AngusSire™ Benchmarking Program

Cohorts 5, 6 and 7

Lessons from the

Angus Sire Benchmarking Program

EBVS RELIABLY PREDICT PROGENY PERFORMANCE

How well did the EBVs of bulls entered in the ASBP predict the performance of their progeny?

Introduction

The Angus Sire Benchmarking Program (ASBP) has demonstrated that there is great potential to achieve genetic improvement in Angus breeding programs by utilising selection tools, such as Estimated Breeding Values (EBVs) and Selection Indexes.

A recent project undertaken by Angus Australia, with funding assistance from the MLA Donor Company, assessed the progeny performance of sires in cohorts 5, 6 and 7 of the ASBP, to analyse how well the EBVs of the sires when entered in the program aligned with the actual performance of their progeny. The project builds on previous work which examined cohorts 1, 2 and 3.

This project has confirmed that EBVs provided a reliable prediction of how the progeny from sires in the ASBP subsequently performed, and should be used with confidence when selecting animals for use within a beef breeding program.

Background

The Angus Sire Benchmarking Program is an initiative of Angus Australia that aims to a) generate progeny test data on modern Angus bulls, particularly for hard to measure traits such as feed efficiency, abattoir carcase measurements, meat quality attributes and female reproduction; b) generate data for the validation and refinement of the TransTasman Angus Cattle Evaluation (TACE); and c) build a comprehensive phenotype and genotype database on Australian Angus animals for genomic technology validation, research and development.

The ASBP program in each cohort joins on average 40 sires a year to approximately 2000 Angus cows, to produce 25 progeny (50:50 steers and heifers) per sire using fixed time AI. In this program, the progeny of each sire are comprehensively performance recorded across a range of traits relating to fertility, weight, feed efficiency and carcase merit.

Project Design

To evaluate how well the EBVs of the sires in cohorts 5 to 7 of the ASBP aligned with the actual performance of their progeny, the following steps were completed:

1. The TransTasman Angus Cattle Evaluation EBVs when the sires were entered into the ASBP were collated.

   The EBVs for sires in each cohort were as follows:

   - Cohort 5 - March 2015 TransTasman Angus Cattle Evaluation
   - Cohort 6 - March 2016 TransTasman Angus Cattle Evaluation
   - Cohort 7 - March 2017 TransTasman Angus Cattle Evaluation

2. The performance of progeny for all traits was collated and the standard adjustments and contemporary groupings applied.

   The performance data was then analysed through the Statistical Analysis System (SAS) to generate Least Squares Means (LSMs), being each sire's average progeny performance for each trait.

3. Once the EBVs and progeny performance of each sire had been collated, the EBVs of sires in each cohort were ranked from highest to lowest for each trait. Then, the average EBV of the highest 10 and lowest 10 sires were used to calculate how much difference in performance was predicted between the progeny sired by bulls in each of the two groups.

   The predicted difference was then compared to the actual difference in progeny performance that was observed within the ASBP to ascertain how well the EBVs predicted the breeding value of the highest and lowest 10 sires for each trait.

Project Design - Example

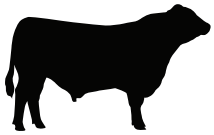
ASBP Cohort Sires

Highest 10
Bwt EBV Sires

Avg. EBV = +6.4 kg

Bred to

Lowest 10
Bwt EBV Sires

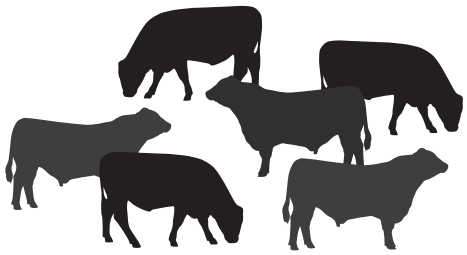


Avg. EBV = +2.4 kg

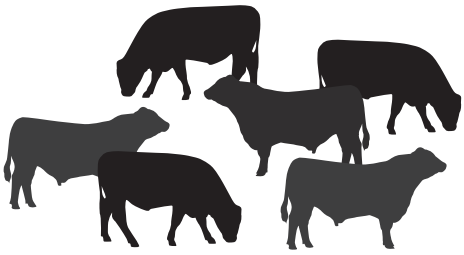
EBV Difference
= 4 kg
= 2 kg difference expected
in progeny

ASBP Cooperator herds

Progeny Avg. of
Highest 10 Bwt EBV Sires = 34 kg



Progeny Avg. of
Lowest 10 Bwt EBV Sires = 32 kg



Performance of progeny
Difference = 2 kg

EBVs reliably predicted the performance of the progeny

Traits Analysed

Calving Ease

Birth Weight: Weight at birth in kilograms, with lower values indicating lighter birth weights. Birth weight was recorded on both steer and heifer progeny in the ASBP.

