

STARTING vs FINISHING EBVS DID THEY CHANGE?

HOW MUCH DID THE EBVS OF SIRES IN THE ASBP CHANGE?



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 BREEDPLAN 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 1 to 3 of the ASBP. The project 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 shown that while the EBVs for some individual sires did change, 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 carcass measurements, meat quality attributes and female reproduction; b) generate data for the validation and refinement of Angus BREEDPLAN; 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 carcass 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: EBVs and EBV accuracies were calculated utilising the latest Angus BREEDPLAN analytical software, based on the pedigree and performance information that was available when the sires were entered into the ASBP. Ensuring that the latest Angus BREEDPLAN analytical software was used was important in accounting for the influence of any changes that had occurred to the analytical software while sires were being evaluated in the ASBP.

The performance information utilised to generate the EBVs for sires in each cohort was as follows:

- Cohort 1 EBVs (based on information available at the October 2010 Angus BREEDPLAN analysis)
 - Cohort 2 EBVs (based on information available at the October 2011 Angus BREEDPLAN Analysis)
 - Cohort 3 EBVs (based on information available at the October 2012 Angus BREEDPLAN analysis)
2. 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. All sires had also been genotyped and their genomic predictions were incorporated in the calculation of their Final EBVs.
3. 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.



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 Growth (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 carcass weight at 750 days of age. Higher EBVs indicate heavier carcass weight.

Carcase Eye Muscle Area (EMA) (cm²): Genetic differences between animals in eye muscle area at the 12/13th rib site in a 400kg carcass. 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 carcass. 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 carcass. 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 carcass. 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 illustrated that while the EBVs for some individual sires did change, 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 1, 2 and 3 of the ASBP, the 10 sires in each cohort with the highest initial Birth Weight EBVs had an average initial EBV of +6.2 kg. By comparison, the average final Birth Weight EBV for these same sires was +6.6 kg, equating to a change of only 0.4 kg. The average accuracy of the initial and final Birth Weight EBVs for these sires increased from 75% to 94%.

Similarly, the 10 sires in each cohort with the lowest initial Birth Weight EBV had an average initial EBV of +2.8 kg. By comparison, the average final Birth Weight EBVs of these same sires was also +2.8 kg. The average accuracy of the initial and final Birth Weight EBVs for these sires increased from 78% to 95%.

