Tools to Assist Genetic Improvement in Central Australia
Selecting cattle best suited to the environment and markets

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There are three basic streams within which genetic improvement can be made.

1. Differences between breeds

These are often exaggerated, but there are important differences - select breed(s) to suit environment and our ever changing markets. CRC Northern Breeding programs will offer some guide to some areas here (refer Page 53).

2. Variation within breeds

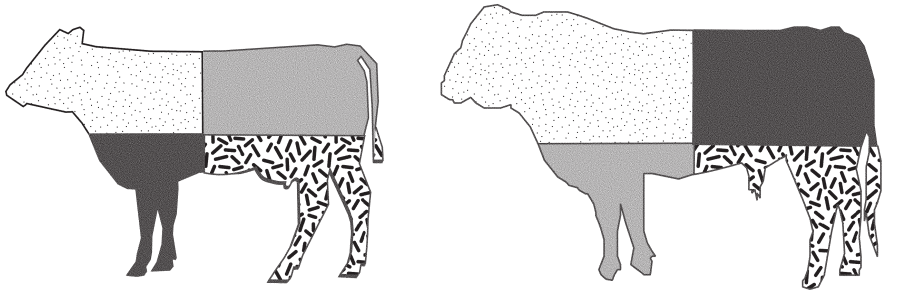
Bulls drive genetic change. Whether you are purbreeding, crossbreeding or developing composites, it is equally important to select the best bulls for particular situations.

- First, establish which traits are important and set priorities (refer Appendix A).
- BREEDPLAN EBVs can assist selection of the right bulls (refer Appendix B and Appendix C). As a minimum, learn the average EBVs for the Breed(s) being used, and buy bulls relative to this. If greater finesse is needed BreedObject is a tool to combine EBVs into $INDICES which can be customised for environments. These are now often seen in bull sale catalogue, and on websites (refer Appendix D).

3. Utilising hybrid vigour?

In situations where British Breeds do well and achieve market premiums, straight breeding remains a sound option. In other situations, crossbreeding or Composites offer potential benefits. As crossbreeding is often difficult to maintain in extensive situations, Composites involving breeds such as the Senepol, Tuli, Belmont Red, Bonsmara may have an expanding role here (refer Appendix E).

And keep in mind: *"Cattle breeding is a relatively simple matter, the challenge is to use the best of new technology, while still keeping it simple and suited to this exensive environment!"*



Appendix A

PRIORITISING AND BALANCING A BREEDING PROGRAM

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Introduction

Most beef producers want to increase the returns from their beef enterprises so it is reasonable to assume that profitability is the major production objective.
There are many characteristics of animals that contribute to profit. It would be ideal to select animals that excel in all traits related but in reality this is not possible; a compromise is always necessary. In the context of making genetic change you must determine if the characteristic related to profit is under a level of genetic control (the heritability).

Once you have decided what characteristics are important and whether or not they have high or low heritability you can formulate a plan for improvement. Some characteristics you will improve by genetic selection other by nutrition or management. The rest of this paper will concentrate on genetic improvement but never discount the importance of making sure the whole system is working.

Genetics sets the base to which, management and nutrition will value add. The seed stock breeder designs the genetic package. This statement is true if we accept that most of the genetic improvement at the commercial herd level comes from the sires introduced. (87% of the genetic composition of the current drop of calves influenced by the sire selection policy over the last 3 generations). Selection of females plays a minor part but they are still daughters of previously introduced sires.

Bull breeders and buyers now have access to GROUP BREEDPLAN Estimated Breeding Values (EBVs) for a range of traits (Appendix B p34) and index values that describe the profitability of animals for different market and production systems. Through the use of these EBVs and indices it is possible to achieve a high probability of selecting the best animals for your production environment and customer requirements.

SETTING THE DIRECTION OF A BREEDING PROGRAM

The first, and most important step is to establish a clear set of breeding objectives for your herd. This involves analysing the current performance and comparing this with the anticipated requirements of future customers and with your herd production targets. On completing this exercise you will be well placed to specify the characteristics required in replacement bulls to meet your breeding goals.

The worksheet, Table 1, can be used to assist in this exercise. The steps required to complete the worksheet are as follows:

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Appendix A

Step 1. List the traits of economic importance
List only those traits of real economic importance to your customers and/or your herd's future productivity. This will include traits influencing reproductive performance, growth, carcase yield and meat quality. You may also wish to include traits such as temperament and structural soundness.

Step 2. List customer's requirements
Remember "the breeding for today is already done". Your breeding objectives should relate to your vision of likely future market demands in at least 3 to 5 years time. That is when the results of your current breeding decisions will be realised.

Due to the uncertainty of predicting future market opportunities it is important that your breeding objectives are designed to ensure that future generations of progeny have a high degree of versatility and the ability to match a range of production and market situations.

