AngusSire™ Benchmarking Program

Cohorts 5, 6 and 7

Lessons from the

Angus Sire Benchmarking Program

EBVS: DID THEY CHANGE?

How much did the EBVs of sires in the ASBP change?

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 EBVs of sires entered in cohorts 5, 6 and 7 of the ASBP. The project builds on previous work which examined cohorts 1, 2 and 3, and analysed whether the sires' EBVs when they were initially joined in the ASBP program differed considerably from their EBVs at the end of program, by which time their progeny had been comprehensively performance recorded.

This project has confirmed that while the EBVs for some individual sires did change, as expected, there was, on average, minimal change in the EBVs of the sires. The initial sire EBVs, despite being of low accuracy, described the relative genetic merit of the sires well.

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 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 determine if the EBVs of sires when they were initially joined in the ASBP aligned with their EBVs when their progeny had been comprehensively performance recorded, the following steps were undertaken.

1. Initial EBVs: The TransTasman Angus Cattle Evaluation EBVs and EBV accuracies 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

1. Final EBVs: The EBVs and EBV accuracies for each sire once they had been progeny tested in the ASBP were collated. The "final" EBVs included comprehensive performance information obtained from the progeny of each sire in the ASBP, as well as other industry data.

2. Once both the "initial" and "final" EBVs and EBV accuracies from each sire had been collated, the "initial" EBVs of sires in each cohort were ranked from highest to lowest for each trait, and the average "initial" EBV and EBV accuracy of the highest and lowest 10 sires for each trait was calculated. This was then compared to the corresponding average "final" EBV and EBV accuracy for these sires, to evaluate how much change in EBVs and EBV accuracies had occurred.

It should be noted that several enhancements were implemented into the analytical software that is used within the TransTasman Angus Cattle Evaluation between when the initial and final EBVs were published. The most notable of these enhancements was the implementation of a new methodology for incorporating genomic information in the prediction of breeding value. Any effect of the introduction of enhancements to analytical software on the EBVs that are published has not been removed from this analysis.

EBVs Analysed

Calving Ease

Birth Weight (kg): Genetic differences between animals in calf weight at birth. Lower EBVs indicate lighter birth weight.

Gestation Length (days): Genetic differences between animals in the length of time from the date of conception to the birth of the calf. Lower EBVs indicate shorter gestation length.

Growth

200 Day Weight (kg): Genetic differences between animals in live weight at 200 days of age due to genetics for growth. Higher EBVs indicate heavier live weight.

400 Day Weight (kg): Genetic differences between animals in live weight at 400 days of age. Higher EBVs indicate heavier live weight.

600 Day Weight (kg): Genetic differences between animals in live weight at 600 days of age. Higher EBVs indicate heavier live weight.

Carcase Composition

Carcase Weight (kg): Genetic differences between animals in hot standard carcase weight at 750 days of age. Higher EBVs indicate heavier carcase weight.

Carcase Eye Muscle Area (EMA) (cm^2): Genetic differences between animals in eye muscle area at the 12/13th rib site in a 400kg carcase. Higher EBVs indicate larger eye muscle area.

Carcase Rump Fat (mm): Genetic differences between animals in fat depth at the P8 rump site in a 400kg carcase. Higher EBVs indicate more fat.

Carcase Rib Fat (mm): Genetic differences between animals in fat depth at the 12/13th rib site in a 400kg carcase. Higher EBVs indicate more fat.

Carcase Intra-muscular Fat (IMF) (%): Genetic differences between animals in intramuscular fat (marbling) at the 12/13th rib site in a 400kg carcase. Higher EBVs indicate more intramuscular fat.

Fertility

Days to Calving (days): Genetic differences between animals in the time from the start of the joining period (i.e. when the female is introduced to a bull) until subsequent calving. Lower EBVs indicate a shorter time to calving.

Feed Efficiency

Net Feed Intake – Feedlot (kg/day): Genetic differences between animals in feed intake at a standard weight and rate of weight gain when animals are in a feedlot finishing phase. Lower EBVs indicate more feed efficiency.