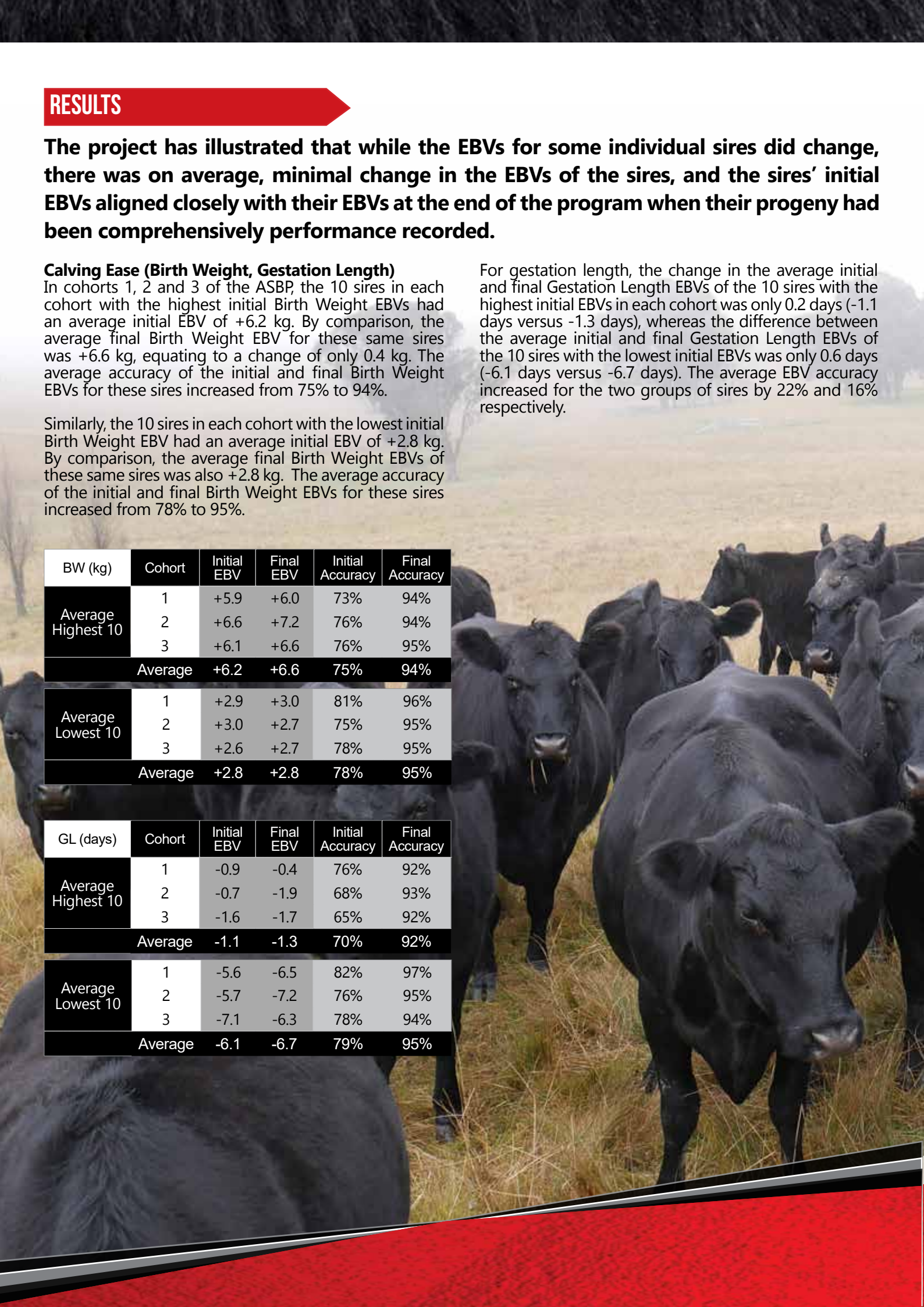
For gestation length, the change in the average initial and final Gestation Length EBVs of the 10 sires with the highest initial EBVs in each cohort was only 0.2 days (-1.1 days versus -1.3 days), whereas the difference between the average initial and final Gestation Length EBVs of the 10 sires with the lowest initial EBVs was only 0.6 days (-6.1 days versus -6.7 days). The average EBV accuracy increased for the two groups of sires by 22% and 16% respectively.

BW (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+5.9	+6.0	73%	94%
	2	+6.6	+7.2	76%	94%
	3	+6.1	+6.6	76%	95%
	Average	+6.2	+6.6	75%	94%

Average Lowest 10	1	+2.9	+3.0	81%	96%
	2	+3.0	+2.7	75%	95%
	3	+2.6	+2.7	78%	95%
	Average	+2.8	+2.8	78%	95%

GL (days)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	-0.9	-0.4	76%	92%
	2	-0.7	-1.9	68%	93%
	3	-1.6	-1.7	65%	92%
	Average	-1.1	-1.3	70%	92%

Average Lowest 10	1	-5.6	-6.5	82%	97%
	2	-5.7	-7.2	76%	95%
	3	-7.1	-6.3	78%	94%
	Average	-6.1	-6.7	79%	95%



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, 400 Day Weight and 600 Day Weight was +51 kg, +93 kg and +125 kg respectively. By comparison, the average final EBV for the same sires was +53 kg, +95 kg and +127 kg, representing a change of only 2 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, 400 and 600 day weight. The increase in accuracy for these EBVs was 23% for 200 Day Growth (69 to 92%), 22% for 400 Day Weight (70% to 92%) and 21% for 600 Day Weight (71% to 92%).

Similarly, the average initial EBV of the 10 sires in each cohort with the lowest EBV for 200 Day Growth, 400 Day Weight and 600 Day Weight was +36 kg, +68 kg and +89 kg respectively. The average final EBV for the same sires was +37 kg, +71 kg and +89 kg, representing a change of only 1 kg, 3 kg and 0 kg. The increase in accuracy for the 200 Day Growth, 400 Day Weight and 600 Day Weight EBVs was 18%, 20% & 19% respectively.

