THE 2010 SUMMER TRANS-TASMAN SHORTHORN GROUP BREEDPLAN GENETIC EVALUATION REPORT

The information contained in this Report was compiled by the Agricultural Business Research Institute (ABRI) from data input to the pedigree and performance databases of the Shorthorn Society of Australia, the Beef Shorthorn Society of Australia Inc. and the New Zealand Shorthorn 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 GROUP BREEDPLAN Estimated Breeding Values (EBVs) as calculated in the 2010 Summer Trans-Tasman Shorthorn GROUP analysis. This analysis combined the integrated pedigree and performance databases of the Shorthorn breed in Australia and New Zealand. This report presents Shorthorn breeders with a listing of genetic merit (or EBVs) for Shorthorn sires and dams.

GROUP BREEDPLAN estimates the breeding values for individual animals 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 other 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 16 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 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 version of GROUP BREEDPLAN software includes:

- allowance for re-ranking of sires when used in different herds
- allowance for differences in the variation of performance between herds
- an enhanced estimation procedure for generating EBVs for groups of base animals.

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 breed.

The Report

The Sire List reports GROUP EBVs for 1,101 registered sires in Australia and/or New Zealand for up to 16 traits. To be eligible for reporting in this listing a sire must have performance recorded progeny born in the last five 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 have at least 75% accuracy for the trait (except for Eye Muscle Area, Retail Beef Yield Percent and Intra-muscular Fat Percent which require only 65% accuracy). Having met this criterion, sires are reported as trait leaders if their EBV for the trait is within the top 10% of the breed (top 5% of the breed for 200-Day Growth, 400-Day Weight and 600-Day Weight). The sire trait leaders for Birth Weight also must have positive post-birth growth traits (measured at 200, 400 & 600 days). No trait leaders are reported for Calving Ease, Mature Cow Weight, Rib Fat or Rump Fat.

The Dam trait leader lists include the top 30 Australian and New Zealand dams for each of the traits Birth Weight, 200-Day Milk, 200-Day Growth, 400-Day Weight and 600-Day Weight. To be included in a particular trait leader list a dam must have had at least one calf in the past two years, at least 2 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).

This listing **DOES 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 increases 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.

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.

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 animal 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 is 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 those shown in Table 1.

The higher the accuracy of an EBV, the more likely it is that the EBV is a close estimate of the animal's true breeding value (which is never known). 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 their EBVs indicate.

Accuracy for a particular trait and heritability for that trait can be used to calculate confidence intervals for EBVs. For various accuracy levels 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%**
Gestation Length	1.9	1.7	1.4	1.0	0.3
Birth Weight	1.7	1.5	1.3	0.9	0.3
200-Day Milk	6.7	6.0	5.0	3.6	1.2
200-Day Growth	9.7	8.7	7.3	5.3	1.7
400-Day Weight	12.7	11.3	9.5	6.9	2.2
600-Day Weight	16.1	14.4	12.1	8.8	2.8
Scrotal Size	1.0	0.9	0.8	0.5	0.2
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 67% chance that the *true* breeding value will be within plus or minus 1 standard error of the EBV, and a 96% chance that it will be within 2 standard errors. For example, for a 600-Day Weight EBV which is reported with 99% accuracy there is a 67% chance that the *true* breeding value is within plus or minus 2.8 kg and a 96% chance that the *true* breeding value is within plus or minus 5.6 kg (ie 2 x 2.8 kg).

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: indicates lighter birth weights, 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.

200-Day 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 200-Day 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 200-Day 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 Wt 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 Wt 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.

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.

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 300kg 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. Differences between Rib Fat and Rump Fat EBVs may indicate differences in fat distribution.

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 up to 16 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 Shorthorn 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 +40 kg and Sire 2 an EBV of +10 kg for the same trait. The difference is 30 kg. Half of this is passed on to the progeny. That is, calves from Sire 1 would be expected to be +15 kg 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 amounts to a production difference of 450 kg live weight.

