EBVS ARE NO BULL

EBVS OF BULLS ENTERED IN THE ASBP HAVE PROVIDED A RELIABLE PREDICTION OF THE PERFORMANCE OF THEIR PROGENY

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

A recent project undertaken by Angus Australia assessed the progeny performance of sires in cohorts 1 to 3 of the ASBP, to analyse how well the BREEDPLAN EBVs of the sires when entered in the program aligned with the actual performance of their progeny.

This project has illustrated that BREEDPLAN 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 measurement, 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.

Within each cohort of the ASBP, on average, 40 sires a year are joined 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 BREEDPLAN EBVs of the sires in cohorts 1 to 3 of the ASBP aligned with the actual performance of their progeny, the following steps were completed:

1. EBVs were generated based on the pedigree and performance information that was available when the sires were entered into the ASBP, utilising the latest Angus BREEDPLAN analytical software. 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. The performance of progeny for all traits was collated and the standard BREEDPLAN adjustments and contemporary groupings applied.

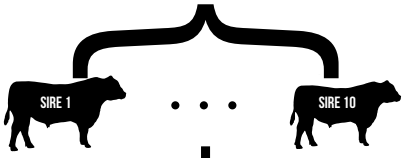
The performance data was then analysed through the Statistical Analysis System (SAS) to generate Least Squares Means (LSMs), being each sire's average progeny performance for each trait.

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.

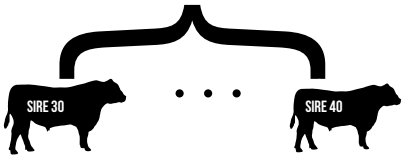
The predicted difference was then compared to the actual difference in progeny performance that was observed within the ASBP to ascertain how well the EBVs predicted the breeding value of the highest and lowest 10 sires for each trait.

STEP 1. RANK EACH COHORT OF SIRES ON THEIR EBV WHEN ENTERED IN THE ASBP

HIGHEST 10



LOWEST 10

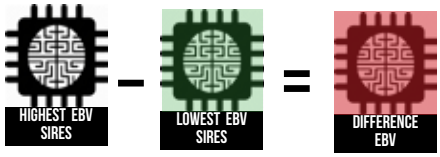


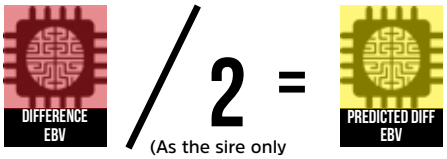
STEP 2. CALCULATE AVERAGE EBVS FOR HIGHEST AND LOWEST RANKED SIRES

CALCULATE AVERAGE EBV FOR HIGHEST 10 EBV SIRES

CALCULATE AVERAGE EBV FOR LOWEST 10 EBV SIRES

STEP 3. CALCULATE PREDICTED DIFFERENCE IN PROGENY PERFORMANCE BETWEEN HIGH AND LOW GROUP

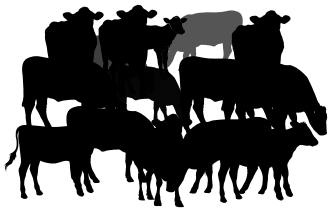




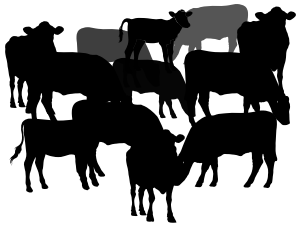
(As the sire only contributes half the calves' genetics)

STEP 4. OBTAIN ACTUAL AVERAGE PERFORMANCE FOR THE PROGENY OF THE SIRES

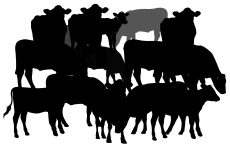
measure average progeny performance for the highest EBV sires



measure average progeny performance for the lowest EBV sires



STEP 5. CALCULATE DIFFERENCE IN PROGENY PERFORMANCE



PROGENY PERFORMANCE OF HIGHEST EBV SIRES

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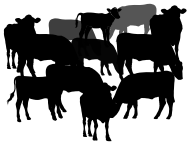