200 (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+49	+48	70%	94%
	2	+52	+54	69%	90%
	3	+53	+56	69%	93%
Average		+51	+53	69%	92%
Average Lowest 10	1	+38	+38	78%	93%
	2	+37	+38	73%	92%
	3	+34	+35	74%	93%
Average		+36	+37	75%	93%

400 (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+90	+87	71%	93%
	2	+94	+92	70%	90%
	3	+96	+105	69%	92%
Average		+93	+95	70%	92%
Average Lowest 10	1	+70	+71	74%	93%
	2	+69	+74	72%	93%
	3	+66	+67	74%	92%
Average		+68	+71	73%	93%

600 (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+120	+116	73%	94%
	2	+127	+125	71%	91%
	3	+129	+139	70%	92%
Average		+125	+127	71%	92%
Average Lowest 10	1	+90	+90	76%	93%
	2	+91	+96	73%	94%
	3	+85	+82	73%	93%
Average		+89	+89	74%	93%



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 Carcass Weight EBVs of the 10 sires with the highest initial EBVs in each cohort was only 2 kg (+125 kg versus +127 kg), whereas there was no difference between the average initial and final Carcass Weight EBVs of the 10 sires with the lowest initial EBVs (Initial and Final EBVs both +89 kg). The average EBV accuracy increased for the two groups of sires by 21% and 19% respectively.

The average initial EBV of the 10 sires in each cohort with the highest EBV for Carcass EMA, IMF, Rib and Rump Fat was +7.8cm², +2.8%, +1.0mm and +1.2mm respectively. By comparison, the average final EBV for the same sires was +8.1cm², +2.8%, +1.1mm and +1.3mm. This represents a very small change in the carcass 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 27% for Carcass EMA (61% to 88%), 28% for Carcass IMF (59% to 87%), 26% for Carcass Rib Fat (63% to 89%) and 23% for Carcass Rump Fat (64% to 87%).

Similarly, the average initial EBV of the 10 sires in each cohort with the lowest EBV for Carcass EMA, IMF, Rib and Rump Fat was +2.2 cm², +0.7%, -1.5mm and -1.7mm respectively. The average final EBV for the same sires was +2.1 cm², +0.5%, -1.7mm and -1.5mm, representing a change of only 0.1 cm², +0.2 %, 0.2mm and 0.2mm. The increase in accuracy for Carcass EMA, IMF, Rib and Rump Fat was 28%, 32%, 28% & 26% respectively.

CWt (kg)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+67	+70	62%	89%
	2	+68	+77	60%	85%
	3	+72	+83	60%	87%
Average		+69	+77	61%	87%
Average Lowest 10	1	+49	+51	63%	88%
	2	+48	+44	61%	87%
	3	+46	+37	62%	87%
Average		+48	+44	62%	87%

Carc EMA (cm ²)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+7.5	+7.5	66%	89%
	2	+9.0	+9.1	58%	88%
	3	+7.0	+7.8	60%	86%
Average		+7.8	+8.1	61%	88%
Average Lowest 10	1	+2.7	+3.4	57%	86%
	2	+2.1	+1.9	59%	84%
	3	+1.8	+0.9	55%	86%
Average		+2.2	+2.1	57%	85%

Carc IMF (%)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+2.7	+2.4	63%	88%
	2	+2.7	+2.7	57%	87%
	3	+3.0	+3.2	58%	85%
Average		+2.8	+2.8	59%	87%
Average Lowest 10	1	+0.9	+1.1	57%	84%
	2	+0.7	+0.1	48%	83%
	3	+0.6	+0.2	51%	84%
Average		+0.7	+0.5	52%	84%

Carc Rib (mm)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+1.2	+1.5	66%	89%
	2	+0.9	+1.0	61%	89%
	3	+0.9	+0.8	61%	89%
Average		+1.0	+1.1	63%	89%
Average Lowest 10	1	-1.1	-0.8	62%	90%
	2	-2.0	-2.5	60%	86%
	3	-1.3	-1.8	57%	87%
Average		-1.5	-1.7	60%	88%