Gestation Length: Length of time in days from conception to birth, with lower values indicating shorter gestation length. Gestation length was recorded on both steer and heifer progeny in the ASBP.

Growth

200 Day Weight: Weight in kilograms at 200 Days of age (i.e. weaning weight), with higher values indicating heavier weaning weights. 200 Day Weight recorded on both steer and heifer progeny in the ASBP.

400 Day Weight: Weight in kilograms at 400 Days of age (i.e. yearling weight), with higher values indicating heavier yearling weights. 400 Day Weight recorded on both steer and heifer progeny in the ASBP.

600 Day Weight: Weight in kilograms at 600 Days of age (i.e. 20 months), with higher values indicating heavier yearling weights. 600 Day Weight recorded on both steer and heifer progeny in the ASBP.

Carcase Composition

Carcase Weight: Weight of the hot standard carcase in kilograms at 750 days of age (i.e. 25 months), with higher values indicating heavier carcase weights. Carcase Weight recorded on steer progeny in the ASBP.

Carcase Eye Muscle Area (EMA): Eye Muscle Area in cm^2 in a 400kg carcase, higher values indicating larger Eye Muscle Area. Carcase Eye Muscle Area measured on steer progeny in the ASBP.

Carcase Rump Fat: Subcutaneous fat measurement in mm at the P8 rump site in a 400kg carcase, higher values indicating more rump fat. Carcase Rump Fat measured on steer progeny in the ASBP.

Carcase Rib Fat: Subcutaneous fat measurement in mm at the 12th and 13th rib site in a 400kg carcase, higher values indicating more rib fat. Carcase Rib Fat measured on steer progeny in the ASBP.

Carcase Intra-muscular Fat (IMF): Percentage of intra-muscular fat (NIR calibrated to ether extracted at the UNE meat science laboratory) in a 400kg carcase, higher values indicating more intramuscular fat. Carcase Intra-muscular Fat measured on steer progeny in the ASBP.

Fertility

Days to Calving: Length of days from the start of joining (i.e bull in date) to calving, with lower values indicating shorter days to calving and improved female reproduction. Days to Calving was recorded on the heifer progeny of sires in the ASBP for their first joining as yearlings.

Feed Efficiency

Net Feed Intake – Feedlot: Feed Intake measured in kg of feed intake per day at a standard weight and rate of weight gain, lower values indicating better feed efficiency through less feed intake for the same weight and rate of weight gain. Net Feed Intake – Feedlot is recorded on all steer progeny in the ASBP at the Tullimba Research Feedlot.

Results

The project has shown that the EBVs of the sires entered in cohorts 5, 6 and 7 provided a reliable prediction of the performance of their progeny.

Calving Ease (Birth Weight, Gestation Length)

The difference between the average Birth Weight EBV of the highest and lowest 10 Birth Weight EBV sires in each cohort was on average 3.7 kg, across cohorts 5, 6 and 7. This equates to a predicted difference in the average birth weight of progeny of sires in both groups of 1.9 kg. The predicted difference is only half the difference in the EBVs as the sires only contribute to half of their progeny's genetics.

When the average birth weight of the progeny from the highest and lowest 10 Birth Weight sires was measured, the actual difference in birth weight was 1.5 kg, demonstrating the EBVs were accurately predicting the breeding value of sires for birth weight.