Table 3: Average GROUP EBVs for the 2008 drop calves analysed in the 2010 Summer Trans-Tasman Shorthorn GROUP BREEDPLAN

CE DIR	CE DTRS	Gestation Length	Birth Weight	200-Day Milk	200-Day Growth	400-Day Weight	600-Day Weight
-0.7	**+0.2**	**-1.1**	**+3.0**	**+5**	**+24**	**+32**	**+42**

Mature Weight	Scrotal Size	Carcase Weight	EMA	Rib Fat	Rump Fat	Retail Beef Yield	IMF%
+39	**+1.2**	**+30**	**+3.5**	**-0.8**	**-0.8**	**+1.0**	**+0.4**

3. Compare Sires with the Current Shorthorn Genetic Level

The current genetic level for the breed can be determined from the average EBVs for all calves born in 2008. If you are interested in using a sire with a 200-Day Growth EBV of +29 then comparison to the averages in Table 3 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 20% of the genetic level of the 2008 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 that small herds can do this over two or more joinings if required.

Statistics of the 2010 Summer Analysis

The continued increase in submission of data for evaluation in the Trans-Tasman Shorthorn GROUP BREEDPLAN analysis reflects the support of Shorthorn breeders in Australia and New Zealand to objective measurement of their cattle as a means of genetic improvement. Table 5 summarises the data statistics for the 2010 Summer Trans-Tasman Shorthorn GROUP BREEDPLAN analysis.

Table 5: Summary Statistics of the 2010 Summer Trans-Tasman Shorthorn GROUP BREEDPLAN Analysis

Number of Sires	9,375
Number of dams	75,332

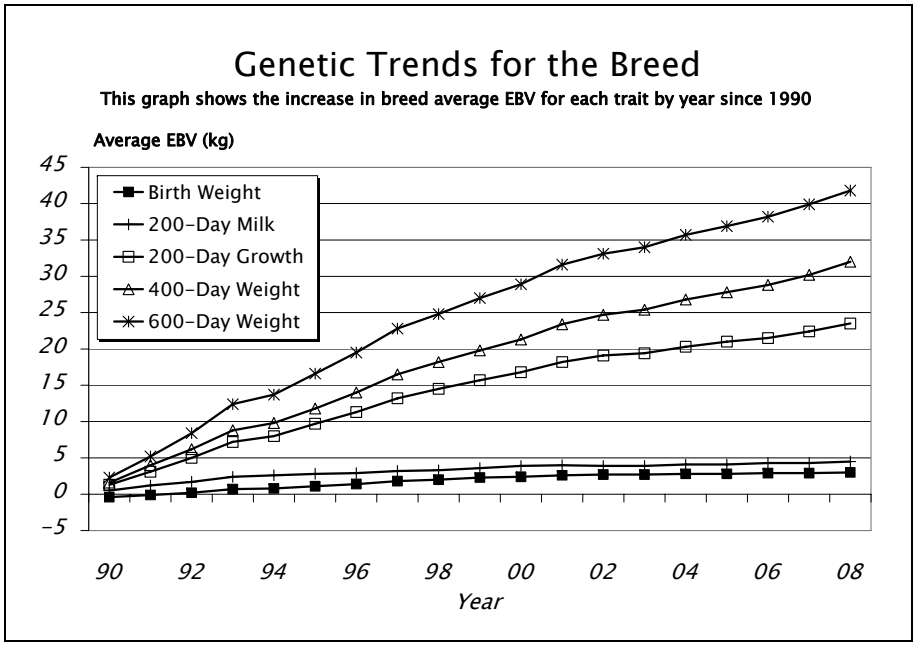
	RECORDS		
TRAITS	**Australia**	**New Zealand**	**Total**
Gestation Length	14,956	2,478	17,434
Birth Weight	59,459	14,267	73,726
200 day weight *	110,561	24,918	135,479
400 day weight *	72,285	9,897	82,182
600 day weight *	46,705	10,199	56,904
Mature weight *	4,010	359	4,369
Scrotal Size	14,102	1,733	15,835
Scan *	33,777	4,980	38,757
Carcase *	1,831	0	1,831

***** animals with at least one observation

Genetic Trends 1990-2008

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 indicator of genetic trends for the growth and milk traits for the Shorthorn breed.

The breed has made significant genetic progress since 1990. Over the years there has been an 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: Trans-Tasman Shorthorn BREEDPLAN results are calculated using software developed by the Animal Genetics & Breeding Unit, a joint venture of NSW DPI and the University of New England. BREEDPLAN development is supported by funding from Meat and Livestock Australia