PROGENY PERFORMANCE OF LOWEST EBV SIRES

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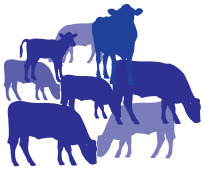
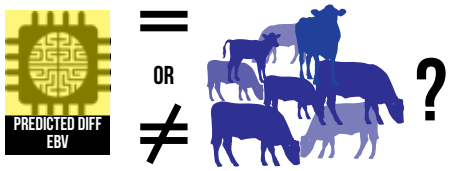


ACTUAL DIFFERENCE IN PROGENY PERFORMANCE

STEP 6. COMPARE PREDICTED DIFFERENCE TO ACTUAL DIFFERENCE IN PROGENY PERFORMANCE



QUESTION: DOES THE PREDICTED DIFFERENCE IN PROGENY PERFORMANCE REFLECT THE ACTUAL DIFFERENCE OBSERVED?

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 was 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 was 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 was 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 was recorded on steer progeny in the ASBP.

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

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

Carcase Intra-muscular Fat (IMF): Percentage of intra-muscular fat (ether extracted at the UNE meat science laboratory) in a 400Kg carcase, with higher values indicating more intramuscular fat. Carcase Intra-Muscular Fat was 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, with lower values indicating better feed efficiency through less feed intake for the same weight and rate of weight gain. Net Feed Intake – Feedlot was recorded on all steer progeny in the ASBP at the Tullimba Research Feedlot.

RESULTS

THE PROJECT HAS INDICATED THAT THE EBVS OF THE SIRES ENTERED IN COHORTS 1, 2 AND 3 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 3.4 kg, across cohorts 1, 2 and 3. This equates to a predicted difference in the average birth weight of progeny of sires in both groups of 1.7 kg. Note: 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 1.9 kg, demonstrating the EBVs were accurately predicting the breeding value of sires for birth weight.

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 5.1 days across cohorts 1, 2 and 3. Therefore it was predicted that the progeny of the 10 sires with the lowest Gestation Length EBVs would be born, on average, 2.5 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 2.6 days, and closely aligned with the difference predicted by the sire EBVs.

Birth Weight	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	5.9 kg	6.6 kg	6.1 kg	6.2 kg
Average Low EBV	2.9 kg	3.0 kg	2.6 kg	2.8 kg
Diff EBV	3.0 kg	3.6 kg	3.5 kg	3.4 kg
Expected Difference (EBV)	1.5 kg	1.8 kg	1.8 kg	1.7 kg
Average High LSM	37.0 kg	39.7 kg	38.5 kg	38.4 kg
Average Low LSM	35.7 kg	37.1 kg	36.5 kg	36.4 kg
Actual Difference (LSM)	1.3 kg	2.6 kg	2.0 kg	1.9 kg

Gestation Length	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	-0.9 days	-0.7 days	-1.6 days	-1.1 days
Average Low EBV	-5.6 days	-5.7 days	-7.1 days	-6.1 days
Diff EBV	4.6 days	5.1 days	5.5 days	5.1 days
Expected Difference (EBV)	2.3 days	2.5 days	2.7 days	2.5 days
Average High LSM	284.1 days	284.1 days	283.7 days	283.1 days
Average Low LSM	280.5 days	279.2 days	281.7 days	280.5 days
Actual Difference (LSM)	3.6 days	2.2 days	2.1 days	2.6 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, 400 Day Weight and 600 Day Weight EBV in each cohort was on average 15.2 kg, 25.2 kg and 36.6 kg respectively, across cohorts 1, 2 and 3. This equates to a predicted difference in the average weight of progeny of sires in both groups of 7.6 kg, 12.6 kg and 18.3 kg at 200, 400 and 600 days of age.

When weighed, the actual difference in the weight of progeny was 5.2 kg, 10.2 kg and 17.0 kg, and demonstrated the EBVs of the sires provided a reliable indication of their genetics for growth.

200 Day Growth	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	49.4 kg	52.3 kg	52.6 kg	51.4 kg
Average Low EBV	37.9 kg	36.5 kg	34.2 kg	36.2 kg
Diff EBV	11.5 kg	15.8 kg	18.4 kg	15.2 kg
Expected Difference (EBV)	5.7 kg	7.9 kg	9.2 kg	7.6 kg
Average High LSM	237.0 kg	224.3 kg	202.6 kg	221.3 kg
Average Low LSM	233.1 kg	219.0 kg	196.3 kg	216.2 kg
Actual Difference (LSM)	3.9 kg	5.3 kg	6.3 kg	5.2 kg