Experience has shown that using a balanced approach to breeding where all traits are considered will give you a degree of versatility. Major problems arise when single trait selection is practiced and extremes in one trait are used.

Step 3. List future herd production targets
In order to optimise the use of the land and feed resources, it is important to set realistic targets for weaning rates, turn-off weights etc.

This may require an investigation of the typical production levels achieved by other producers in your region. Don't be too conservative. It is a good practice to set targets as good or better than the top 25% of herds in your region.

Step 4. List your herd's current performance
This is often the most difficult step. It requires knowledge of current herd production levels (e.g. weaning rates, turn-off weights). It will also require feedback from customers on the performance of your stock further along the production and marketing chain (e.g. growth rates during the back grounding and finishing phases, carcase yield and meat quality).

While it is difficult to find such information, with changing markets and seasons, it is hard to determine what direction you should be shifting your herd unless you know the base from where you are starting.

Step 5. List your breeding goals
By comparing current performance levels with future herd production targets and future customer's requirements you can identify those traits to be emphasised in bull purchase decisions.

If your calving rates are less than optimal for your environment, maybe you should be placing greater emphasis on female fertility and/or reducing the milk production potential and/or increasing the fat reserves of your cows, to give them a better chance of re-breeding annually. As an opposite example, your calving % may be fine, but customer feedback indicates that your steers tend to be too light with excessive fat cover. In this case maybe you need to select bulls with greater growth potential and increased leanness. If an audit on the bulls you have purchased over the last few years finds that they are in the top 20% for growth in the chosen breed, then the potential to improve growth by genetics is not very high. Maybe you need to look at nutrition. However if the bulls have been below breed average then you have scope to make genetic improvement.

Step 6. List your selection criteria
Once you have determined your breeding goals the next step is to list the relevant selection criteria that are available to assist in meeting these goals. For many important economic traits there are (EBVs) available to assist bull selection.

For example, if one of your breeding goals is to increase retail beef yield then relevant selection criteria include EBVs for Eye Muscle Area, Fat Depth and Retail Beef Yield %.

Unfortunately, not all economically important traits have objective measurements available. Selection for structural soundness and temperament still require visual assessment and judgment.

Appendix A

Remember that the more traits you consider the less progress for any particular one. While single-trait selection is rarely an optimal breeding strategy it is just as important not to try to incorporate too many traits into your selection program.

Step 7. Prioritize the selection criteria

In most cases, there will be several traits requiring emphasis. It is now important to establish their relative importance. This will require some knowledge of the scope for genetic improvement of the various traits, the genetic relationships between traits (both favourable and antagonistic) and the relative economic importance of genetic improvement in each trait. This will generally be attempted by local experience. If you prefer a more objective/formalised approach, the best way is with a selection index package such as BreedObject. This will balance all considerations, genetic and economic. (see Appendix D p41)

CONCLUSION

Significant opportunities exist for the use of genetics to improve long-term profitability of commercial beef enterprises. The beef industry is equipped with the knowledge and tools to make faster genetic progress than any other time in history. These tools are world class and conscientious breeders should become familiar with how they may assist their goals.

ACKNOWLEDGEMENTS

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Appendix A

Table 1. Example completed worksheet for establishing breeding objectives where the main market target is yearling cattle for the domestic supermarket trade. Note, while differing to many Central Aust. situations, the principles apply.

Trait	Future customer's requirements	Future herd production targets	Current performance level	Breeding goals	Selection criteria	Relative importance
Sale weight of steers	-	200-230 kg @ 15 months	170-210 kg @ 15 months	Increase steer weight at turnoff	↑$EBV_{400\ Wt}$	****
Carcase weight	180-230 kg (milk teeth)	-	-	Increase carcase weight	↑$EBV_{400\ Wt}$	****
Fat depth	6-12 mm	-	4 - 8 mm	Improve finishing ability	↑$EBV_{P8\ Fat}$	**
Heifer calving difficulty	-	< 5 % in heifers	10 % in heifers	Improve heifer calving ease	↑$EBV_{CE\ DIR}$ ↑$EBV_{CE\ DTR}$ ~$EBV_{Bth.\ Wt}$	** ** **
Weaning rate	-	> 90%	85 %	Improve female fertility	↑EBV_{SS} ↓EBV_{DC}	** ***
Mature Cow Weight		450 – 500 kgs	480 – 520 kgs	Reduce mature cow weight	↓EBV_{MWt}	*

Appendix B

BREEDPLAN AND THE BULL BUYER

Bull Buying Exercises

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THE BULL BUYER'S DILEMMA

Buying bulls at multi-vendor sales can be difficult. How do you tell if some stock look better due to feed, or are they really genetically superior? Certainly you can visually check structural aspects, temperament etc., and you may have experience with some studs or sire lines, but it would be good to have a better indicator of likely performance of progeny. What growth rates, milking ability, carcase attributes, female fertility do you expect in the progeny, for example?

