THE 2008 Summer MURRAY GREY INTERNATIONAL GROUP BREEDPLAN GENETIC EVALUATION REPORT

The information contained in this Report was compiled by the Agricultural Business Research Institute (ABRI) from data recorded on the pedigree and performance databases of the Murray Grey Beef Cattle Society Ltd, the New Zealand Murray Grey Beef Cattle Society, the American Murray Grey Association and the Canadian Murray Grey Association. The Estimated Breeding Values (EBVs) have been calculated from the raw data as supplied by members. Neither the Societies nor the ABRI oversee or audit the collection of this data.

Introduction

This report contains a summary of the Estimated Breeding Values (EBVs) calculated in the 2008 Summer GROUP BREEDPLAN analysis of the Murray Grey breed. This analysis evaluated the integrated pedigree and performance databases of Murray Grey animals in Australia, New Zealand, America and Canada. Coupled with these databases was data from several UK herds. Subsequently, this report presents Murray Grey breeders with an international listing of genetic merit (or EBVs) for Murray Grey sires and dams.

The 2008 Summer Murray Grey International GROUP BREEDPLAN genetic evaluation analysed performance records from 22,775 sires and 122,468 dams in the calculation of these EBVs. The number of performance records analysed continues to increase, indicating the continuing commitment of Murray Grey breeders worldwide to breed improvement.

GROUP BREEDPLAN estimates the breeding values for individual animals (Estimated Breeding Values - EBVs) using all available information on the animal as well as its progeny and close relatives. The calculation of EBVs takes into account the influence of management, environmental effects and non-genetic effects. GROUP BREEDPLAN provides the best possible estimate of an animal's breeding value, that is, the animal's EBV.

GROUP BREEDPLAN EBVs for up to 17 economically important traits are included in this report. This **does not** constitute an exhaustive list of the traits that must be considered during the selection of functional cattle. However, GROUP EBVs are the best figures available on the relative performance of animals for these important traits. GROUP EBVs used in conjunction with assessment for structural soundness, fertility, mature size and muscling will help take a lot of the guess-work out of cattle breeding.

The Analysis

The EBVs published in this Genetic Evaluation Report were produced using the latest version (version 4.3) of GROUP BREEDPLAN software. This model is an advanced implementation of the Best Linear Unbiased Prediction (BLUP) technology for across-herd genetic evaluation of beef cattle and was developed at the Animal Genetics and Breeding Unit (AGBU) at the University of New England.

This evaluation is based on a wide range of information including the performance of the individual and its relatives for a number of traits, the genetic relationships between the traits and the pedigree links between animals and between herds. EBVs are reported relative to a base of zero set for each trait using historic performance records for the Murray Grey breed.

The Report

The Sire listing reports GROUP EBVs for 449 sires for up to 17 traits. To be eligible for reporting in this listing a sire must be recorded on the "Purebred Register", have performance recorded progeny born in the last two years and have an accuracy of at least 75% for one of the growth traits (ie 200-Day Growth, 400-Day Weight or 600-Day Weight).

Sire trait leaders are highlighted in the main sire list by boxing □ the EBVs for which the animal is a trait leader. To qualify as a sire trait leader, the sire must firstly have at least 75% accuracy for the trait. Having met this criteria, sires are reported as trait leaders if their EBV for the trait is within the top 10% of the breed (as defined by the 2006 born calves) for Birth Weight, 200 Day Growth, 400 & 600 Day Weight and Milk, or within the top 50% of the breed for Scrotal Size, Carcase Weight and Retail Beef Yield. The sire trait leaders for Birth Weight are only selected from sires with positive post-birth growth traits (measured at 200, 400 & 600 days).

No trait leaders are reported for Calving Ease, Gestation Length, Mature Cow Weight, Days to Calving, EMA, Rib Fat, Rump Fat or Intra Muscular Fat Percent.

The Junior Sire listing is similar to the Sire listing but includes only bulls born in 2006 that are recorded on the "Purebred Register" and have at least two post-birth performance observations. Having met this criteria, young sires are reported if their EBVs for 200-Day Growth, 400-Day Weight and 600-Day Weight are among the top 10% for the year drop (refer to Table 4 for percentile bands).

