BLOODTYPING FOR HERD IMPROVEMENT

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INTRODUCTION

In the last four years Invermay has developed blood tests for hybrid identification and parentage in deer (Dratch and Fennessy 1985, Dratch 1987, Tate and Dratch 1988). Both these tests use the technique of electrophoresis to analyse inherited variation in blood proteins. Hybrid identification analyses proteins which have species specific types while parentage testing uses proteins which show a range of types within one species.

During the past two years deer farmers and veterinarians have made use of these tests through MAFDeer Bloodtyping Services (Tate et al. 1988). This paper describes our experience in solving problems associated with three important goals in deer herd improvement.

1. Genetic improvement in pure deer species.
2. Maximising the percentage of elk(wapiti) in a hybrid herd.
3. Using pedigree data in breeding selection

Part 1: Genetic improvement in pure deer species

The Goal

The goal of a large segment of deer breeders in New Zealand is to achieve genetic improvement in the production traits of pure deer species. Genetic improvement in pure stocks is important in improving production even if hybrids between the pure species are the basis of a production industry.

The Problem

One problem breeders of pure deer face is that some hybrid animals can be mistaken for pure animals of outstanding performance. Mistaken introduction

of hybridisation into a pure herd compromises the breeding goal and can reduce the value of animals to that of comparable hybrid stock.

This is especially true in red deer where hybrid animals with a small proportion of elk(wapiti) are easily confused with red deer of outstanding performance. The value of red deer with outstanding liveweight or antler weight is usually several times that of comparable hybrids.

Mistaken identification of Mesopotamian fallow hybrids as outstanding European fallow deer may be a problem in the future (Tate 1989). Hybridisation may also be an issue in elk of outstanding performance. On Invermay some hybrid calves (pure elk x Fiordland wapiti) are growing faster than pure elk grown under the same conditions. A possible explanation of this is that the pure elk are not achieving their full potential under New Zealand conditions.

Hybrid Identification Blood Test

Bloodtyping is a simple and objective means of identifying hybrids. When a large number of animals are typed it can confirm the purity of a herd. It applies to red deer, elk(wapiti), Mesopotamian fallow, European fallow, Pere David's deer, Mollucan rusa, Javan rusa, sambar and their hybrids.

Example: The Landcorp Nucleus Herds

Landcorp has screened the fastest growing red deer from its own farms throughout New Zealand to form two nucleus herds, one in the South Island and one in the North. Animals showing visual characters of hybrids were excluded from the nucleus. In addition the animals were bloodtyped. In the South 104 animals were typed and 4% of these were identified as hybrid and a further 8% as suspect. (see Tate et al. 1988 for a detailed explanation of these terms). All hybrid and suspect animals were excluded from the South Island nucleus herd. In the North 94 animals were typed and 8% of these were identified as hybrid and 10% as suspect. The suspect animals were followed up with an investigation of their origin and their parents were bloodtyped where possible. The suspect status was removed if these

parent herds showed no signs of hybridisation. All remaining suspect animals and all the hybrids were excluded from the North Island nucleus herd.

In this example the hybrid identification test provided an important additional screen which detected 12 hybrid animals which were indistinguishable from red deer in appearance. The screen was valuable to ensure that the high growth rate of the elite red herds was not simply due to hybridisation.

The example shows the care breeders need to take to maintain purity in a herd. There are relatively few deer behind fences in the world which have documented and proven origins. This applies not only to red deer but to supposed pure Elk(Wapiti)(Tate 1988). There is enough doubt concerning the origins of farmed deer in New Zealand that a number of breeders have tested all their deer and are testing all deer before purchase irrespective of the source.

Purity

Only when a large group of animals are typed from a single population can comments be made regarding purity of that population. We do not support claims of purity based only on a negative test result (ie. no hybridisation detected) in a single animal.

Recently we examined the purity of three New Zealand feral herds (Brown 1988,) - the Otago herd (from Minaret Station) the Rakaia (from Mt Hutt Station) and the Coastal Wairarapa Herd (from Arahura deer farm). The numbers of animals typed were 89, 311 and 54 respectively. No hybrids were detected in any of the herds. Even in the Coastal Wairarapa herd where the sample size was low the test would have detected as little as 0.5% elk genes in the population. As no elk genes were detected the purity of these three herds is confirmed.

Part 2: Maximising the proportion of elk in a hybrid herd.

The Goal

The goal of many breeders who own pure imported elk is to use pure sires to increase the percentage of elk in their hybrid herds to the point where the hybrid progeny are indistinguishable from pure elk.

The Problem

The majority of elk-red hybrid animals in New Zealand are of Fiordland origin and so the proportion of elk and red deer is unknown. 'Fiordland wapiti' as these animals are commonly called vary widely in their genetic makeup. Some are almost indistinguishable from red deer while a few are close to pure elk. An objective means of assessing the proportion of elk genes in these hybrids is required to maximise the results of a hybrid breeding program.