Buying bulls on the property allows better selection within that herd, but how do you compare with other herds?

BREEDPLAN CAN HELP

BREEDPLAN is the Australian and International beef cattle performance recording and evaluation scheme which has been available since 1985. There are now more than 2000 herds enrolled in Australia, representing most breeds. As a testimony to BREEDPLAN's international standing, most of the NZ stud industry is now enrolled, the Hereford, Salers, Braunvieh and Shorthorn Associations in the US and several breeds in South Africa. There are also herds in Canada, Europe, Thailand, Argentina and Mexico.

CALCULATION OF BREEDING VALUES

BREEDPLAN is a computer-aided system for Estimating the Breeding Values of cattle. The estimates are called EBVs. This is done by measuring the performance of individual animals (e.g. for growth, calving ease, carcase attributes) and comparing it with their contemporaries run in the same conditions. This is of course an age old technique. What is clever about BREEDPLAN, is that powerful computers also containing the pedigree records allowing much more than the individual's own performance to be used. The performance of relatives (parents, brothers and sisters, progeny) are added to improve the accuracy of an EBV. Correlated traits are also used. For example, we know that weight gains to yearling and to two year old generally 'go together'. If, for example, two bulls weigh similarly at yearling, but differ at 2 years, the initial yearling EBVs are adjusted a little as BREEDPLAN 'suspects' that some random non-genetic events may have influenced the yearling weights. This is later confirmed or otherwise by the performance of progeny, and the EBVs may be further adjusted. In these and other ways, increasingly accurate estimates of breeding values are progressively made.

GROUP BREEDPLAN/SIRE SUMMARIES

GROUP BREEDPLAN is the version which allows comparison **between** herds, within a breed. Information from common bulls and cows is used to link and compare **across** herds. It has rapidly become by far the most commonly used system. BREEDPLAN also offers within-herd analysis.

Most of the major Australian breeds are now in GROUP BREEDPLAN.

Sire and Dam summaries are a major feature of GROUP BREEDPLAN. Sires with sufficient genetic links and records have their EBVs published. The following examples show the type of information available in sire summaries and sale catalogues.

Breednote 02/3 – Updated March 2002

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Appendix B

READING A BREEDPLAN CATALOGUE

[redacted]		GROUP BREEDPLAN EBVs - 2002							
		Birth Weight (kg)	**200-Day Milk (kg)**	**400-Day Weight (kg)**	**600-Day Weight (kg)**	**Scrotal Size (cm)**	**Rump Fat (cm)**	**EMA (cm)**	**IMF % (cm)**
Bull A	EBV	+8.2	+7	+35	+50	+.7	+1.5	+0.6	+0.2
	*Acc.**	*95%*	*70%*	*80%*	*80%*	*85%*	*75%*	*70%*	*65%*
Bull B	EBV	+2.3	+14	+19	+30	+1.3	+1.0	+3.5	0.0
	Acc.	*85%*	*60%*	*70%*	*75%*	*80%*	*81%*	*98%*	*62%*
Breed Av. ('00 born calves)		+3.9	+7	+32	+46	+0.9	0.2	+1.7	0.0

These EBVs are set against a zero base that is held constant. For many breeds the base was set in the 1970s. It is therefore more important to compare EBVs with breed average for the year of birth. In this case, two year old bulls for sale in 2002, were born in 2000. In the above example, Bull A is above average for all the weights, and average for milk and scrotal size compared to '00 born calves of this breed.

Now, let's see how progeny of the two bulls would compare, in more detail.

Birth Weight - This EBV is the best predictor of the birth weight of a bull's progeny. Bull A is well above breed average, and when joined to a random group of cows, would produce calves averaging 3kg heavier than bull B. (There is a 6kg difference in birth weight EBVs between the bulls. Half of this - the sire's contribution - will be expressed in the calves.) Birth weight is by far the most important genetic influence on calving ease. Gestation length, calf shape, uterine environment and pelvic area of the cow are also involved. Many non-genetic factors also influence calving ease.

* Accuracy figures (expressed as %) are an indication of how much information has been provided and hence the 'reliability' of each EBV. EBVs of lower accuracy are more likely to change as more information is collected. There is an equal chance of this change being up or down. The following bull selection exercises assume EBVs are of similar accuracy, as is often the case at any one sale.

Milk - BREEDPLAN partitions weaning weight into the growth and milk components. The milk EBV predicts milking ability of a bull's daughters - in kilograms of extra weaning weight their calves would have. Bull B is well above breed average and would have the best milking daughters. In many Central Aust. situations, high milk is a disadvantage.

