ANIMAL GENETICS AND BREEDING UNIT

A joint unit of I&I NSW and UNE

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How to Conduct a Progeny Test

Mike Goddard

Introduction

Progeny tests can provide useful information to help cattle breeders identify the best bulls for their objectives. The advantages of progeny tests are:

i. Potentially the most accurate way to estimate a bull's breeding value.

ii. Can record traits which are not recorded on live animals such as carcase traits.

iii. Can record these traits on the commercially relevant class of offspring (eg. feedlot finished steers). This is important if the trait recorded on bulls (eg. fat depth) is a genetically different trait to the same measurement made on slaughter animals.

However, progeny tests can be quite misleading if not carried out correctly. The rules for obtaining accurate results are simple and common sense but they are often ignored. The purpose of this note is to briefly set out the requirements for obtaining good data for progeny testing.

The principle

An animal's performance depends on its genes (half from its sire and half from its dam) and the environment in which it grows from conception on. The importance of environmental factors is often underestimated. For instance, neighbouring paddocks may provide different diets so that cattle in them grow at different rates. When the cattle are transferred to a common environment (eg. a feedlot) partial compensation occurs so the pre-feedlot environment continues to affect growth rate and carcase traits. Even within a feedlot pens vary in environment (hotter or wetter or windier) causing differences in performance.

Therefore the central principle of a good progeny test is that there should be no differences between the offspring of each sire except the sire. That is, on average, the genetic merit of the cows to which a bull is mated and the environment in which the offspring are reared should be the same for all bulls.

Rules for the design of a progeny test

To achieve the aim of the 'central principle' above the rules are:

i. Randomly allocate cows to bulls.

ii. Mate bulls at the same time so that the offspring have the same average age.

iii. Rear the calves together and treat them all alike.

iv. Apply minimal culling to the calves at least prior to the first weighing (eg. weaning).

v. Slaughter the calves as a group.

vi. If the offspring have to be split into groups for practical management, make sure that each bull is represented in each group.

vii. If the progeny test is carried out over more than one property, the best design is to use all bulls on all properties. However, this can be relaxed by having at least one sire that links the properties provided he has sufficient progeny on each property.

Other rules can be relaxed under some circumstances. For instance, it is possible to allocate cows non-randomly to bulls if the basis for allocation is recorded and corrected for in the analysis. However, it is always better to design the comparison correctly than to rely on statistical analysis to correct the bias.

There is no simple answer to the number of offspring required for an accurate progeny test. The accuracy increases as the number of offspring increases. For a trait with a heritability of 30%, the accuracy of a perfectly designed progeny test with N offspring per sire is SQRT(N/(N+12)). For instance with 10 offspring the accuracy is 0.67 and with 20 offspring it is 0.79. This can be compared with the accuracy of an EBV based only on an animal's own performance for such a trait which is 0.55. N in the formula is the number of effective progeny which is less than the actual number. N depends on the number of progeny from this sire and the number of progeny from other sires to which they can be compared. If a sire's offspring have few contemporaries by other sires in the same management groups then the effective number is much less than the actual number.

If a contemporary group contains Na progeny of bull A and No progeny of other bulls, the effective number of progeny for bull A (N) is

$$N=N_aN_o/(N_a+N_o)$$

The total number of effective progeny from bull A is obtained by adding the effective number from each contemporary group in which he has progeny.

The cost of carrying out a progeny test is high and some may question whether it is necessary to follow the rules. Unfortunately the accuracy of sire evaluations based on 'informal' progeny tests or anecdotal information is very low and may seriously mislead cattle breeders. The dairy industry learnt long ago that to make progress it had to conduct progeny tests properly and correctly analyse the data.

Rules for data collection

The data needed are:

i. Sire and birth dates of calves at least to the nearest fortnight (dam if cows not randomly allocated to bulls).
ii. Management group if all calves not reared together including pen if in a feedlot.
iii. Weaning weight.
iv. Feedlot entry date and weight (or date and weight for any change of environment).
v. Slaughter weight and data.
vi. Carcase and other traits as desired.

Analysis of progeny test data

The appropriate way to analyse the data from a progeny test is to calculate EBVs for the bulls tested. There is likely to be other information on these bulls or their relatives in the BREEDPLAN data and it is desirable that all EBVs used by the industry should be on the same base and comparable. Therefore the data from correctly carried out progeny tests should be combined with the BREEDPLAN data and used to calculate an enlarged set of EBVs which will include carcase traits.

I suggest that BREEDPLAN accept any progeny test data which meets the above rules. In general data which does not meet these rules is likely to give misleading comparisons of sires and so should not be used. It is possible that a large industry database which accumulated poor quality data could be of some use. For instance, sires that consistently perform well over many independent offspring groups could be identified. However, to quickly find sires that will be of positive value to the breed before they are old and surpassed by younger bulls, it is more logical to carry out an accurate progeny test.

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