Carc Rump (mm)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+1.7	+1.7	68%	88%
	2	+0.9	+1.1	63%	86%
	3	+1.1	+1.0	60%	87%
Average		+1.2	+1.3	64%	87%
Average Lowest 10	1	-1.2	-0.4	63%	87%
	2	-2.4	-3.2	55%	83%
	3	-1.6	-1.0	60%	84%
Average		-1.7	-1.5	59%	85%

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 collated and included in the Angus BREEDPLAN analysis. The difference in Days to Calving EBVs for the average of the highest ten sires in each cohort was 0.9 days (-1.4 days to -2.3 days), with an 18% increase in accuracy. A smaller difference in Days to Calving EBVs was observed when assessing the average of the lowest ten Days to Calving EBV sires in each cohort. The difference was calculated to be 0.2 days (-5.5 days to -5.3 days) with an accuracy increase of 16% (46% to 62%).

DTC (days)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	-2.2	-3.6	50%	68%
	2	-1.1	-2.1	41%	58%
	3	-0.8	-1.1	42%	59%
	Average	-1.4	-2.3	44%	62%
Average Lowest 10	1	-5.9	-4.9	49%	66%
	2	-5.4	-6.5	48%	63%
	3	-5.1	-4.6	40%	58%
	Average	-5.5	-5.3	46%	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 -0.22 kg/day (+0.70 kg/day versus +0.48 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 +0.13 kg/day (-0.21 kg/day versus -0.08 kg/day). The average EBV accuracy increased for the two groups of sires by 32% and 34% respectively.

NFI-F (kg/day)	Cohort	Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Average Highest 10	1	+0.66	+0.42	48%	79%
	2	+0.68	+0.57	47%	82%
	3	+0.75	+0.44	48%	80%
	Average	+0.70	+0.48	48%	80%
Average Lowest 10	1	-0.19	-0.14	47%	70%
	2	-0.24	+0.01	40%	78%
	3	-0.21	-0.12	40%	79%
	Average	-0.21	-0.08	42%	76%



CONCLUSION

This project has shown clearly that while the EBVs for some individual sires did change, there was, on average, minimal change in the EBVs of sires in cohorts 1, 2 & 3 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.

SUMMARY

EBV		Initial EBV	Final EBV	Initial Accuracy	Final Accuracy
Birth Weight	Highest 10	+6.2	+6.6	75%	94%
	Lowest 10	+2.8	+2.8	78%	95%
Gestation Length	Highest 10	-1.1	-1.3	70%	92%
	Lowest 10	-6.1	-6.7	79%	95%
200 Day Growth	Highest 10	+51	+53	69%	92%
	Lowest 10	+36	+37	75%	93%
400 Day Weight	Highest 10	+93	+95	70%	92%
	Lowest 10	+68	+71	73%	93%
600 Day Weight	Highest 10	+125	+127	71%	92%
	Lowest 10	+89	+89	74%	93%
Carcase Weight	Highest 10	+69	+77	61%	87%
	Lowest 10	+48	+44	62%	87%
Carcase EMA	Highest 10	+7.8	+8.1	61%	88%
	Lowest 10	+2.2	+2.1	57%	85%
Carcase IMF	Highest 10	+2.8	+2.8	59%	87%
	Lowest 10	+0.7	+0.5	52%	84%
Carcase Rib Fat	Highest 10	+1.0	+1.1	63%	89%
	Lowest 10	-1.5	-1.7	60%	88%
Carcase Rump Fat	Highest 10	+1.2	+1.3	64%	87%
	Lowest 10	-1.7	-1.5	59%	85%
Days to Calving	Highest 10	-1.4	-2.3	44%	62%
	Lowest 10	-5.5	-5.3	46%	62%
Net Feed Intake - Feedlot	Highest 10	+0.70	+0.48	48%	80%
	Lowest 10	-0.21	-0.08	42%	76%

FURTHER INFORMATION

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