The Dam trait leader lists include the top 40 dams for each of the following traits - Birth Weight, 200-Day Milk, 200-Day Growth, 400-Day Weight and 600-Day Weight. More than 40 dams may be listed if there are other eligible dams with the same EBV for the nominated trait as the 40th dam selected. To be included in a particular trait leader list a dam must be recorded on the "Purebred Register", have at least one performance recorded calf born in the past two years, at least 3 natural calves recorded and an EBV accuracy of at least 60% for that trait.

For inclusion in the Birth Weight trait leader list a dam must have a low Birth Weight EBV with positive EBVs for post-birth growth traits (measured at 200, 400 & 600 days).

These listings **DO NOT** attempt to identify the best animals for use in **YOUR** breeding program. You must determine the best possible combination of EBVs an animal should have to fit into your breeding program.

To select an animal for your breeding program you should consider the animal's performance overall, take all its EBVs into consideration and use these figures to predict how that animal will improve your herd.

Accuracy of EBVs

By definition EBVs are estimated breeding values. They are estimated because it is impossible to predict with 100% certainty the genetic merit of an animal and therefore the genetic merit of the progeny of a particular mating.

The accuracy of an EBV depends on two major factors:

1. The heritability of the trait. That is, the proportion of an animals superiority that is passed on to its progeny; and
2. The amount of performance information available on an animal and its relatives.

The accuracy of an EBV will increase as more performance information on an animal and its relatives becomes available. The following examples indicate how accuracy is related to progeny numbers and relatives.

If the only information available is an animal's own performance for one trait with a heritability of 30%, the accuracy will be 55% (provided the bull is in an effective contemporary group). If information is also known on about 10 paternal half sibs and 2 maternal half sibs, then accuracy increases to 61%. If information were also known on 10 progeny then accuracy would further increase to 77%. Note that animals with parents of high accuracy could have higher accuracy than the examples shown in Table 1.

Highly accurate EBVs are very reliable. There is little risk that the progeny performance of an individual with high accuracy EBVs will, on average, be much different than the EBVs indicate. Alternatively, the average progeny performance of an individual with low accuracy values may be quite different from what his EBVs indicate.

Table 1: Accuracy of EBVs for a trait with heritability of 30% (400-Day Weight)

Information Available	Accuracy
Individual	55
Individual + 10 PHS* + 2 MHS**	61
Individual + 20 PHS* + 4 MHS**	64
10 Progeny	67
Individual + 10 PHS + 2 MHS + 10 Progeny	77

* PHS = Effective paternal half sibs.

** MHS = Effective maternal half sibs.

Accuracy for a particular trait and heritability for that trait can be used to calculate confidence intervals for EBVs. For various levels of accuracy the possible changes in EBVs (known as standard errors) for each trait are shown in Table 2.

Table 2: Standard errors of EBVs at different levels of accuracy

	Accuracy (%)				
EBV	**60%**	**70%**	**80%**	**90%**	**99%**
Birth Weight	1.9	1.7	1.4	1.1	0.3
Milk	5.6	5.0	4.2	3.1	1.0
200-Day Growth	7.7	6.9	5.8	4.2	1.4
400-Day Weight	12.4	11.1	9.3	6.8	2.2
600-Day Weight	15.5	13.9	11.6	8.5	2.7
Mature Cow Weight	24.0	21.4	18.0	13.1	4.2
Scrotal Size	1.0	0.9	0.8	0.6	0.2
Days to Calving	5.0	4.4	3.7	2.7	0.9
Carcase Weight	12.8	11.4	9.6	7.0	2.3
Rib Fat	1.2	1.0	0.9	0.6	0.2
Rump Fat	1.6	1.4	1.2	0.9	0.3
Eye Muscle Area	2.0	1.7	1.5	1.1	0.3
Retail Beef Yield %	1.2	1.1	0.9	0.7	0.2
Intra Muscular Fat %	0.8	0.7	0.6	0.4	0.1

Statistically, there is a 68% chance that the *true* breeding value will be within plus or minus 1 standard error of the EBV, and a 95% chance that it will be within 2 standard errors.

For example, for a 600-Day Weight EBV that is reported with 99% accuracy, there is a 68% chance that the *true* breeding value is within plus or minus 2.7 kg. Further, there is a 95% chance that the *true* breeding value is within plus or minus 5.4 kg (ie 2 x 2.7 kg). This means that as further information is added for this animal (eg from progeny), the EBV would be expected to fall within the range of ± 2.7 kg 68% of the time and within ± 5.4 kg 95% of the time.