400 and 600-Day Wt - these EBVs predict weight at various ages, so are most useful in turn for yearling or heavy steer producers. Bull A is ahead in both these areas, and would produce on average, calves heavier by 8kg and 10kg as yearlings or steers, respectively. NOTE 200 day growth and Mature Cow Wt EBVs are also available , but not used in this example.

Scrotal size - Bull A is breed average, bull B is above average and will breed daughters with earlier puberty and shorter calving intervals and sons with earlier puberty and bigger scrotal size. (Some breeds also give the female fertility EBV, Days to Calving, see later)

Carcase Traits - Compared to breed average, Bull A will produce earlier finishing or fatter progeny, with average muscling and above average marbling. (Further details later).

Note: Some breeds also report other Mature Wt, Fertility, Carcase and Calving Ease EBVs. These are discussed on the following exercises. Formore info on all these EBVs, including the newest EBV for feed efficiency see http://breedplan.une.edu.au ; then go to Technical Information , Breednotes.

Appendix B

BULL SELECTION EXERCISES

(In all these exercises assume bulls are sound and fertile. For simplicity, accuracy is not given. Answers are on last page.

EXERCISE I – GROWTH, MILK AND MATURE WT
GROUP BREEDPLAN EBVs (Kg)

BULL	BIRTH WEIGHT	200-DAY MILK	400-DAY WEIGHT	600 DAY WEIGHT	MATURE COW WEIGHT
A	-1	+5	+30	+45	+52
B	+2	+2	+25	+28	+35
C	+5	-8	+40	+50	+60
D	+2	+10	+25	+30	+34
E	+1	0	+28	+40	+36
Breed Av for drop	+2	+3	+28	+35	+46

The following buyers are selecting from this sire list. Which bulls should they choose?

Buyer 1 - Wants to increase yearling and final weights and avoid calving difficulty. The main product is heavy steers. Replacement heifers are retained.

Buyer 2 - Is straightbreeding in a harsh environment where cows with high EBVs for milk are slower to rebreed. Large mature cow size is also not favoured. Increased growth rate in two year old steers is also sought. (Answers on back page)

FERTILITY EBVs

The male fertility trait, scrotal size (SS) is an indicator of male fertility, but more importantly, high SS bulls are known to breed more fertile females. The female fertility trait - days to calving (DC), is also available for breeds providing the necessary joining and calving information. Calving ease and gestation length EBVs are also being provided by some breeds.

Scrotal size EBVs are in cm. Bulls with high figures will breed sons with bigger SS and daughters with earlier puberty and shorter days to calving.
Days to calving EBVs are in days, and predict the interval between commencement of joining (or AI) and calving. Sires with negative DC EBVs are preferred as they will breed daughters with shorter calving intervals.

Appendix B

EXERCISE II - FERTILITY

From this example catalogue, advise the clients on their bull choice.

	GROUP BREEDPLAN EBVs			
Bull	**400d Wt (kg)**	**600d Wt (kg)**	**Scrotal Size (cm)**	**Days to Calving (Days)**
A	+40	+50	+1.2	-9
B	+44	+40	+2.0	-6
C	+34	+40	-0.5	+9
D	+48	+58	-1.0	+12
E	+43	+51	+2.5	-4
Breed Av for drop	+36	+43	+0.4	0
(Assume all bulls have adequate Scrotal Size for current mating load)				

Buyer 1 - Has a commercial pure bred herd turning store steers and seeks to improve female fertility, while maintaining heavy steer weights.

Buyer 2 - Intends to use the bull as a terminal cross over cross bred cows, selling both the heifers and steers as yearlings.

.**CARCASE EBVs**

BREEDPLAN is actively involved in the carcase area. Commercial scanning services accredited by Breed Societies, are available to measure fatness, eye muscle area and intra muscular fat (IMF %) of live cattle. Most breeds produce these EBVs along with Carcase Wt and Estimated Meat Yield % (EMY%). Wherever possible, BREEDPLAN is also collecting abattoir Carcase data, particularly on marbling and other meat quality factors, to contribute to these EBVs. Some breeds also 'import' overseas information on sires to further strengthen the Australian analysis.

The improvement of these carcase EBVs has recently accelerated, as data from the Co-operative Research Centre (CRC) has contributed to the design of the BREEDPLAN carcase EBV system used since 1999. All CRC cattle have BREEDPLAN links. Since 2001, carcase EBVs are predications of the differences expected in a 300kg steer cascase, i.e. at a weight end point, rather than to the age end point used until 1999.

Appendix B

EXERCISE III - CARCASE TRAITS

The following is a selection of sires from a British breed catalogue. Which bull should the two clients buy?

