (up from 75.9 per cent) and significantly reduced fat trim by 0.9 per cent (down from 6.8 per cent). The yield of primal cuts increased by 1 per cent (up from 53.1 per cent) in heifers treated with Revalor H.

We decided to probe these results a little further.

Primal cuts were categorised into high (over $10 per kilogram wholesale; fillet, striploin and cuberoll), medium ($4 to $10 per kilogram wholesale, rump, topside, round, silverside, silverside eye and blade) and low (less than $4 per kilogram wholesale; shin, chuck, and roll roast) value and their yields were analysed for the influence of production factors.

- Breed of sire significantly increased the percentage of high value primal (9.53 per cent for Blonde d’Aquitaine and Limousin cf. 9.18 per cent for Wokalup composite) but there was no influence of dam breed. Sire breed also influenced the amount of medium-value primal cuts from carcases in the order Limousin 29.3 per cent, Blonde d’Aquitaine 29.0 per cent and Wokalup composite 28.2 per cent of cold carcase weight.
- Revalor H increased the percentage of both medium and low-value primal cuts by 0.7 per cent (up from 28.4 per cent) and 1.2 per cent (up from 13.3 per cent).

Sire breed and Revalor H treatment were big influences on some chiller measurements.
• Using European terminal sires (Limousin or Blonde d’Aquitaine) increased the size of the carcase, the eye muscle area and reduced P8 fat depth.
• Revalor H acted in a similar manner to breed of sire by increasing carcase size, eye muscle area and reducing P8 fat.

What about the eating quality of the meat?
The meat was rated for three attributes with a higher score indicating better quality:

<table>
<thead>
<tr>
<th>Tenderness</th>
<th>Flavour</th>
<th>Juiciness</th>
</tr>
</thead>
<tbody>
<tr>
<td>generally the most important (1-6 scale)</td>
<td>either like or dislike mild, medium or strong flavours (1-6 scale)</td>
<td>(1-5 scale)</td>
</tr>
</tbody>
</table>

Analyses of all taste tests determined the effect of ageing the meat, breed type, level of protein in the diet and the use of the growth promotant, Revalor H.

The taste panel results showed that the meat was generally of high eating quality, tender and moist, qualities which significantly enhanced by ageing in cryovac packs at 4°C for 17 days.

By far the most important result was that ageing improved the tenderness score by 1.1 scores. Neither ageing nor any other factor influenced the flavour of the meat.

Breed of sire and dam did not consistently influence the tenderness, flavour or juiciness of the meat and there was no conclusive effect of dietary protein level on eating quality.

Revalor H marginally reduced the tenderness and juiciness of the meat. This equated to 0.2 tenderness scores in meat which was not aged, but the effect was greater in aged meat dropping the tenderness score by 0.6 units. It is generally believed that HGPS do not appreciably affect the eating quality of meat, but with more than 1200 taste test scores the effect warrants further attention.

Our results confirmed the generally held beliefs that post-slaughter factors such as cold toughening and ageing can affect eating quality more than pre-slaughter factors such as age of the animal, fatness, breed, nutritional treatment and sex.

Conclusions
The terminal sire crossbreeding system we evaluated in two very different years confirmed that relatively high levels of production (live-weight of calf per hectare) could be produced, up until weaning. The extra milking ability of dairy-crossbred dams produced at least an extra 20 kilograms of liveweight at weaning. Generally, feeding costs were kept to a minimum, even in the early calved groups (March-April) in 1994 with a late break in May, and this meant the overhead costs of running the breeding cows were low.

Where the Euro-crossbreds calves appear to come into their own is their performance in the subsequent year under various ‘growing out’ production systems. Several of these showed the ability of these animals to grow rapidly and produce carcases between 220 and 260 kilograms. Some of these carcases were suitable for the domestic market, others for the local restaurant trade and others were suitable for the Asian export markets that Western Australia is starting to service.

The supplementation and feedlot work clearly showed the importance of adequate protein in the diet of Euro-cross calves and their response to growth promotants. It also emphasised the ability of these crossbreds to produce muscle (the saleable product) rather than fat which the customer does not want and is costly for the industry to trim.

Finally, taste panel testing showed that the meat was generally of high eating quality, tender and moist. These qualities were enhanced further by ageing in cryovac packs. Future work will continue to place emphasis on the product characteristics – saleable meat yield and eating quality – and should provide useful information to the industry as it moves toward a system of value-based marketing.

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