Results

The project has shown that while the EBVs for some individual sires did change, as expected, there was on average, minimal change in the EBVs of the sires, and the sires' initial EBVs aligned closely with their EBVs at the end of the program when their progeny had been comprehensively performance recorded.

Calving Ease (Birth Weight, Gestation Length)

In cohorts 5, 6 and 7 of the ASBP, the 10 sires in each cohort with the highest initial Birth Weight EBVs had an average initial EBV of +6.3 kg. By comparison, the average final Birth Weight EBV for these same sires was +6.3 kg, reflecting no change in the EBV. The average accuracy of the initial and final Birth Weight EBVs for these sires increased from 75% to 93%.

Similarly, the 10 sires in each cohort with the lowest initial Birth Weight EBV had an average initial EBV of +2.6 kg. By comparison, the average final Birth Weight EBVs of these same sires was also +3.1 kg. The average accuracy of the initial and final Birth Weight EBVs for these sires increased from 81% to 95%.

Birth Weight (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 6.1 kg	+ 6.2 kg	78 %	94 %
	6	+ 6.7 kg	+ 6.5 kg	74 %	92 %
	7	+ 6.0 kg	+ 6.3 kg	73 %	92 %
	Average	+ 6.3 kg	+ 6.3 kg	75 %	93 %
Average Lowest 10	5	+ 2.6 kg	+ 3.4 kg	77 %	94 %
	6	+ 2.7 kg	+ 3.2 kg	82 %	95 %
	7	+ 2.5 kg	+ 2.6 kg	85 %	96 %
	Average	+ 2.6 kg	+ 3.1 kg	81 %	95 %

Gestation Length (days)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	- 1.5 days	- 1.9 days	69 %	94 %
	6	- 2.2 days	- 3.4 days	78 %	95 %
	7	- 2.7 days	- 3.2 days	80 %	95 %
	Average	- 2.1 days	- 2.8 days	76 %	95 %
Average Lowest 10	5	- 8.3 days	- 8.5 days	80 %	95 %
	6	- 7.9 days	- 7.7 days	82 %	94 %
	7	- 7.0 days	- 8.1 days	76 %	94 %
	Average	-7.7 days	- 8.1 days	79 %	94 %

For gestation length, the change in the average initial and final Gestation Length EBVs of the 10 sires with the highest initial EBVs in each cohort was only 0.7 days (-2.1 days versus -2.8 days), whereas the difference between the average initial and final Gestation Length EBVs of the 10 sires with the lowest initial EBVs was only 0.4 days (-7.7 days versus -8.1 days). The average EBV accuracy increased for the two groups of sires by 19% and 15% respectively.

Growth (200, 400 & 600 Day Weights)

The average initial EBV of the 10 sires in each cohort with the highest EBV for 200 Day Growth and 400 and 600 Day Weight was +56 kg, +104 kg and +138 kg respectively. By comparison, the average final EBV for the same sires was +58 kg, +105 kg and +141 kg, representing at most a change of 3 kg between the EBVs when the sires were entered in the ASBP and the EBVs when all the sires' progeny performance data had been analysed for 200 Day Growth and 400 and 600 Day Weight. The increase in accuracy for these EBVs was 16% for 200 Day Growth (75 to 91%), 16% for 400 Day Weight (75 to 91%) and 15% for 600 Day Weight (77 to 92%).

Similarly, the average initial EBV of the 10 sires in each cohort with the lowest EBV for 200 Day Growth and 400 and 600 Day Weight was +39 kg, +74 kg and +96 kg respectively. The average final EBV for the same sires was +41 kg, +78 kg and +101 kg, representing a change of only 2 kg, 4 kg and 5 kg. The increase in accuracy for the 200 Day Growth and 400 and 600 Day Weight EBVs was 16%, 15% & 14% respectively.