	GROUP BREEDPLAN EBVs					
	400d Wt kg EBV	**600d Wt kg EBV**	**Rump fat mm EBV**	**EMA sq cm EBV**	**EMY % EBV**	**IMF % EBV**
Bull A	+56	+83	+1.3	+0.3	- 0.2	+0.3
Bull B	+50	+74	- 0.2	+2.0	+0.1	- 0.1
Bull C	+55	+80	- 0.7	+4.1	+0.4	+0.1
Bull D	+58	+78	+0.8	+2.0	+0.1	- 0.2
Breed Average for Drop	+52	+68	+0.2	+1.6	0.0	0.0

Client 1 - Sells yearling steers to a feedlot which is long-term feeding for Japan and has been advised to increase size and growth to 2 years, reduce fatness, maintain or improve muscularity and improve marbling.

Client 2 - Is purebreeding and feels his herd is getting too lean. He wishes to increase fat cover a little, without sacrificing muscling.

Answers

Exercise I

Buyer 1 " A (High 400 and 600 D EBVs, with low birth and positive milk)
" 2 - " E (Adequate 600 D wt; low milk, neutral Birth Wt and moderate Mature cow Wt EBVs

Exercise II

Buyer 1 - Bull A (The highest priority is the Negative (short) DC EBV, and 600 D Wt is also good)
" 2 - " D (Fertility EBVs relating to progeny are not important, so select highest 400 D Wt EBV)

Exercise III

Buyer 1 - Bull C (Fat EBVs is -ve, Eye muscle, yield % and IMF % +ve, 600 D Wt EBV is also high)
" 2 - " D (Fat EBV is +ve, and EMA EBV above av)

Appendix C

How much can you pay for superior bulls?

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How Much Extra Can You Pay For Superior Bulls?

This of course depends on many factors, including:

- The target markets. Are there premiums for meat quality or yield aspects?
- Are the bulls to be used as a terminal sire or for a self-replacing herd?
- Joining rate and working life of bulls.
- Cost of any extra feed consumed by faster growing or bigger cattle.
- * Cost of extra finance/insurance for higher value bulls.

Valuing a High Growth Terminal Sire

Let's start with a simple case with a Terminal sire. Turn-off weight is the main consideration, and sale is by liveweight.

A yearling steer breeder is choosing between bulls with 400-day wt EBVs of +30kg (Breed Av) and +50kg.

We know the bulls will breed yearlings 10kg different in weight (20kg difference between the bulls' EBVs, half of which is passed on to the progeny). The extra value of the high growth bull therefore depends on how many progeny he breeds and any extra feed costs for them.

In the simplest situation, (below) with a terminal sire and low cost feed, the gross value of this extra weight would carry through virtually to a net benefit. Depending on how heavily the bull will be used, you could pay an extra $60 (example A) to $100 (example B, table 1) per kg of EBV that a bull is above breed average. Let's take $70 as a conservative value, also allowing for such things as servicing the extra capital involved. .

If the average priced bull for your breed is say $2500, a bull with 400-day wt EBV 10kg above breed average, would therefore be worth $3200 (ie 10kg x $70 = $700 above breed av). Conversely, you might only pay $1800 for a bull 10kg below breed average (see table 1). This, of course, assumes that all other traits meet your minimum standards.

The steers by the higher growth bull, if sold on to a finisher, will also generate extra profit here. If it is a feedlot, with high feed costs, the extra weight gain is of course not "free" and has to be discounted for feed costs. There are still net benefits though, as high growth steers reach a target weight sooner, with less feed consumed, compared to lower growth cattle.

For example, in the "Trangie", NSW selection line experiments, HIGH LINE steers took 20 days less to put on 100kg liveweight in a feedlot and ate 10-15% less feed than CONTROL LINE steers gaining 100kg. This was at Supermarket weights. The lines differed in 400 day EBVs by about 25kg.

Feed efficiency gains of high growth cattle are largely eliminated if the steers are carried on to constant **ages**.

	A	B
Calves/year	30	40
Years joined	3	4
Total calves	90	160
Extra weight	900 kg	1600 kg
Extra gross value @ $1.30/kg	$1170	$2080
Sire differences in 400-day EBVs = 20 kg So; extra value of bull per 1 kg of Sire EBV (Extra gross value /20)	$58.50	$104
Rounded to	$60	$100

Example 1: Terminal Sire, growth only considered. With the high growth bull used at a low mating load (A), and a higher mating load and longer working life (B).

Valuing a Sire for Self Replacing Herds

Let's now assume the breederis planning on keeping heifers, that feeder steers are sold to a finisher who in turn sells dressed weight with price adjusted for carcase yield.

Example 2: Value of Bulls for a Yearling, self-replacing herd.

