Key CRC results from the straightbreeding progeny test

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Introduction

For most of the nineties the Beef Quality CRC conducted a large scale progeny test program on some 35 industry properties and five or six research institutions owned by the core partners. Seven breeds were represented and cattle were subjected to different growout and finishing methods and slaughtered at carcase weights suitable for a number of markets. This complex design has given some interesting results that have major industry application.

Most importantly results from this CRC project were used in BREEDPLAN as early as 1998 in version 4.1 of the software and further improvements have been made recently. The purpose of this paper is to highlight the significance of these results and suggest further industry use for them.

Industry application of results

The major industry outcome of this program has undoubtedly been the modification of the BREEDPLAN carcase model. At times it is easy to overlook the amount of effort behind what appears as small improvements in an existing program such as BREEDPLAN.

Behind the implementation of these new carcase EBVs are records from approximately 8000 carcases from the Beef Quality CRC and scans taken on over 10,000 stud heifers and bulls in seedstock herds. The stud calves were by the same sires as the commercial calves so comparisons of sire performance could be made using both scanning and carcase. To have the sires produce both commercial calves from commercial herds and stud calves in the seedstock herds was one of the major challenges faced by organizers of CRC and the participating breeders.

From analysis of this data researchers concluded a number of important points for data collection and reporting of EBVs.

- Estimated Breeding Values (EBVs) for fat depth, eye muscle area (EMA), retail beef yield (RBY) and intra-muscular fat (IMF; marbling), as a result of the Beef Quality CRC, now use information from carcase as well as scanning to produce a single EBV for each of these important carcase traits. It was demonstrated that scanning progeny ranked sires similarly to progeny carcase measures. Because they are strongly correlated both the measures can be combined into one EBV for fat, EMA and IMF. It would make little sense to have a scanning EBV and a carcase EBV for nominally the same trait.
- Data was available to allow the EBVs to be corrected to a 300 kg carcase weight. Previously carcase EBVs were on an age basis. EBVs such as EMA are now effectively corrected for weight and will appear more closely related to the way cattle are marketed (generally drafted on a weight basis). They are also more closely associated with other industry based measures of carcase such as visual muscle score.
- Carcase data can be collected at any weight and the sires will rank very similarly for the four traits, fat, EMA, RBY and IMF. A sire producing fat carcases at domestic weights will also produce fat carcases at Japanese export weights. The importance of this is that only one set of carcase EBVs is needed ie. we don't need fat depth EBVs at 200 kg and at 400 kg. This however does not imply that the same sire will be suitable for all market situations. You need to match your genetics to the market specifications.
- Similarly carcase data can be collected from grainfed or grassfed carcases. There is no need for an IMF-Feedlot distinct from an IMF-Grassfed EBV.
- Relationships between the carcase traits were calculated such that even when a trait is not measured directly (eg. retail beef yield), it can be estimated from the known genetic relationship with all other EBVs, in the case of RBY the most important EBVs are fat and EMA.

The following diagram (Figure 1) will help to explore a little further the ranking of sires when evaluated under different market endpoints. Each different shape in the graph represent an EBV for IMF for a sire calculated using either information from domestic weight carcases or from export weight carcases. Each shape represents a different sire. The important point is that while at the domestic weights the points are closer together the order (ranking) is the same. The sire that produced the carcases with the highest average IMF at export weights also produced the highest IMF carcases when measured at domestic weights. A point of clarification is necessary at this point; the EBVs shown in figure 1 are experimental EBVs, not BREEDPLAN EBVs; the EBV presented in BREEDPLAN is one that uses data from both the export and the domestic slaughter endpoints, adjusted to 300 kg carcase weight.

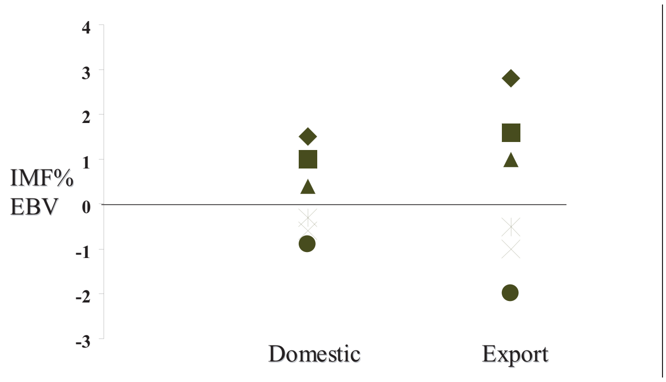

Figure 1. EBVs could be calculated using domestic or export data; the ranking of sires stays the same but the spread is greater when using the export data.