Birth Weight	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	6.1 kg	6.7 kg	6.0 kg	6.3 kg
Average Low EBV	2.6 kg	2.7 kg	2.4 kg	2.6 kg
Difference in EBV	3.5 kg	4.0 kg	3.6 kg	3.7 kg
Expected Difference (EBV)	1.8 kg	2.0 kg	1.8 kg	1.9 kg
Average High LSM	38.5 kg	38.3 kg	38.4 kg	38.4 kg
Average Low LSM	37.3 kg	36.3 kg	37.1 kg	36.9 kg
Actual Difference (LSM)	1.2 kg	2.0 kg	1.3 kg	1.5 kg

Similarly, the difference between the average Gestation Length EBV of the highest and lowest 10 Gestation Length EBV sires in each cohort was on average 5.6 days across cohorts 5, 6 and 7. Therefore, it was predicted that the progeny of the 10 sires with the lowest Gestation Length EBVs would be born, on average, 2.8 days earlier than the progeny of the 10 sires with the highest Gestation Length EBVs.

When the gestation length data of progeny from both groups of sires was collated, the difference was 2.7 days, and closely aligned with the difference predicted by the sire EBVs.

Gestation Length	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	-1.5 days	-2.2 days	-2.7 days	-2.1 days
Average Low EBV	-8.3 days	-7.9 days	-7.0 days	-7.8 days
Difference in EBV	6.8 days	5.7 days	4.3 days	5.6 days
Expected Difference (EBV)	3.4 days	2.9 days	2.2 days	2.8 days
Average High LSM	280.9 days	281.1 days	281.4 days	281.1 days
Average Low LSM	277.7 days	278.7 days	278.8 days	278.4 days
Actual Difference (LSM)	3.3 days	2.3 days	2.6 days	2.7 days

Growth (200, 400 & 600 Day Weights)

The difference between the average EBV of the highest and lowest 10 EBV sires for 200 day growth and 400 and 600 day weight EBV in each cohort was on average 17.3 kg, 29.1 kg and 42.1 kg respectively, across cohorts 5, 6 and 7. This equates to a predicted difference in the average weight of progeny of sires in both groups of 8.7 kg, 14.6 kg and 21.1 kg at 200, 400 and 600 days of age.

When weighed, the actual difference in the weight of progeny was 8.6 kg, 14.2 kg and 19.9 kg, and demonstrated the EBVs of the sires provided a reliable indication of their genetics for growth.

200 Day Weight	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	55.4 kg	56.4 kg	58.4 kg	56.7 kg
Average Low EBV	33.4 kg	40.5 kg	44.2 kg	39.4 kg
Difference in EBV	22.0 kg	15.9 kg	14.2 kg	17.3 kg
Expected Difference (EBV)	11.0 kg	8.0 kg	7.1 kg	8.7 kg
Average High LSM	251.0 kg	217.6 kg	231.6 kg	233.4 kg
Average Low LSM	237.4 kg	209.2 kg	227.9 kg	224.8 kg
Actual Difference (LSM)	13.6 kg	8.4 kg	3.7 kg	8.6 kg

400 Day Weight	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	102.5 kg	101.8 kg	105.7 kg	103.3 kg
Average Low EBV	63.8 kg	76.5 kg	82.3 kg	74.2 kg
Difference in EBV	38.7 kg	25.3 kg	23.4 kg	29.1 kg
Expected Difference (EBV)	19.3 kg	12.7 kg	11.7 kg	14.6 kg
Average High LSM	375.7 kg	360.4 kg	362.9 kg	366.3 kg
Average Low LSM	359.2 kg	347.0 kg	350.2 kg	352.1 kg
Actual Difference (LSM)	16.5 kg	13.4 kg	12.7 kg	14.2 kg

600 Day Weight	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	137.8 kg	137.2 kg	138.2 kg	137.7 kg
Average Low EBV	81.6 kg	99.0 kg	106.1 kg	95.6 kg
Difference in EBV	56.2 kg	38.2 kg	32.1 kg	42.1 kg
Expected Difference (EBV)	28.1 kg	19.1 kg	16.0 kg	21.1 kg
Average High LSM	571.3 kg	623.2 kg	586.8 kg	593.8 kg
Average Low LSM	545.7 kg	603.2 kg	572.6 kg	573.8 kg
Actual Difference (LSM)	25.6 kg	19.9 kg	14.2 kg	19.9 kg

Carcase Composition (Carcase Weight, Eye Muscle Area, Intramuscular Fat, Rib and Rump Fat)

The difference between the average EBV of the highest and lowest 10 EBV sires for Carcase Weight, Eye Muscle Area, Rib Fat, Rump Fat and Intramuscular Fat EBV in each cohort was on average 30.8 kg, 6.7 cm^2, 3.7 mm, 4.0 mm and 2.6% respectively, across cohorts 5, 6 and 7. This equates to a predicted difference in the sires average carcase progeny performance of 15.4 kg dressed carcase weight, 3.3 cm^2 eye muscle area, 1.8 mm rib fat depth, 2.0 mm rump fat depth and 1.3% intramuscular fat.