Appendix C

How much is a high performance sire worth? Brian Sundstrom

In this case, many factors have to be balanced. The most comprehensive way to do this is to obtain BreedObject $Indexes on the sale bulls. These weight all the EBVs according to the economies of the enterprise, and produce an index, or $EBV for each bull. These are available for several market situations, in some sale catalogues these days, or can be looked up on Breed Society websites. [eg http;//breedplan.une.edu.au then Links to whichever breed is needed] Table 2 shows examples an index for a self replacing herd, Yearling production system.

Progeny of bull 37 will produce, on average, an additional $7 per cow joined, compared to bull 91 which has a breed average index ($37 - $23 ÷ 2). The breed average indices are available along with all the other averages for EBVs for participating breeds.

We can now expand this example picking up the figures from example 1B for a situation where the bulls are to be used for 4 years joining, to 40 cows a year ie 160 cows.

Bull 37 would generate an extra $7 each from the 160 cows joined = $1120 over a breed average bull. It is then up to market forces between the bull buyer, the bull seller and the feeder steer buyer to decide how much of this $1120 is paid for the bull compared to breed average.

Bull	EBVs+									Yearling
No	BW	200M	200D	400D	600D	DC	SS	FD	EMA	$INDEX
37	4.9	14	38	72	85	0.5	0.9	0.4	2.5	+37
71	6.6	7	36	64	83	-3.8	1.3	-0.3	2.6	+36
34	5.5	3	31	60	74	-2.5	0.7	0.4	5.2	+35
25	8.3	2	34	54	82	-4.3	0.3	-0.4	2.6	+31
27	4.6	15	32	57	74	0.3	1.9	0.5	-1.0	+26
125	1.5	8	28	48	67	-1.4	0.4	1.8	0.4	+24
91	3.0	11	16	38	50	-5.3	1.1	0.7	1.0	**+23***
77	1.5	11	12	26	40	-5.6	0.1	1.0	1.2	+18
53	1.4	10	12	25	39	-5.9	1.0	1.0	-1.3	+16
531	8.5	14	36	52	70	5.9	1.2	1.3	-1.3	+15
151	5.1	7	18	31	49	2.4	-0.5	-0.1	2.1	+13
113	2.7	-1	16	33	50	1.9	1.5	0.4	-1.2	+11

Table 2: Value of bulls for a Yearling, self-replacing herd.

Note: *Breed average for his year of birth.
+ EBVs in turn: Birth weight, Milk, 200, 400 and 600 day weight, days to calving, scrotal size, fat depth, eye muscle area.

Appendix D

BreedObject,
Balancing EBVs/$Indices

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BreedObject is a software tool for use with BREEDPLAN. It assists the targeting of beef breeding programs by calculating the optimum mix of EBVs for any given situation. The program is designed for stud and commercial breeders and anyone else making selection or bull buying decisions.

Astute cattle breeders already attempt to balance their selection by placing varying emphasis on say the growth, fertility and carcase EBVs. BreedObject is a tool to optimise this balance, based on economic and production data for relevant commercial enterprises.

In the BreedObject program, the available BREEDPLAN EBVs on a line of animals are given economic weightings. These are generally customised for each user and situation eg For a Breed Society or an individual bull buyer. The weighted EBVs are combined into a single EBV, the $INDEX. In this way, a group of animals can be ranked for a variety of markets/environments. The main use for breeders in Central Aust. would be as extra infromation(rankings) when buying bulls.

Other uses, mainly in the stud industry, include:

- Ranking bulls for selection in seedstock herds
- Selection among potential AI sires
- Assessing trait importance for different production environments and markets
- Managing genetic trade-offs (eg. growth vs calving ease, meat yield % vs marbling, growth vs mature cow size, fertility vs carcase)
- Breeds and/or breeders identifying potentially elite young sires for further testing
- Gaining an indication of the differences in price justified between bulls
- The BreedObject technology was developed by AGBU+. It is being commercialised by ABRI as part of the BREEDPLAN service. Delivery options are still evolving, but are currently:
- Breed Societies develope a series of indices for typical markets/production environments for which their stock are most commonly used. These indices are usally developed by Society technical staff in close collaboration with AGBU geneticists. The indices are then used on the Society websites where users can list animals with all their EBVs and their $ indices. They are then available for sale catalogues and other uses described above. Examples are given on the following page.
- Some consultants have done a BreedObject training course run by AGBU. Commercial or stud breeders can engage such consultants to set up the program for their use eg. To rank bulls for the environment and herd and end market where they will be used. When the program is run, users can alter breeding or marketing objectives to see the effect on bull rankings.

National Beef Recording Scheme BREEDNOTE 02/5 Agdex 420/32

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Part of this role involves Technical Specialist and Advisory work with BREEDPLAN from an office at ABRI. His other role is with the Beef CRC group.

Appendix D

- A website version is available for public use. This also includes options to catalogue sale bulls, semen or embryos with BreedObject indices – http://www.breedobject.com.