A further result of the CRC project is that the current version of BREEDPLAN is able to correct for the differences in the spread so there is no disadvantage to those evaluated at domestic weights.

Similar results were obtained when EBVs based on data from pasture fed cattle were compared to EBVs based on data from grain finished cattle. The grain finished cattle tended to be fatter and had higher levels of marbling. There was a greater spread in the sires when based on feedlot finished data but the ranking was the same. Again BREEDPLAN corrects for the greater variation so that no sire is disadvantaged by being evaluated on feedlot or grassfed data alone.

What do EBVs mean in production terms

The CRC progeny test program was unique in that it was a test with detailed records of the production systems and the sires used were of known genetic merit within their respective breeds. They all had EBVs for the traits of interest. This is one of the first trials in the world where it can be demonstrated that the sires used are representative of the breed at large. From the CRC dataset the EBV values can be related to phenotypic (production) values. When based on averages of all CRC sires of a given breed, over all years and all herds this comparison is reasonably robust.

As shown in Table 1, Angus sires used in the CRC were marginally above current breed average for the fatness traits (including IMF) and equal to the current breed average for EMA and RBY (Angus are used here as an example as they had the largest number of records).

Table 1. Carcase EBVs for sires used in CRC compared to breed average for 2,000 drop calves.

EBV	EMA	RIB	RUMP	RBY%	IMF%
Av CRC Sires	1.1	-0.1	0.0	0.2	0.2
Breed Av 2000 drop	1.1	-0.2	-0.2	0.2	0.3

Discussion of the value of EBVs to production levels will be restricted to P8 fat depth (as an example of one of the fat measures) and IMF as apart from carcase weight these two traits have the largest affect on carcase value. Carcase weight was largely determined by the protocol of the research program that called for cattle to be killed at various carcase weights. The dataset is more complete for fatness and IMF, with RBY and EMA not being recorded at all slaughters.

When CRC averages for fat and IMF are matched to the average EBVs of sires you can make some assumptions about the performance of the genetics. An EBV value of 0.0 for rump fat roughly equates to 8.7 mm of fat on domestic weight carcases finished on pasture under the CRC production system and an EBV of 0.2 for IMF% equates to 6.9% IMF under the CRC protocol for grain finished cattle destined for the Japanese market endpoint. Least square means for the average performance for P8 fat and IMF under grain or grass finishing, at the three different slaughter end points, Domestic, Korean and Japanese are shown in Table 2.

Table 2. P8 Fat Depth and IMF% at different market end points and for different finishing systems.

	P8 Fat Depth (mm)				IMF (%)			
	Market			Average All Markets	Market			Average All Markets
Finish System	Domestic	Korean	Japanese		Domestic	Korean	Japanese	
Feedlot	11.0	12.6	14.4	12.6	4.6	5.7	6.9	5.8
Pasture	8.7	10.8	10.7	10.0	4.0	4.5	5.0	4.5
Average Both Finish Systems	9.9	11.7	12.6	11.4	4.3	5.1	6.0	5.2

The averages for the different market end points and the different finish systems are as might be expected. Feedlot finished cattle were fatter and had higher IMF%. Heavier carcase weights (the heavier cattle also tended to be older) also resulted in more fat and higher levels of IMF.

Under the production systems of the Beef Quality CRC the sires used produced carcases with an IMF level of 6.9. This roughly equates to an MSA marble score of 3.4 using the relationship calculated from CRC data. This average of 6.9% was from steers produced by sires with EBVs slightly below breed average.

Assuming a normal distribution this would mean that about 75% of carcases would be above marble score 3. A compliance rate of 75% for a system aiming to produce marble score 3 is likely to be unacceptable and it is probably the reason that most feeding systems are now feeding for longer than the 180 days which was the feeding period for the CRC.