GROUP EBVs - Traits Reported

Calving Ease EBVs: are based on calving ease (CE) scores, birth weights and gestation length information. More positive EBVs are favourable and indicate easier calving.

DIR direct CE indicates how this animal influences the birth of its progeny.

DTRS is daughter's calving ease and indicates how well the animal produces daughters that have easier calving.

Gestation Length EBV: are based on AI records. Lower (negative) GL EBVs indicate easier calving and increased growth after birth.

Birth Weight EBV: indicates the genetic potential for birth weight. The lower the birth weight EBV of a sire the lighter is the birth weight potential of his progeny.

Scrotal Size EBV: is an indicator of fertility in males, which passes on in part to female relatives. Increased scrotal size is associated with increased fertility in male progeny and with earlier age at puberty of male and female progeny.

Days to Calving: is an indicator of female fertility based on the time between the cow's first exposure to a bull and when she subsequently calves. Cows that calve late in the season or fail to calve are penalised. This is more useful as a sire trait. Lower (negative) EBVs are preferred indicating shorter days to calving for the sire's daughters.

Milk EBV: reflects extra calf weight which is due to the genetic influence a sire has on his daughters' milking and mothering ability. Bulls with above average Milk EBVs are expected to sire daughters with above average milking potential. To improve milk in your female herd, select bulls with well above the current breed average EBV and with high accuracy. An animal's Milk EBV is usually less accurate than its growth EBVs because of the lower heritability of the trait and the time lag before the performance of the daughter's calves becomes available.

200-Day Growth EBV: is an estimate of an animal's genetic potential for growth to weaning. This trait should be emphasised if you are selecting cattle to finish for the lightweight domestic trade. It is also important to consider the maturity patterns required for this trade.

400-Day Weight EBV: is an estimate of an animal's genetic potential for yearling weight. This trait should be emphasised where you are targeting the domestic and/or yearling trade, or where you require increased weights of your vealers.

600-Day Weight EBV: is an estimate of an animal's potential for growth to maturity. This trait should be emphasised if you breed for the heavyweight export markets or if you wish to extend the growth potential of your progeny.

Mature Cow Weight EBV: is an estimate of the genetic difference in cow weight at 5 years of age. Smaller, or more moderate EBVs are generally more favourable.

Carcase Weight EBV: is an indicator of the genetic difference in carcase weight at a standard age of 650 days.

Eye Muscle Area EBV: indicates an animal's genetic potential for eye muscle area on a standard 300 kg carcase. Sires with relatively higher EMA EBVs are expected to produce better muscled and higher percentage yielding progeny at the same carcase weight than will sires with lower EMA EBVs.

Rib and Rump Fat EBVs: are indicators of an animal's genetic potential for subcutaneous fat depth on a standard 300kg carcase. Sires with low, or negative, fat depth EBVs are expected to produce leaner progeny at any particular carcase weight than will sires with higher EBVs.

Retail Beef Yield Percent EBV: indicates genetic differences between animals for retail yield percentage in a standard 300kg carcase. Sires with larger EBVs are expected to produce progeny with higher yielding carcases.

Intra Muscular Fat Percent EBV: indicates genetic differences between animals for intra muscular fat percentage (marbling) in a standard 300kg carcase. Sires with positive EBVs are expected to produce progeny with higher average marble scores.

Comparing Animals on Performance Using EBVs

EBVs are a tool that will help you to make more "educated" decisions when you are choosing breeding stock. In this Report you have access to EBVs for 17 important traits. **Always** remember to consider the many other important traits such as structural soundness.

1. Use the EBVs of a sire and dam to predict the outcome of the mating

It is easy to do. Take a bull with an EBV of +30 kg for 600-Day weight for example. On average he will pass half of his genes for 600-Day weight (equivalent to +15 kg) on to his progeny. The dam will also contribute to half of the calf's genetics. If the dam's EBV for 600-Day weight is +10 kg then the calf will get +5 kg from her. In this example, the calf would be expected to be: (15+5) = +20 kg above the fixed base for the Murray Grey breed at 600 days of age.

2. Compare EBVs to estimate the difference in output from two sires

Sire 1 has an EBV for 600-Day weight (the age of selling your cattle) of +40kg and Sire 2 has an EBV of +10 for the same trait. The difference is 30 kg. Half of this difference is passed on to the progeny.