Bloodtyping to determine the percentage of elk in a herd

Bloodtyping has proved valuable in determining the percentage of elk and red deer genes in hybrid herds. If twenty or more animals from one herd are bloodtyped then the percentage of elk genes in the herd can be calculated. This percentage provides an important means of comparing herds, monitoring the progress of upgrading programs using a pure elk sire and in structuring upgrading programs. Examples of the use of bloodtyping are given below.

Bloodtyping also provides an aid to assessing the proportion of elk genes in a single animal. However more blood markers are required to accurately determine the percentage of elk and red deer genes in a single animal. The best way to determine the proportion of elk or red deer genes in an individual animal is to combine bloodtyping data with a visual assessment of the animal and it's performance records if these are available. If all three indicators agree then there is a high degree of confidence that a correct estimate has been made.

Example 1. Determining the proportion of elk and red deer in a herd of Fiordland wapiti.

Invermay and Landcorp have established at Orokonui a herd of animals captured in the wapiti block in Fiordland. The Fiordland animals formed the foundation herd for an upgrading program using a pure elk sire. Because of their appearance the animals are thought to have a high percentage of elk(wapiti) genes compared to other groups of Fiordland Wapiti. Bloodtyping of the animals provided the means to compare the animals with other herds. It also gave a base percentage for the Fiordland animals from which to predict the percentage of elk in later generations.

Bloodtyping showed the original Orokonui herd of Fiordland wapiti contained 56%, elk genes (44% red deer). This compares favourably with other groups of Fiordland wapiti that we have typed at 30%, 46%, and 53% elk (in each case the balance is red deer).

The figure of 56% elk genes for the base herd of Fiordland Wapiti also allows a prediction of how many generations it will take of mating to a pure elk bull to get offspring of a given percentage of elk.

	% Elk
Original Fiordland Stock	56%
Prediction -	
First generation to a pure elk sire	78%
Second generation to a pure elk sire	89%
Third generation to a pure elk sire	94%

For example it would take 3 generations or approximately six years to reach the percentage of 94% elk.

Example 2: A client owns a group of animals supposedly the progeny of a pure elk bull match with Fiordland cows. The client wanted to check parentage and select a mating group of his top cows to mate to a pure elk sire.

We tested the group which gave a percentage of 62% elk genes in the herd. However the bloodtyping clearly showed that not all the animals were from a pure elk sire. These animals showed red deer types at one or other of the primary markers indicating both parents must have contained red deer genes. Removal of animals which did not have a pure elk sire from the herd boosted the herd percentage to 69% elk.

In a herd such as this further gains could be made by selecting out the top performers (eg by weight and/or most elk-like appearance) into an elite group. In another example we divided the top 20% animals (by weight and most elk-like in appearance) into an elite group. This raised percentage of the top hybrid mating group 6% from 69% to 75% elk.

Part 3: Using pedigree data in breeding selection

The Goal

A breeding program based on objective performance and pedigree recording.

The Problem

Good records of performance and pedigree are necessary to select the best animals for ongoing breeding and selection. However in deer accurate pedigree records can be difficult to obtain.

Determining paternity requires single sire mating. If replacement stags are used the variation in gestation length of red deer hinds results in a period of about 12 days at calving when the sire cannot be determined accurately.

Maternity is usually determined by suckling observations. These observations are often made some months after calving just prior to weaning. Cross-suckling and adoption of calves is difficult to detect without intense observation and this is usually not practical on commercial farms.

Parentage Testing

Parentage testing provides an independent means to check parentage records made on farm. It can be used to solve cases of uncertain paternity and detect cases of cross-suckling and adoption. At this stage the correct parentage of calves can only be solved by parentage testing if the number of alternative parents is low. Where the number of potential parents is large(eg: 20 hinds in a mating group) parentage testing may not identify the parent, although it should exclude a large proportion (currently over seventy percent) of the the hinds from the parentage problem. With further development work, matching all the hinds and calves in a mating group using bloodtyping alone is a reality.

Example: Paternity case

A client was uncertain of whether his English or European stag sired two calves. We obtained blood from the dams, calves and sires. The results clearly excluded his English stag from the parentage of one calf and the European stag from the parentage of the other calf. In each case the alternative sire was identified as the father by a process of elimination (Tate 1987).

Herd tests and cross-suckling

Initial results on first calving hinds at Invermay showed a high level of the parentage assignments made were incorrect (between 19% and 36%). However parentage testing on 21 of Invermay's old hinds (8 years+) detected no mismatches. In the subsequent year continuous daylight observations of 15 Invermay first calvers whose offspring were tagged at birth suggested that the high level of mismatches in first calvers was due to cross-suckling and adoption. Of the 13 calves, 1 was adopted, 2 regularly suckled three hinds and 2 regularly suckled two hinds (J. Sigsgaard and M. Fisher unpublished data).

This year we are parentage testing 10 commercial herds to determine the levels of parentage mismatches in commercial breeding herds. This study will provide the breeders involved with an assessment of the accuracy of their parentage matching procedures. It will also determine whether mismatching at calving in farmed deer is an issue which deer breeders and researchers need to address. If so, parentage bloodtyping will be a useful tool to identify the farm management procedures which give the most accurate parentage records.

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