But the worst carcase was around 2% IMF and the best carcase around 12%. Sires used to produce these carcases had EBVs ranging from –1.4 to 2.5. Once again using CRC data it has been shown that EBVs are a good predictor of the level of marbling expected in the calves. It can be confidently stated that choosing bulls with higher EBVs for IMF will push marbling levels higher and increase compliance rates. There is scope to use genetics to improve compliance.

Of the six market by finishing combinations used in the CRC, in reality only in the grain finished Japanese market endpoint combination is IMF% of major importance but this is not the case for P8 fat depth. Most market specifications will include a preferred fat depth range.

As stated earlier the sire that produces the fattest calves under a grass finished, domestic market protocol will also produce the fattest calves under the grain finished Japanese market protocol. But this does not mean that the one sire fits all. While the average for each of the markets appears OK using sires with approximately average EBVs, the requirements could be very different if you examine the expected range of performance.

For the grain finished Japanese market the average P8 fat was 14.4mm. The range was from 6 to 24 mm from an EBV range in the sires of –3.2 to 4. So the sires used in the CRC generally caused little concern for this finishing by market combination. However some caution needs to be taken if the range in EBVs from the Angus population at large is considered. It ranges from –6.1 to +7.2 a range nearly twice as large as the range in the CRC sires. Selecting a sire from among the highest P8 Fat EBVs is likely to produce steers unsuitable for longfed feedlot finishing.

If considering the pasture finished system producing for the domestic market where the same sires with fat EBVs ranging from –3.2 to 4 produced carcases with a mean fat depth of 8.7 mm with most cattle being between 3 and 15 mm. In this case the very lean bulls with industry EBVs extending down to –6, should be of concern.

A further important result from this research is the significant effect that the herd of origin had on the final outcome of the carcase results. As shown in Figure 2 carcases from different herds had different levels of IMF. Remember that the calves that produced these carcases were all run together after weaning and so the differences shown here were largely preweaning effects. Only some of this difference can be explained by the genetic differences between sires but not all. Commercial breeders still need to critically examine the genetic level of their cowherd and their nutritional and management regimes as well as the genetics of their sires if they are to maximize performance.

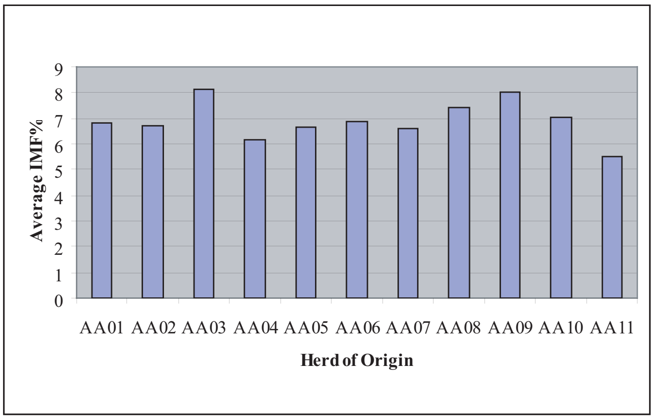

Figure 2. Average IMF% by herd of Origin.

Take Home Messages

- CRC results have modified and increased the accuracy of BREEDPLAN EBVs over the last 5 years
- Animals can be evaluated under different production systems but the EBVs are still valid
    - ♦ Animals evaluated under grain or grass finishing rank the same
    - ♦ Animals evaluated at different slaughter rank the same
- BREEDPLAN corrects for the different range of values found under different finishing systems and different market endpoints
- This means there is no need for a Grainfed EBV distinct from a Grassfed EBV for any of the carcase traits
- Similarly there is no need for a Export EBV and a Domestic EBV
- Average animals appear to fit market categories reasonably well but there is a range in genetic values and a range in phenotypic performance
    - ♦ (CRC has shown that EBVs predict reasonably well the phenotype)
- When choosing genetics for commercial production knowledge of the production system and the market requirements is vital
- Genetics information can be a major asset to improving the compliance of cattle to market specifications but there are many environmental effects that also need consideration.

Notes