400 Day Weight	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	90.1 kg	93.6 kg	96.0 kg	93.2 kg
Average Low EBV	70.0 kg	68.5 kg	65.6 kg	68.0 kg
Diff EBV	20.1 kg	25.1 kg	30.4 kg	25.2 kg
Expected Difference (EBV)	10.1 kg	12.5 kg	15.2 kg	12.6 kg
Average High LSM	356.4 kg	326.4 kg	398.1 kg	360.3 kg
Average Low LSM	348.9 kg	322.4 kg	379.0 kg	350.1 kg
Actual Difference (LSM)	7.5 kg	4.0 kg	19.1 kg	10.2 kg

600 Day Weight	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	119.7 kg	126.6 kg	128.7 kg	125.0 kg
Average Low EBV	89.7 kg	90.5 kg	85.0 kg	88.4 kg
Diff EBV	30.0 kg	36.1 kg	43.7 kg	36.6 kg
Expected Difference (EBV)	15.0 kg	18.0 kg	21.8 kg	18.3 kg
Average High LSM	569.9 kg	492.7 kg	550.3 kg	537.6 kg
Average Low LSM	560.6 kg	480.5 kg	520.7 kg	520.6 kg
Actual Difference (LSM)	9.3 kg	12.2 kg	29.6 kg	17.0 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 21.7 kg, 5.7 cm^2, 2.5 mm, 3.0 mm and 2.0% respectively, across cohorts 1, 2 and 3. This equates to a predicted difference in the sires average carcase progeny performance of 10.9 kg dressed carcase weight, 2.8 cm^2 eye muscle area, 1.2 mm rib fat depth, 1.5 mm rump fat depth and 1.0% intramuscular fat.

When the steer progeny were slaughtered and abattoir carcase measurements collected, the actual difference in the carcase performance weight of progeny was 18.2 kg dressed carcase weight, 2.8 cm^2 eye muscle area, 1.1 mm rib fat depth, 1.3 mm rump fat depth and 1.3% intramuscular fat.

This demonstrates that the EBVs of sires in cohorts 1, 2 and 3 provided an accurate prediction of their carcase genetics, and can be used with confidence when selecting animals for superior carcase genetics.

Carcase Weight	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	67.1 kg	68.4 kg	72.3 kg	69.3 kg
Average Low EBV	48.8 kg	48.2 kg	45.7 kg	47.6 kg
Diff EBV	18.3 kg	20.2 kg	26.7 kg	21.7 kg
Expected Difference (EBV)	9.1 kg	10.1 kg	13.3 kg	10.9 kg
Average High LSM	444.3 kg	449.1 kg	463.6 kg	452.3 kg
Average Low LSM	436.4 kg	430.5 kg	435.6 kg	434.1 kg
Actual Difference (LSM)	7.9 kg	18.6 kg	28.1 kg	18.2 kg

Carcase Rib Fat	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	1.2 mm	0.9 mm	0.9 mm	1.0 mm
Average Low EBV	-1.1 mm	-2.0 mm	-1.3 mm	-1.5 mm
Diff EBV	2.2 mm	2.9 mm	2.3 mm	2.5 mm
Expected Difference (EBV)	1.1 mm	1.5 mm	1.1 mm	1.2 mm
Average High LSM	18.8 mm	15.6 mm	17.9 mm	17.4 mm
Average Low LSM	18.3 mm	13.8 mm	16.7 mm	16.3 mm
Actual Difference (LSM)	0.5 mm	1.8 mm	1.1 mm	1.1 mm

Carcase Rump Fat	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	1.7 mm	0.9 mm	1.1 mm	1.2 mm
Average Low EBV	-1.2 mm	-2.4 mm	-1.6 mm	-1.7 mm
Diff EBV	2.9 mm	3.4 mm	2.6 mm	3.0 mm
Expected Difference (EBV)	1.4 mm	1.7 mm	1.3 mm	1.5 mm
Average High LSM	25.2 mm	20.8 mm	20.3 mm	22.1 mm
Average Low LSM	24.6 mm	18.3 mm	19.6 mm	20.8 mm
Actual Difference (LSM)	0.6 mm	2.5 mm	0.7 mm	1.3 mm