As a **bull buyer**, the use of BreedObject can be as simple as learning to read this new style of catalogue information. At the other end of the scale, buyers can (with help from a consultant) obtain their own customised rankings on potentially any BREEDPLAN herd's sale bulls.

Table 1 Example Hereford Website listing of four bulls selected by a bull buyer to have the following EBVs: Birth Wt < 4.5kg; 600 day Wt > 70kg; Milk < 10kg and EMA > 2.3 cm²

Hereford Animal Listing

Entries:1-4 of 4 are shown **Sorted by**:Animal Name

Hide EBVs Hide $Index Values

Selection Criteria: Animal is a Published Sire, Animal is Registered, Birth Wt. (kg) <= 4.5, 600 Day Wt. (kg) >= 70, Milk (kg) >= 10, Eye Muscle Area (sq.cm) >= 2.3,

Home Animal Enquiry EBV Enquiry Member Enquiry Sale Catalogues Semen Catalogues

Name	Calv. Ease Direct (%)	Calv. Ease Dtrs (%)	Gest. Len. (days)	Birth Wt. (kg)	200 Day Wt. (kg)	400 Day Wt. (kg)	600 Day Wt. (kg)	Mat. Cow Wt. (kg)	Milk (kg)	Scrotal Size (cm)	Days to Calv.	Carcase Wt. (kg)	Eye Muscle Area (sq.cm)	Rib Fat (mm)	Rump Fat (mm)	Retail Beef Yield (%)	IMF %	Super-market	Hereford Prime	Short Fed (100-150 Days)	Long Fed Export
COORA CAMOOWEAL Q081 (AI)	+7.8	-1.0	-1.9	+3.9	**+32**	**+54**	**+81**	+83	+22	**+2.1**	-1.1	+49	+2.8	-0.8	-0.8	-0.3	+0.2	+$39	+$39	+$38	+$36
COORA ELLIMATTA S142	+7.4	-	-1.7	+2.8	+28	+51	+70	+65	+15	+2.0	-	+46	+3.7	+0.1	+0.1	-0.4	+0.3	+$40	+$39	+$41	+$39
JC CATALYST (IMP)	-3.3	-	-0.4	+3.7	**+33**	**+68**	**+88**	+81	+22	+2.6	-	+53	+5.4	-1.7	-1.7	+1.0	-0.3	+$38	+$41	+$41	+$37
PEPPERTREE NAMBUCCA	0.0	0.0	-1.1	+4.5	**+32**	**+50**	**+83**	+91	+11	**+2.2**	-	+44	+3.1	+1.0	+1.3	-0.5	-0.7	+$37	+$26	+$25	+$12
Breed Avg. EBVs for 1999 Born Calves	-0.8	0.0	+0.1	+3.9	+20	+31	+46	+46	+7	+0.8	-1.1	+23	+1.7	0.0	0.0	+0.1	0.0	+$20	+$19	+$18	+$17

(11 Trait Leading EBVs shown in this table)

Online Contact: Hereford Help
Site Designed & Supported by: ABRI

7 March 2001

Australian Hereford Society

The four standard Hereford $indices are shown on the right hand collumns.
Coora Camooweal, with a short fed index of $38 is predicted to 'earn' an extra $10 per cow joined, compared to a breed av. bull with an $18 index.(Half of the $20 difference in the Sire EBVs, $38 - $18, will be expressed in the progeny).

Further information: ABRI (02) 6773 3555, fax (02) 6772 5376, breedplan@abri.une.edu.au, sbarwick@metz.une.edu.au

BREEDPLAN EBVs and BreedObject indexes are calculated using software developed by the +Animal Genetics and Breeding Unit (AGBU) - a joint institute of NSW Agriculture and the University of New England. Development of BreedObject is supported by Meat and Livestock Australia.

Appendix E

THOUGHTS ON COMPOSITE BREEDING FOR CENTRAL AUSTRALIA

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Most people would agree that crossbreeding offers potential production advantages. The problem in extensive areas is managing the ongoing program, providing replacement females etc. In practice, few properties have been able to sustain quality crossbreeding. An alternative for some situations, is to use Composites.

Composites are formed by crossing existing Breeds, then intermating to stabilise the new mix. The aim is to:

- Combine best features of various breeds to suit environment and markets
- Retain as much hybrid vigour as possible

WHAT'S NEW ABOUT COMPOSITES?

Most breeds currently in this area such as Hereford, Santa Gertrudis and Droughtmaster, were themselves Composites if you go back far enough. They have been stabilised into Breeds.. What is new, is the availability of more Bos Taurus/Sanga breeds, with adaptation to semi-arid and subtropical areas. Eg: Breeds such as the Senepol, Bonsmara and Tuli. Another factor in areas where Brahman crosses are run, is the MSA pressure on meat quality(for over 25% Brahman). The current wave of interest in new Composites is therefore a natural progression, with breeders testing new options to deliver desirable adaptation/meat quality combinations.