When the steer progeny were slaughtered and abattoir carcase measurements collected, the actual difference in the carcase performance weight of progeny was 13.4 kg dressed carcase weight, 2.6 cm^2 eye muscle area, 1.8 mm rib fat depth, 0.9 mm rump fat depth and 1.5% intramuscular fat.

This demonstrates that the EBVs of sires in cohorts 5, 6 and 7 provided an accurate prediction of their carcase genetics, particularly for carcase weight, EMA and IMF, and can be used with confidence when selecting animals for superior carcase genetics. The results for fat depth were variable in some cohorts, which may be explained by the difficulties in accurately collecting these measurements.

Carcase Weight	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	77.3 kg	83.2 kg	86.3 kg	82.3 kg
Average Low EBV	40.6 kg	52.9 kg	60.8 kg	51.4 kg
Difference in EBV	36.7 kg	30.3 kg	25.5 kg	30.8 kg
Expected Difference (EBV)	18.4 kg	15.1 kg	12.7 kg	15.4 kg
Average High LSM	429.3 kg	435.2 kg	429.9 kg	431.5 kg
Average Low LSM	411.2 kg	423.4 kg	419.8 kg	418.1 kg
Actual Difference (LSM)	18.1 kg	11.9 kg	10.1 kg	13.4 kg

Carcase EMA	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	10.6 cm^2	11.1 cm^2	8.4 cm^2	10.0 cm^2
Average Low EBV	2.8 cm^2	3.6 cm^2	3.6 cm^2	3.3 cm^2
Difference in EBV	7.8 cm^2	7.5 cm^2	4.8 cm^2	6.7 cm^2
Expected Difference (EBV)	3.9 cm^2	3.8 cm^2	2.4 cm^2	3.3 cm^2
Average High LSM	89.2 cm^2	94.1 cm^2	90.3 cm^2	91.2 cm^2
Average Low LSM	87.3 cm^2	89.7 cm^2	88.8 cm^2	88.6 cm^2
Actual Difference (LSM)	1.9 cm^2	4.4 cm^2	1.6 cm^2	2.6 cm^2

Carcase Rib Fat	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	1.9 mm	2.1 mm	1.8 mm	1.9 mm
Average Low EBV	-2.2 mm	-1.5 mm	-1.6 mm	-1.8 mm
Difference in EBV	4.1 mm	3.6 mm	3.4 mm	3.7 mm
Expected Difference (EBV)	2.0 mm	1.8 mm	1.7 mm	1.8 mm
Average High LSM	18.2 mm	14.7 mm	15.3 mm	16.1 mm
Average Low LSM	15.6 mm	14.6 mm	12.8 mm	14.3 mm
Actual Difference (LSM)	2.6 mm	0.1 mm	2.5 mm	1.8 mm

Carcase Rump Fat	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	2.2 mm	1.9 mm	1.3 mm	1.8 mm
Average Low EBV	-2.6 mm	-1.9 mm	-2.2 mm	-2.2 mm
Difference in EBV	4.8 mm	3.8 mm	3.5 mm	4.0 mm
Expected Difference (EBV)	2.4 mm	1.9 mm	1.7 mm	2.0 mm
Average High LSM	19.6 mm	19.6 mm	22.9 mm	20.7 mm
Average Low LSM	19.5 mm	19.6 mm	20.3 mm	19.8 mm
Actual Difference (LSM)	0.1 mm	0.0 mm	2.6 mm	0.9 mm