200 Day Growth (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 55 kg	+ 56 kg	72 %	91 %
	6	+ 56 kg	+ 57 kg	75 %	90 %
	7	+ 58 kg	+ 60 kg	77 %	93 %
	Average	+ 56 kg	+ 58 kg	75 %	91 %
Average Lowest 10	5	+ 34 kg	+ 34 kg	73 %	91 %
	6	+ 40 kg	+ 43 kg	76 %	92 %
	7	+ 44 kg	+ 47 kg	76 %	91 %
	Average	+ 39 kg	+ 41 kg	75 %	91 %

400 Day Weight (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 103 kg	+ 102 kg	73 %	92 %
	6	+ 102 kg	+ 103 kg	75 %	90 %
	7	+ 106 kg	+ 110 kg	77 %	92 %
	Average	+ 104 kg	+ 105 kg	75 %	91 %
Average Lowest 10	5	+ 64 kg	+ 67 kg	75 %	91 %
	6	+ 77 kg	+ 81 kg	77 %	92 %
	7	+ 82 kg	+ 85 kg	76 %	91 %
	Average	+ 74 kg	+ 78 kg	76 %	91 %

600 Day Weight (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 138 kg	+ 138 kg	77 %	93 %
	6	+ 137 kg	+ 143 kg	77 %	91 %
	7	+ 138 kg	+ 143 kg	77 %	93 %
	Average	+ 138 kg	+ 141 kg	77 %	92 %
Average Lowest 10	5	+ 82 kg	+ 83 kg	77 %	92 %
	6	+ 99 kg	+ 106 kg	78 %	93 %
	7	+ 106 kg	+ 114 kg	78 %	92 %
	Average	+ 96 kg	+ 101 kg	78 %	92 %

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

For the carcass composition traits, the change in the average initial and final Carcase Weight EBVs of the 10 sires with the highest initial EBVs in each cohort was only 3 kg (+82 kg versus +79 kg), with a similar difference between the average initial and final Carcase Weight EBVs of the 10 sires with the lowest initial EBVs (+52 kg versus +54 kg). The average EBV accuracy increased for the two groups of sires by 21% and 22% respectively.

The average initial EBV of the 10 sires in each cohort with the highest EBV for Carcase EMA, IMF, Rib and Rump Fat was +10.0cm^2, +3.6%, +1.9mm and +1.8mm respectively. By comparison, the average final EBV for the same sires was +9.3cm^2, +3.3%, +1.5mm and +0.9mm. This represents a very small change in the carcase composition EBVs generated at the initial joining period to the EBVs generated when all the sire's progeny carcass performance had been included in the analysis. The increase in accuracy for these EBVs was 23% for Carcase EMA (65% to 88%), 25% for Carcase IMF (62% to 87%), 23% for Carcase Rib Fat (66% to 89%) and 22% for Carcase Rump Fat (65% to 87%).

Similarly, the average initial EBV of the 10 sires in each cohort with the lowest EBV for Carcase EMA, IMF, Rib and Rump Fat was +3.3 cm^2, +0.9%, -1.8mm and -2.2mm respectively. The average final EBV for the same sires was +4.1 cm^2, +0.9%, -1.4mm and -2.0mm, representing a change of only 0.8 cm^2, 0 %, 0.4 mm and 0.2mm. The increase in accuracy for Carcase EMA, IMF, Rib and Rump Fat was 24%, 29%, 23% & 20% respectively.