That is, calves from Sire 1 would be expected to be +15kg on average heavier than those from Sire 2 if used on dams of similar genetic value and breed, run under similar conditions. Over a single year's drop of 30 calves this difference amounts to a potential production increase of 450kg live weight.

3. Compare Sires with the Current Murray Grey Genetic Level

The current genetic level for the breed can be determined from the average EBVs for all calves born in 2006. These average EBVs are shown in Table 3.

Table 3: Average GROUP EBVs for the 2006 drop calves analysed in the 2008 Summer Murray Grey GROUP BREEDPLAN

CE-Direct	CE-Dtrs	Gestation Length	Birth Weight	Milk	200-Day Growth	400-Day Weight	600-Day Weight	Mature Cow Weight
-0.2	**-1.2**	**-0.1**	**+2.6**	**+3**	**+15**	**+24**	**+36**	**+37**

Scrotal Size	Days to Calving	Carcase Weight	EMA	Rib Fat	Rump Fat	Retail Beef Yield	IMF%
+0.3	**-1.2**	**+21**	**+1.0**	**-0.2**	**-0.2**	**+0.6**	**0.0**

If you are interested in using a sire with a 200-Day Growth EBV of +17 then comparison to the above averages will show you that the sire is above the current average genetic level for the breed for 200-Day Growth.

By then comparing the sire's EBVs to the full set of percentile bands shown in Table 4, you can determine that for 200-Day Growth the sire is in fact in the top 40% of the current genetic level of the 2006-born calves.

Herd Linkage

A feature of GROUP BREEDPLAN is the checking of linkage between herds. It is these pedigree links between herds that allow across-herd comparisons.

Genetic linkage can occur through both sires and dams although sires generally contribute most to linkage (usually by AI). Linkage is calculated during the GROUP BREEDPLAN analysis and is dependent upon the information available at that time. However, as a broad guide, for a performance-recording herd to become linked it needs to:

1. Use at least 2 sires from this genetic evaluation report that have:
   - greater than 75% accuracy for at least one of the 200, 400 or 600 day growth traits; and
   - been used by at least 2 other performance recording herds.

2. Have approximately 15 or more progeny performance recorded (with at least a 200-day weight) from each of these sires. Note small herds can do this over two or more joinings if required.

Statistics of the 2008 Summer Analysis

The continued increase in submission of data for evaluation in the Murray Grey International GROUP BREEDPLAN analysis reflects the support of Murray Grey breeders world wide to objective measurement of their cattle as a means of genetic improvement.

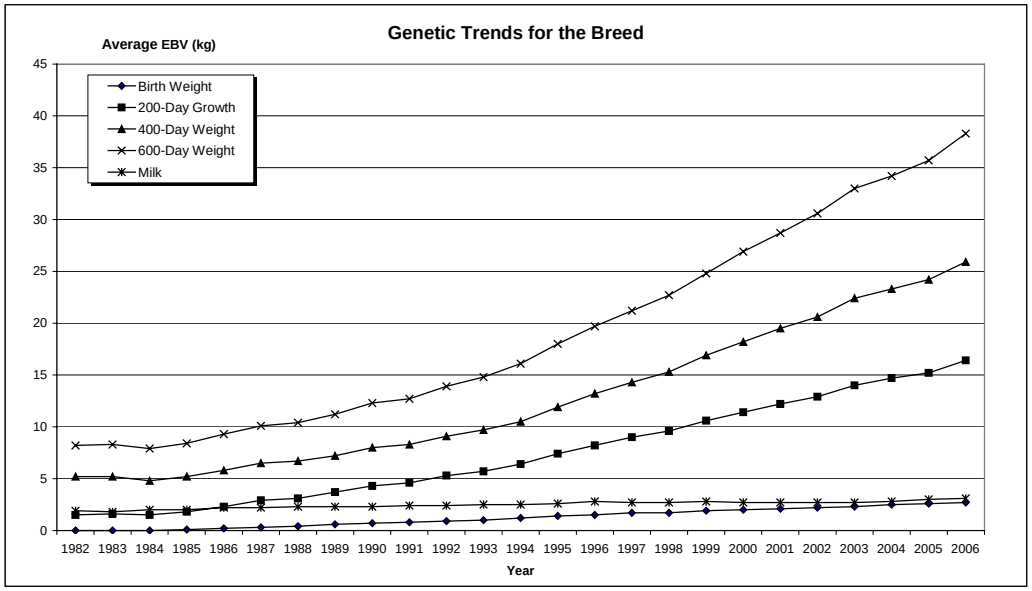
Table 5: Basic data from the Murray Grey analysis