Carcase IMF	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	2.8 %	3.9 %	4.0 %	3.6 %
Average Low EBV	0.5 %	0.9 %	1.4 %	0.9 %
Difference in EBV	2.3 %	3.0 %	2.6 %	2.6 %
Expected Difference (EBV)	1.2 %	1.5 %	1.3 %	1.3 %
Average High LSM	9.9 %	9.3 %	9.4 %	9.5 %
Average Low LSM	8.4 %	7.8 %	7.8 %	8 %
Actual Difference (LSM)	1.5 %	1.5 %	1.6 %	1.5 %

Fertility (Days to Calving)

The difference between the average Days to Calving EBV of the highest and lowest 10 Days to Calving EBV sires in each cohort was on average 4.5 days across cohorts 5, 6 and 7. Therefore it was predicted that the heifer progeny of the 10 sires with the lowest Days to Calving EBVs would calve, on average, 2.2 days earlier than the progeny of the 10 sires with the highest Days to Calving EBVs

When the heifer progeny were calved down at 2 years of age and their calving records collated, the progeny sired by the lowest Days to Calving EBV sires calved on average, 1 day earlier than the progeny sired by the highest Days to Calving EBV sires.

Days to Calving	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	-1.3 days	-2.5 days	-3.5 days	-2.4 days
Average Low EBV	-6.6 days	-6.5 days	-7.8 days	-6.9 days
Difference in EBV	5.3 days	4.0 days	4.3 days	4.5 days
Expected Difference (EBV)	2.7 days	1.9 days	2.1 days	2.2 days
Average High LSM	302 days	298 days	305 days	301 days
Average Low LSM	302 days	298 days	308 days	302 days
Actual Difference (LSM)	0 days	0 days	3 days	1 days

Feed Efficiency (Net Feed Intake – Feedlot)

The difference between the Net Feed Intake - Feedlot EBV of the highest and lowest 10 NFI-F EBV sires in each cohort was on average 0.7 kg/day across cohorts 5, 6 and 7, indicating the progeny of the lowest NFI-F sires were predicted to eat 0.3 kg less feed per day for the same weight and rate of weight gain.

When the steer progeny were tested for feed intake at Tullimba Research Feedlot using GrowSafe technology, the actual difference between the progeny of the high and low NFI-F EBV sire groups was 0.2 kg/day.

Net Feed Intake - Feedlot	Cohort 5	Cohort 6	Cohort 7	Average
Average High EBV	0.6 kg/day	0.6 kg/day	0.6 kg/day	0.6 kg/day
Average Low EBV	-0.3 kg/day	-0.1 kg/day	-0.0 kg/day	-0.1 kg/day
Difference in EBV	0.9 kg/day	0.7 kg/day	0.6 kg/day	0.7 kg/day
Expected Difference (EBV)	0.5 kg/day	0.3 kg/day	0.3 kg/day	0.3 kg/day
Average High LSM	-1.9 kg/day	-3.4 kg/day	-3.3 kg/day	-2.9 kg/day
Average Low LSM	-2.4 kg/day	-3.5 kg/day	-3.4 kg/day	-3.1 kg/day
Actual Difference (LSM)	0.5 kg/day	0.1 kg/day	0.1 kg/day	0.2 kg/day

Conclusion

This project has revealed that Estimated Breeding Values provided an accurate prediction of the breeding value of sires in cohorts 5, 6 and 7 of the Angus Sire Benchmarking Program.

When selecting animals for use within a breeding program, the use of EBVs and selection index values, coupled with the significant genetic variation that is present within the Angus breed, provides a considerable opportunity to improve the productivity and profitability of a beef breeding enterprise.

Trait	Expected Difference	Actual Difference
Birth Weight	1.9 kg	1.5 kg
Gestation Length	2.8 days	2.7 days
200 Day Weight	8.7 kg	8.6 kg
400 Day Weight	14.6 kg	14.2 kg
600 Day Weight	21.1 kg	19.9kg
Carcase Weight	15.4 kg	13.4 kg
Carcase Rib Fat	1.8 mm	1.8 mm
Carcase Rump Fat	2.0 mm	0.9 mm
Carcase EMA	3.3cm^2	2.6cm^2
Carcase IMF	1.3%	1.5%
DTC	2.2 days	1 days
NFI-F	0.3 kg/day	0.2 kg/day

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