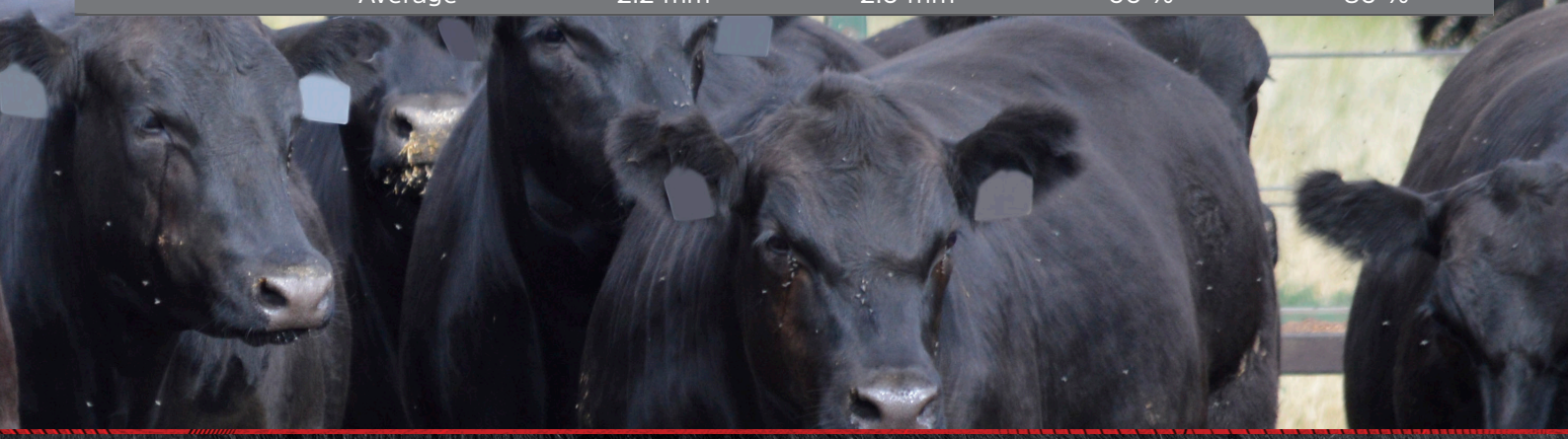
Carcase Weight (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 77 kg	+ 72 kg	66 %	88 %
	6	+ 83 kg	+ 80 kg	68 %	87 %
	7	+ 86 kg	+ 85 kg	66 %	89 %
	Average	+ 82 kg	+ 79 kg	67 %	88 %
Average Lowest 10	5	+ 41 kg	+ 42 kg	63 %	88 %
	6	+ 53 kg	+ 56 kg	69 %	88 %
	7	+ 61 kg	+ 64 kg	67 %	88 %
	Average	+ 52 kg	+ 54 kg	66 %	88 %

Carcase EMA (cm^2)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 10.6 cm^2	+ 8.1 cm^2	66 %	88 %
	6	+ 11.1 cm^2	+ 11.4 cm^2	64 %	87 %
	7	+ 8.4 cm^2	+ 8.3 cm^2	66 %	88 %
	Average	+ 10.0 cm^2	+ 9.3 cm^2	65 %	88 %
Average Lowest 10	5	+ 2.8 cm^2	+ 3.9 cm^2	59 %	84 %
	6	+ 3.6 cm^2	+ 4.8 cm^2	62 %	84 %
	7	+ 3.6 cm^2	+ 3.7 cm^2	63 %	86 %
	Average	+ 3.3 cm^2	+ 4.1 cm^2	61 %	85 %

Carcase IMF (%)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 2.8 %	+ 2.9 %	60 %	85 %
	6	+ 3.9 %	+ 3.4 %	62 %	87 %
	7	+ 4.0 %	+ 3.5 %	63 %	88 %
	Average	+ 3.6 %	+ 3.3 %	62 %	87 %
Average Lowest 10	5	+ 0.5 %	+ 0.6 %	51 %	84 %
	6	+ 0.9 %	+ 0.6 %	58 %	85 %
	7	+ 1.4 %	+ 1.4 %	55 %	84 %
	Average	+ 0.9 %	+ 0.9 %	55 %	84 %

Carcase Rib Fat (mm)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 1.9 mm	+ 2.3 mm	66 %	89 %
	6	+ 2.1 mm	+ 0.4 mm	67 %	89 %
	7	+ 1.8 mm	+ 1.7 mm	65 %	90 %
	Average	+ 1.9 mm	+ 1.5 mm	66 %	89 %
Average Lowest 10	5	-2.2 mm	-1.9 mm	66 %	89 %
	6	-1.5 mm	-0.3 mm	67 %	89 %
	7	-1.6 mm	-2.1 mm	65 %	88 %
	Average	- 1.8 mm	- 1.4 mm	66 %	89 %