	2006 Winter	2007 Summer	2007 Winter	2008 Summer
No of Sires	21,931	22,323	22,539	22,775
No of Dams	118.955	120,263	121,294	122,468
Birth Weight	143,885	147,715	150,565	153,662
200 Day Wt	122,103	124,134	127,125	129,223
400 Day Wt	79,877	81,648	83,264	85,197
600 Day Wt	51,784	53,174	54,298	55,692
Mature Wt	11,762	12,142	12,609	13,058
Scrotal Size	10,800	11,407	11,619	12,084
Scan	24,594	25,645	26,214	27,207
Carcase	763	775	775	777
Gestation Length	11,996	12,471	12,684	13,051
Days to Calving	35,230	36,025	36,684	37,363

Genetic Trends 1982-2006

The GROUP BREEDPLAN analysis allows for the production of genetic trends, an indication of the genetic progress in participating herds. In Figure 1, the average Estimated Breeding Values for calves in each year are shown as an estimate of genetic trends for the growth and milk traits.

The breed has made significant genetic progress since 1982. Over these years there has been a slight increase in the average EBVs for birth weight and milk, while significant gains have been made in 200-day growth and 400 and 600-day weights.



Note: Murray Grey BREEDPLAN results are calculated using software developed by the Animal Genetics & Breeding Unit, a joint venture of NSW Agriculture and the University of New England.

READING THE SIRE SUMMARY

										GROUP ESTIMATED BREEDING VALUES														
Ident			Owner	------- Statistics ------						Calving-Ease		- Birth -		- Fertility -		---------- Growth ----------					---------- Carcase ----------					
Aust		%	Aust	Num	Prog	Scan	Carc	Perf		DIR	DTRS	GL	Bwt	SS	DC	MILK	200	400	600	Mwt	Cwt	EMA	RIB	RUMP	RBY%	IMF%
NZ	Name	MG	NZ	Herd	Anly	Prog	Prog	Dtrs		acc	acc	acc	acc	acc	acc	acc	acc	acc	acc	acc	acc	acc	acc	acc	acc	acc
BZZ 100	**BZZ POWER**	**100%**	**9**	195	1078	34	0	329		**+9.5**	**+9.6**	**-4.4**	**+2.9**	**+0.7**	**-1.9**	**+6**	**+18**	**+26**	**+40**	**+35**	**+9**	**-1.1**	**-0.3**	**-0.2**	**0.0**	**+0.1**
99999T123	S: BZZ DONALD		150							87%	85%	97%	98%	93%	83%	98%	98%	98%	98%	97%	97%	89%	92%	92%	87%	72%
1	**2**		**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**

EBV: Estimated Breeding Value is the estimated genetic merit of an animal for each recorded production trait. EBVs reflect the difference that can be expected in an animal's performance relative to the breed baseline of zero for each trait. On average, half of this difference will be passed on to the animal's progeny.

EBVs in this report are calculated from the available performance information on the animal, its parents, progeny and its close relatives across a number of herds. This information is adjusted for age at measurement and dam age while allowing for differences between herds, years, season of calving, management effects and for mating and selection biases.

If no EBV is listed in an animal's record, then not enough information for the animal is available to report an EBV for the trait.

ACC: Accuracy (%) is based on the amount of performance information available on the animal and its close relatives - particularly the number of progeny analysed. Accuracy is also based on the heritability of the trait and the genetic correlations with other recorded traits. Hence accuracy indicates the "confidence level" of the EBV.

Accuracy ranges from 0-99% and indicates the probability of an EBV changing with the addition of more progeny data. The magnitude of possible change decreases as accuracy increases. Accuracy below 50% should be regarded as low, between 50-75% as medium, between 76-90% as medium-high and above 90% as high. EBVs with less than 20% accuracy are not reported.

The accuracy is printed below the EBV for the trait.

1. **Ident:** is the Society identification number of the animal. The Murray Grey Beef Cattle Society of Australia identifier is printed on the top line and the New Zealand Murray Grey Beef Cattle Society identifier is printed on the second line.

2. **Animal Name:** is the Society name for the animal.
   Sire: is the Society name for the animal's sire.

3. **% MG:** is the Murray Grey blood percent of the animal as recorded on the Society database.

4. **Owner:** the number in this column is an owner code that is indexed in a separate report.

