AGBU ANIMAL GENETICS AND BREEDING UNIT
A joint unit of NSW DPI and UNE

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The Value of Recording Scrotal Size and Days to Calving

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In the design of beef cattle breeding programs an important decision is the choice of traits to record. This decision should be based, in part, on the costs of recording additional traits compared to the economic benefits resulting from additional genetic improvement. The following note is an extended summary of an investigation into the value of recording scrotal circumference and days to calving in BREEDPLAN. For more details read the two papers published by AGBU scientists in the Australian Journal of Agricultural Research. Vol: 45,8.

The Breeding Objective

To evaluate different recording schemes, a precise definition of the Breeding Objective is required. The Breeding Objective used in these calculations relate to a pasture based enterprise in temperate Australia where British-breed steers weighing 440 kg are finished at 16 months. The breeding objective consisted of the 11 traits in Table 1. The objective included a female (weaning rate) and male (no. of mates) component of fertility. The economic weights given in Table 1 are the values ($/cow-year) of a 1 unit increase in that trait while all other traits in the objective are held constant, eg. the economic value of increasing sale weight by 1 kg without an increase in cow weight is $0.75 per cow year. Table 1 also gives the economic weight per genetic standard deviation (v * s) so that the economic importance of the traits with respect to genetic improvement can be more fairly compared. As selection criteria or traits with EBVs, we included the standard BREEDPLAN growth traits (Birth, 200, 400 and 600 day weight) and in an improved recording scheme, Scrotal Circumference as a male characteristic and Days to Calving as a female record. These traits were assumed correlated with the traits in the objective, -0.55 between Days to Calving and cow weaning rate and 0.30 between Scrotal Circumference and bull mating rate.

The Population Structure

The investigated population was assumed to be 200,000 cows of which 5% or 10,000 cows were in seedstock herds with BREEDPLAN type performance recording. These seedstock herds after keeping the best bulls for their own herds, sell the next top bulls to commercial breeders who breed 70% of their cows to those selected bulls. The other 30% are bred to unselected home bred bulls that are sons of the former group. Selection is always on the best index given the records, except that allowance is made for 20% of bulls to be culled for reasons unrelated to their EBVs. For other assumptions about the population (eg. age at first calving, mating ratio or productive lifetime) and the full genetic correlation matrix see the papers referred to above.

Table 1: Economic Values, Heritabilities and Genetic Standard Deviations for the Traits in the Breeding Objective

Trait	Unit	Economic Values (v)$ per unit	h^2	Genetic Standard Deviation (s)	v*s
Sale Weight direct	kg	0.75	0.28	16.4	12.3
Sale Weight maternal	kg	0.75	0.08	8.8	6.6
Cow live weight	kg	-0.35	0.35	22.5	-7.88
Dressing percentage	%	6.80	0.33	1.03	7.00
Saleable meat percentage	%	5.45	0.55	1.48	8.07
Fat depth on rump	mm	0.20	0.37	0.84	0.17
Cow weaning rate	%	3.10	0.05	8.05	24.96
Bull fertility	mate	0.50	0.20	8.94	4.47
Cow survival rate	%	4.95	0.03	1.73	8.56
Calving difficulty direct	%	-.040	0.10	4.43	-1.77
Calving difficulty maternal	%	-0.40	0.10	4.43	-1.77

The Costs of Performance Recording

A performance recording scheme is an investment with fixed costs, eg. registration costs, extension service costs, and variable costs that can be directly related to the recording of a particular trait. The costs used in our calculations are given in Table 2.

Table 2: Costs of performance recording per animal

Cost factor	Recording Costs $
Fixed costs*	10.0
Birth weight	3.0
Weaning weight	1.0
400-Day weight	1.5
600-Day weight	1.5
Days to calving	0.5
Scrotal size	2.0

* per cow in seedstock herds

These costs include the time to record the information as well as the processing cost at the computer centre, however it is assumed that the recording takes place during normal handling of cattle. Cost and returns of a breeding program have to be discounted to account for the fact that costs always appear before the returns. A discount rate of 6 % for costs and 8 % for return was used. The difference between the two allows for a certain amount of risk. The returns from one year of selection have been discounted and accumulated over 25 years, that is, over a number of generations of descendants of the selected animals. Both seedstock and commercial sectors of the population generate returns by using genetically improved animals.

Results

Recording female and male fertility traits increases the accuracy of selection as shown below.

Table 3: Accuracy of selection for the Breeding Objective for young bulls and first calving cows

Recording scheme	Young Bulls	2 year old cows
Standard weights	0.21	0.21
Weight & fertility*	0.27	0.26

* fertility = Days to Calving and Scrotal Circumference

The Breeding Objective contains a number of important traits that have low heritability and cannot be directly recorded in young animals. Therefore the accuracy of selection is generally low in animals that have not been progeny tested. Nevertheless inclusion of fertility selection criteria has increased the accuracy from 0.21 to 0.27 or by 26%.

To judge the value of the increase in performance recording one has to compare total returns and total costs. Returns are accumulated as previously described over a number of generations at an increasingly discounted rate. Returns minus all costs (Fixed and variables) is the profit as presented in Table 4.

Table 4: Cost and returns of performance recording per cow in the total population

Recording scheme	Variable Costs	Returns	Profit*
Weight only	0.28	8.14	6.81
Weight & Fertility	0.33	10.36	8.98

* Profit = Return - Variable Costs - $1.05 (fixed costs)

From Table 4 it can be seen that for the total population the recording of scrotal circumference in young bulls and the recording of days to calving has a major effect on the profit of the breeding program. For a cost of 5 cents per cow in the population the profit increases by $2.17, a ratio of 1:43. This makes days to calving and scrotal size the most cost effective records.

With increasing number of traits recorded the makeup of the genetic gain will change from an extreme growth only to a more balanced situation where other traits are improved too as shown in Table 5.

Table 5: Predicted genetic gain per year for selected traits in the breeding objective

Trait	Unit	Recording Scheme	
		Weight	Weight & Fertility
Sale weight direct	kg	2.91	2.51
Sale weight maternal	kg	0.04	0.01
Cow weight	kg	2.86	2.93
Dressing percentage	%	-0.01	-0.01
Saleable Meat %	%	0.0	0.0
Fat depth	mm	0.03	0.02
Cow weaning weight	%	0.07	0.38
Bull fertility	mate	0.20	0.49
Cow survival rate	%	0.01	0.00

Selection on fertility has reduced the genetic gain made for sale weight somewhat but increased the progress made in cow weaning rate and bull mating potential. Carcass characteristics are not changed greatly by selection on weight or on weight and fertility.

From the estimated genetic gains per year and the economic values of each trait an annual genetic gain in $ can be calculated. The increased accuracy of selection will result in an increased annual genetic rate of gain from $1.43 to $2.22 in the breeding unit. While this genetic gain might look small it is cumulative and maintained in later generations.

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