Carcase Rump Fat (mm)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 2.2 mm	+ 1.6 mm	64 %	86 %
	6	+ 1.9 mm	+ 0.4 mm	65 %	86 %
	7	+ 1.3 mm	+ 0.6 mm	66 %	88 %
	Average	+ 1.8 mm	+ 0.9 mm	65 %	87 %
Average Lowest 10	5	- 2.6 mm	- 1.9 mm	66 %	87 %
	6	- 1.9 mm	- 1.4 mm	66 %	86 %
	7	- 2.2 mm	- 2.7 mm	65 %	85 %
	Average	- 2.2 mm	- 2.0 mm	66 %	86 %



Fertility (Days to Calving)

There were also minimal changes in fertility EBVs observed from the initial period at sire joining to the EBVs recorded at the completion of the trial after the heifer progeny had calved down at 2 years of age and all calving records had been collated. The difference in Days to Calving EBVs for the average of the highest 10 sires in each cohort was 0.1 days (-2.4 days to -2.5 days), with an 18% increase in accuracy. A smaller difference in Days to Calving EBVs was observed when assessing the average of the lowest 10 Days to Calving EBV sires in each cohort. The difference was calculated to be 0.4 days (-7.0 days to -6.6 days) with an accuracy increase of 18% (44% to 62%).

Days to Calving (days)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	-1.3 days	-3.0 days	44 %	64 %
	6	-2.5 days	-2.5 days	41 %	61 %
	7	-3.5 days	-2.1 days	41 %	57 %
	Average	-2.4 days	-2.5 days	43 %	61 %
Average Lowest 10	5	-6.6 days	-6.0 days	44 %	64 %
	6	-6.5 days	-6.9 days	44 %	62 %
	7	-7.9 days	-6.8 days	45 %	61 %
	Average	-7.0 days	-6.6 days	44 %	62 %

Feed Efficiency (Net Feed Intake – Feedlot)

For feed efficiency, the change in the average initial and final Net Feed Intake-Feedlot (NFI-F) EBVs of the 10 sires with the highest initial EBVs in each cohort was -0.26 kg/day (+0.61 kg/day versus +0.35 kg/day), whereas the difference between the average initial and final NFI-F EBVs of the 10 sires with the lowest initial EBVs was only +0.01 kg/day (-0.14 kg/day versus -0.15 kg/day). The average EBV accuracy increased for the two groups of sires by 32% and 35% respectively.

Net Feed Intake - Feedlot (kg/day)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	5	+ 0.64 kg/day	+ 0.42 kg/day	48 %	82 %
	6	+ 0.57 kg/day	+ 0.32 kg/day	50 %	83 %
	7	+ 0.61 kg/day	+ 0.32 kg/day	51 %	82 %
	Average	+ 0.61 kg/day	+ 0.35 kg/day	50 %	82 %
Average Lowest 10	5	-0.30 kg/day	-0.32 kg/day	48 %	80 %
	6	-0.11 kg/day	-0.12 kg/day	45 %	80 %
	7	-0.01 kg/day	0.01 kg/day	42 %	79 %
	Average	-0.14 kg/day	-0.15 kg/day	45 %	80 %

Conclusion

This project has shown clearly that while the EBVs for some individual sires did change, as expected, there was, on average, minimal change in the EBVs of sires in cohorts 5, 6 & 7 of the ASBP, and the initial EBVs of the sires, despite being of low accuracy, described the relative genetic merit of the sires well.

The outcomes from the project demonstrate that EBVs are a reliable selection tool, and beef producers should use EBVs with confidence to identify genetics that are most aligned with their breeding objectives, and in turn, to achieve long term, sustainable genetic improvement.

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