5. **Num Herd:** is the number of herds in which this animal had performance recorded progeny.

6. **Prog Anly:** is the number of progeny of this animal that had performance information analysed.

7. **Scan Prog:** is the number of progeny of this animal that had scan performance information analysed.

8. **Carc Prog:** is the number of progeny of this animal that had abattoir carcase performance information analysed.

9. **Perf Dtrs:** is the number of this animal's daughters that had progeny performance recorded at 200 or 400 days. This is an indicator of the amount of direct information that was available to evaluate the Milk EBV for this animal.

Calving Ease EBVs are based on calving ease (CE) scores, birth weights and gestation length information. The EBVs are reported as differences in the percentage of unassisted calvings. More positive EBVs indicate easier calving.

10. **DIR:** Direct CE indicates how this animal influences the birth of its progeny from two-year-old heifers.

11. **DTRS:** Daughter's CE indicates how easily the animal's daughters will calve.

12. **GL:** Gestation Length EBV (days) is based on AI records. Lower (negative) GL EBVs indicate easier calving and increased growth after birth.

13. **BWT:** Birth Weight EBV (kg) is based on the measured birth weight of animals, adjusted for dam age. The lower the value the lighter the calf at birth and the lower the likelihood of a difficult birth. This is particularly important when selecting sires for use over heifers.

14. **SS:** Scrotal Size EBV (cm) is calculated from the circumference of the scrotum, measured in centimetres and adjusted to 400 days of age. This EBV is an indicator of male fertility in regards to semen quality and quantity. Higher (positive) EBVs indicate higher fertility. Scrotal size is also positively associated with earlier age at puberty of bull and heifer progeny.

15. **DC:** Days to Calving EBV (days) is an indicator of female fertility based on the time between the cow's first exposure to a bull and when she subsequently calved. Cows that calve late in the season or fail to calve are penalised. Lower (negative) EBVs are preferred indicating shorter days to calving for the sire's daughters.

16. **MILK:** 200-Day Milk EBV (kg) is an estimate of an animal's milking ability. For sires, this EBV indicates the effect of their daughter's milking ability on the 200 and 400-day weights of their calves.

17. **200:** 200-Day Growth EBV (kg) is calculated from the weight of animals taken between 80 and 300 days of age. Values are adjusted to 200 days and for dam age. This EBV is the best single estimate of an animal's genetic merit for growth to early ages.

18. **400:** 400-Day Weight EBV (kg) is calculated from the weight of progeny taken between 301 and 500 days of age, adjusted to 400 days and for dam age. This EBV is the best single estimate of an animal's genetic merit for yearling weight.

19. **600:** 600-Day Weight EBV (kg) is calculated from the weight of progeny taken between 501 and 900 days of age, adjusted to 600 days and for dam age. This EBV is the best single estimate of an animal's genetic merit for growth beyond yearling age.

20. **MWT:** Mature Cow Weight EBV (kg) is an estimate of the genetic difference in cow weight at 5 years of age. Smaller, or more moderate EBVs are generally more favourable.

21. **CWT:** Carcase Weight EBV (kg) estimates the genetic difference in untrimmed hot carcase weight and is adjusted to 650 days of age.

22. **EMA:** Eye Muscle Area EBV (cm^2) estimates genetic differences in eye muscle area at the $12/13^{th}$ rib site of a 300 kg dressed carcase. More positive EBVs indicate better muscling on animals.

23. **RIB:** Rib Fat EBV (mm) estimates the genetic differences in fat depth at the $12/13^{th}$ rib in a 300 kg-dressed carcase. More positive EBVs indicate more subcutaneous fat and earlier maturity.

24. **RUMP:** Rump Fat EBV (mm) estimates the genetic differences in fat depth at the P8 site of a 300 kg-dressed carcase. More positive EBVs indicate more subcutaneous fat and earlier maturity.

25. **RBY%:** Retail Beef Yield Percent EBV (%) represents total (boned out) meat yield as a percentage of a 300kg dressed carcase. A more positive EBV indicates higher percentage yield for the 300kg carcase size.

26. **IMF%:** Intra-muscular Fat Percent EBV (%) is an estimate of the genetic difference in the percentage of intra-muscular fat at the 12/13th rib site in a 300 kg carcase. Depending on market targets, larger more positive values are generally more favourable.

Sires whose EBVs are boxed are **trait leaders** for the highlighted trait.