Carcase EMA	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	7.5 cm^2	9.0 cm^2	7.0 cm^2	7.8 cm^2
Average Low EBV	2.7 cm^2	2.1 cm^2	1.8 cm^2	2.2 cm^2
Diff EBV	4.8 cm^2	6.9 cm^2	5.3 cm^2	5.7 cm^2
Expected Difference (EBV)	2.4 cm^2	3.5 cm^2	2.6 cm^2	2.8 cm^2
Average High LSM	84.3 cm^2	83.4 cm^2	89.0 cm^2	85.6 cm^2
Average Low LSM	82.0 cm^2	80.8 cm^2	85.5 cm^2	82.8 cm^2
Actual Difference (LSM)	2.2 cm^2	2.5 cm^2	3.6 cm^2	2.8 cm^2

Carcase IMF	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	2.7 %	2.7 %	3.0 %	2.8 %
Average Low EBV	0.9 %	0.7 %	0.6 %	0.7 %
Diff EBV	1.8 %	2.0 %	2.3 %	2.0 %
Expected Difference (EBV)	0.9 %	1.0 %	1.2 %	1.0 %
Average High LSM	9.7 %	10.4 %	11.3 %	10.4 %
Average Low LSM	9.6 %	8.9 %	9.0 %	9.2 %
Actual Difference (LSM)	0.1 %	1.4 %	2.3 %	1.3 %

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 4.1 days across cohorts 1, 2 and 3. Therefore it was predicted that the heifer progeny of the 10 sires with the lowest Days to Calving EBVs would calve, on average, 2.1 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, 1.0 days earlier than the progeny sired by the highest Days to Calving EBV sires.

Days to Calving	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	-2.2 days	-1.1 days	-0.8 days	-1.4 days
Average Low EBV	-5.9 days	-5.4 days	-5.1 days	-5.5 days
Diff EBV	3.8 days	4.2 days	4.4 days	4.1 days
Expected Difference (EBV)	1.9 days	2.1 days	2.2 days	2.1 days

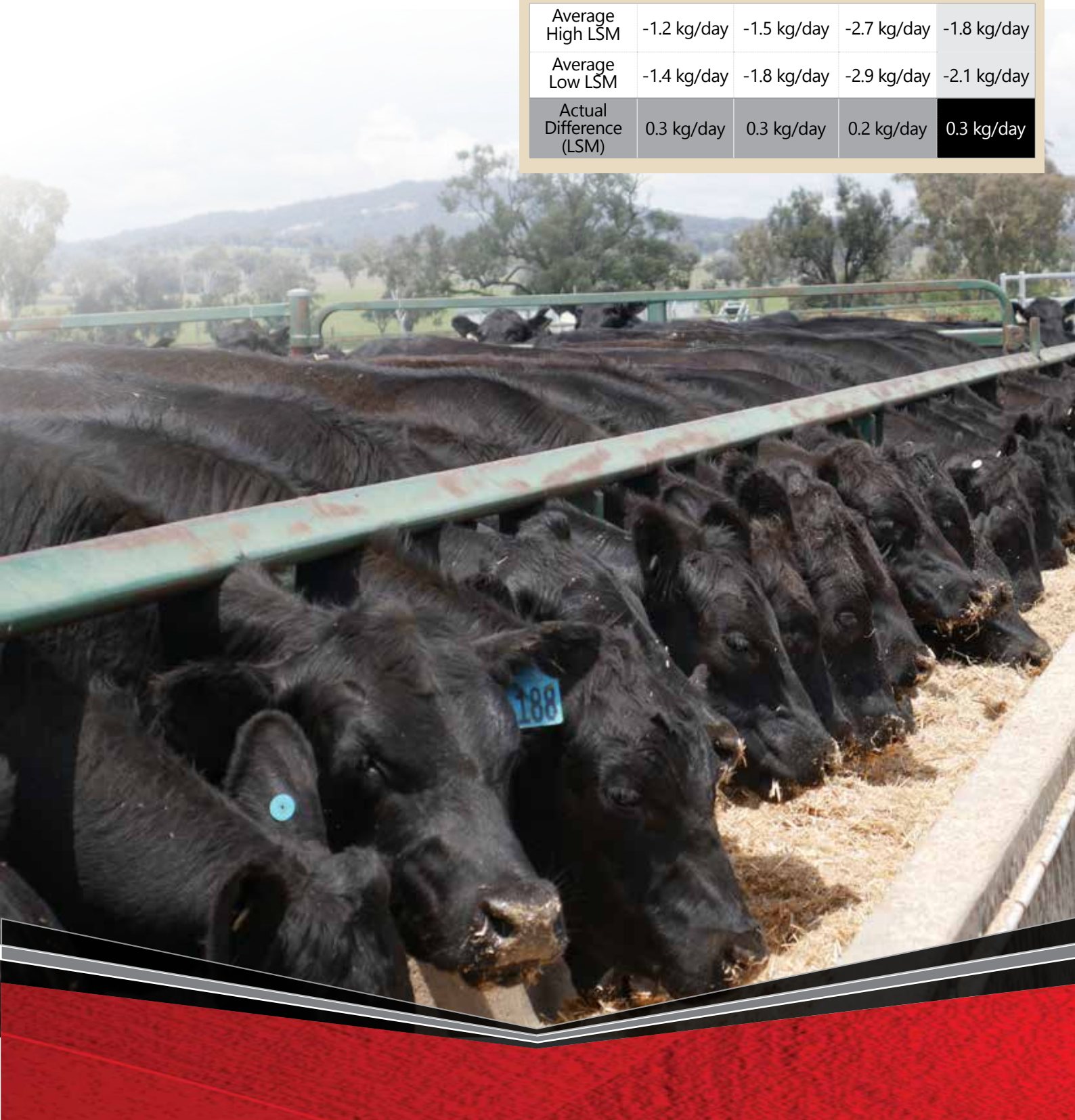
Average High LSM	328.4 days	294.4 days	303.3 days	308.7 days
Average Low LSM	328.9 days	291.8 days	302.5 days	307.7 days
Actual Difference (LSM)	-0.5 day	2.6 days	0.9 day	1.0 day