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HOW MANY BREEDS, HOW MUCH HYBRID VIGOUR?

Well designed Composites will retain a significant proportion of the hybrid vigour. The more breeds involved the more hybrid vigour retained in the Composite. Four equally represented breeds, is often considered an optimum (75% of the hybrid vigour of a 3 bred cross is retained. See table 1). The fewer breeds used, the more important it is to use GOOD BULLS of each breed.

Table 1. Expected retention of hybrid vigour in various crossbreeding and composites programme. Source: Adapted from Gregory and Cundiff (1980) Journal of Animal Science 51: 1124 Note: **Hybrid vigour retention similar in a 3 breed rotation.*

Crossbreeding Systems	**% of maximum hybrid vigour**
Straightbreds	0
3-breed cross	100
Two-breed composite	
½A and ½B	50
⅝A and ⅜B	47
¾A and ¼B	37.5
*Four-breed composite**	
¼A, ¼B, ¼C and ¼D	75
½A, ¼B, ⅛C and ⅛D	66

Appendix E

Hybrid vigour is most important for traits which are only lowly heritable. These include most of the Fertility/Adaptation traits. For situations where these need improving as a priority, Composites should be designed with as many breeds as practical. At the other end of the scale, Carcase traits are generally highly heritable, so it is more important to use good bulls from a smaller numbers of "carcase breeds", rather than chase extra breeds.

OPEN OR CLOSED COMPOSITES?

Closed: Once the breed mix is stabilised, the herd is closed, and normal selection practices are used to improve the 'new breed'. Very large herds are needed and lots of sires of each breed to avoid inbreeding. Some of the Northern Pastoral companies are doing this, with mixes very suited to parts of Central Aust eg: AA Co with their Barkly Composite (¼ Senepol; ¼ Charolais; ½ Santa Gertrudis) and NAPCO with their "Kynuna" Composite (¼ Tuli; ⅛ Brahman; ⅜ Shorthorn; ¼ Red Angus) They also have a large herd of "Alexandria" Composites. (⅜Brahman; ⅛ Africander; 5/16 Shorthorn; 1/16 Hereford and ⅛ Charolais).

Open: The breed group mix is set, then new introductions made of the same(or very similar) mix. This allows introductions of top new sires as they are identified by purebreeding studs. Notes: Most of the main Australian breeds now have very active BREEDPLAN use and many are involved in international analyses. Ie: They should make good progress and it is a pity not to 'harvest' this new genetics as it becomes available. **Is this crossbreeding?** There is often little difference between an open composite system and continual crossbreeding. If Composite breeders bring in sires of the same **breed group** mix (eg. ¼ Tuli; ¼ Brahman; ½ British, but swapping say one of the British breeds), many people would say this can be fairly called an open composite.

SUMMARY POINTS FOR COMMERCIAL BREEDERS

- If have a good crossbreeding system and replacement females organised, doubt role for Composites. (unfortunately only a relatively small proportion of breeders can sustain even relatively simple crossing systems in the long term, due to complications such as drought/agistment; cell grazing; replacement females etc). Similarly, if country is suited to straight British Breeds with good market access, need careful thought before changing.

- Composite breeding need not be complicated nor require really large herd size ie. can be as simple as buying Composite sires of the chosen mix and run as a new breed. In fact, this can be much easier for extensive situations than most crossbreeding systems.

- ¼ Sanga; ¼ Bos Indicus; ½ Bos Taurus (some Euro?) seems to give good market flexibility for many of the more challenging Central Aust. Environments.

Appendix E

- **Getting started: CROSS EXISTING FEMALES TO PRODUCE A SIMILAR MIX TO THAT FINALLY REQUIRED, THEN BUY COMPOSITE BULLS OF THAT MIX TO STABILISE.**

  (i) Egs (for 1/4 Sanga)1 From pure British cow herd. Introduce ½ Sanga ½ Euro sires to breed the ¼ Euro/1/4 Sanga females. Then use Composites sires of this mix on these females.

  (ii) 2 From ½ Brahman/British base - use first cross Sanga x Euro sires to breed the ¼ females, which are then joined to Composite sires of this mix.

- Increasingly, bull buyers are seeking BREEDPLAN figures. These are widely available on Purebreeds, but generally lacking in Composites.

- Other issues include: *Calving difficulty needs to be watched when joining some Composites to heifers - some hybrid vigour here for birthweight too! This is likely to minimise if there are adapted strains in female lines. * Large cows may result with some Composites (a flipside of high growth for most breeds). * Docility needs watching as with any breed, note new BREEDPLAN Docility EBVs and flight speed options coming available.

More detail: http://www.compositebeef.com.au