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 0.9 kg/day across cohorts 1, 2 and 3, indicating the progeny of the lowest NFI-F sires were predicted to eat 0.5 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 0.3 kg/day.

Net Feed Intake - F	Cohort 1	Cohort 2	Cohort 3	Average
Average High EBV	0.7 kg/day	0.7 kg/day	0.7 kg/day	0.7 kg/day
Average Low EBV	-0.2 kg/day	-0.2 kg/day	-0.2 kg/day	-0.2 kg/day
Diff EBV	0.8 kg/day	0.9 kg/day	1.0 kg/day	0.9 kg/day
Expected Difference (EBV)	0.4 kg/day	0.5 kg/day	0.5 kg/day	0.5 kg/day
Average High LSM	-1.2 kg/day	-1.5 kg/day	-2.7 kg/day	-1.8 kg/day
Average Low LSM	-1.4 kg/day	-1.8 kg/day	-2.9 kg/day	-2.1 kg/day
Actual Difference (LSM)	0.3 kg/day	0.3 kg/day	0.2 kg/day	0.3 kg/day



CONCLUSION

This project has revealed that BREEDPLAN Estimated Breeding Values provided an accurate prediction of the breeding value of sires in cohorts 1, 2 and 3 of the Angus Sire Benchmarking Program.

When selecting animals for use within a breeding program, the use of BREEDPLAN 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.

QUESTION: DID THE EBVS OF BULLS ENTERED IN THE ASBP RELIABLY REFLECT THE ACTUAL DIFFERENCE IN THEIR PROGENY'S PEFORMANCE?

ANSWER: YES!

SUMMARY

ANGUS SIRE BENCHMARKING PROJECT COHORTS 1 - 3 HIGHEST 10 VS. LOWEST 10 EBV SIRES

TRAIT	PREDICTED DIFFERENCE (EBV) IN PROGENY PERFORMANCE	ACTUAL DIFFERENCE IN PROGENY PERFORMANCE
Birth Weight	1.7 kg	1.9 kg
Gestation Length	2.5 days	2.6 days
200 Day Weight	7.6 kg	5.2 kg
400 Day Weight	12.6 kg	10.2 kg
600 Day Weight	18.3 kg	17.0 kg
Carcase Weight	10.9 kg	18.2 kg
Carcase Rib Fat	1.2 mm	1.1 mm
Carcase Rump Fat	1.5 mm	1.3 mm
Carcase EMA	2.8 cm^2	2.8 cm^2
Carcase IMF	1.0 %	1.3 %
Days to Calving	2.1 days	1.0 days
Net Feed Intake - F	0.5 kg/day	0.3 kg/day

FURTHER INFORMATION

For further information please contact staff at Angus Australia.
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