Heritability gains credibility

The way to improved animal performance

by Brendan Hutching

THE BEST New Zealand Red deer stags are probably staring down from the walls of many a high country station.

Which is why, according to Peel Forest Estate manager Jeremy Johnston, the average local farmed deer weighs less than its European game park cousin.

Kiwi hunters from the 1930s on, brought down the best wild specimens, effectively culling from the top end.

Johnston shared these thoughts with the 400-strong audience at the South Canterbury and North Otago NZDFA branch fieldday in November.

Peel Forest Estate hosted the fieldday, Fortex provided the food and people came from as far afield as Auckland.

In contrast to the treatment of the New Zealand wild herd, European game parks have aimed to boost stock quality by ruthless culling of the bottom end and selective mating.

Now New Zealand farmers can follow suit, says Johnston. With the heavy cull of the last 18 months almost over, the key to profitability now lies in upgrading individual animal performance.

The question is the speed at which that improvement will be achieved.

Mating different deer strains has been shown to improve progeny performance, but now there's a formula which can be used to calculate the level of improvement.

This should not be confused with hybrid vigour which is generated by cross-breeding between deer species like Red and Wapiti.

The performance boost in the first generation of cross-bred progeny diminishes with subsequent matings, whereas hybridisation between different deer strains within the same species produces a permanent improvement in all subsequent progeny.

The key is heritability, a concept AgResearch Invermay general manager Dr Peter Fennessy explained to the fieldday audience.

Heritability means the ability of the parents to pass on their own traits to their offspring (see panel). Within deer strains heritability is known to be about 40 per cent (or 0.4), but when crossing between strains it jumps to 100 per cent.

Theoretically, the progeny of between-strain matings should improve by at least twice as much as within-strain matings and early data from some New Zealand deer farms seem to support that conclusion.

If so, farmers will have a valuable tool for calculating average progeny weights. They will still need to decide whether to upgrade the herd by further hybridisation or to keep the main herd pure and use hybridisation to produce faster growing animals for slaughter.

Research also shows what many farmers already know from experience: By two years old a stag's velvet and bodyweights clearly indicate how well it will perform in later years.

In the case of velveters, the best two year olds will repeat the performance throughout their lives (see table), hence the advantage of accurate performance recording.

Operations which use the hybridisation factor include Graham Carr NZ Ltd's finishing business near Ashburton, for which Jeremy Johnston claims 59 kg killing weights for half and quarter German rising one year stags.

He says it's also possible to finish a stag to 50 kg, catch the mid-October to November prices and obtain similar weights for hinds by February-March.

Other Canterbury farmers, Alistair Johnston from Ashburton and Dave Collie of Geraldine, also report promising results from European genes.

Collie's pure European weaners — stags and hinds — averaged out about 9 kg heavier than NZ Red weaners at spring weighing.

Sounds good, but what about the economics of a European sire? ▷

Complications clarified

DR FENNESSY'S equation for calculating average progeny performance based on the performance of the parents sounds complicated, but once understood it's easy to use.

Say you want to mate a non-NZ Red stag (strain B) with NZ hinds (strain A) to induce some hybrid vigour and boost performance.

Assume the performance values of the strain B sire are: Liveweight 260 kg; velvet 3.6 kg at 5 yrs.

(Strain B is not identified as any particular breed, but is assumed to be 30 per cent bigger than the NZ Red strain.)

Assume the performance values of strain A sire are: Liveweight 200 kg; velvet 2.5 kg at 5 yrs.

The formula for calculating average progeny performance is: 'Strain A' average plus the difference between the strain average and the individual, multiplied by one half of the heritability for the strain of individual used.

Using the above figures, the average liveweight of stag progeny from a strain B stag over a strain A hind will be 230 kg. This is calculated as follows: 200 kg + (60 kg x 0.5 x 1.0) = 230 kg.

The 200 kg equals the average weight for a strain A stag, the 60 kg difference between that and the weight of the strain B animal is multiplied by 0.5 because the progeny receive only half the male parent's genes. The 1.0 represents the 100 per cent heritability factor.

The equivalent result for selection within a strain, using a top 260 kg stag, would be an average 212 kg stag progeny liveweight because of the 40 per cent heritability within a strain. That is: 200 kg + (60 kg x 0.5 x 0.4) = 212 kg.

The same formula can be used for calculating the average boost in velvet production from hybridisation. In the case of the above sire (which produces 3.6 kg at 5 years) the average progeny would produce 3.05 kg, calculated as follows: 2.5 kg + (1.1 kg x 0.5 x 1.0) = 3.05 kg.

In other words, when an average sized stag of another, bigger, strain is mated with an average NZ Red hind, the offspring will perform better (see table). □

▷ Farm consultant John Tavendale of Ashburton suggests they are manageable. Assuming the European costs an additional $6000 over a NZ Red and the capital recovery cost is set at three years, the additional cost plus interest equals $7500, or $2500 a year. After that costs revert to the normal cost of a good NZ sire.

If the European sire is mated with 50 hinds each season the additional cost is then $50/hind/year. But for that outlay you could gain superior breeding females by retaining all the female progeny and at no extra cost, provided the weaner stags fetched an additional $118 each at sale.

Tavendale says these prices have been achieved to date.

Performance recording received the thumbs-up from several speakers, while NZDFA councillor Tim Brittain gave three reasons for establishing a national deer register using a unique number for every farmed deer.

First: For performance recording which would assist achieving genetic gains for the industry as a whole and a marketing advantage for the individual farmer.

The NZDFA's recently established Deer Development Council has endorsed selected computer software systems as meeting the standard required by deer farmers as a way of encouraging recording.

The DDC has also set up a recording system of its own for farmers without computers. In return for supplying information on tag numbers, parentage, body and velvet weights, the system furnishes a report including mating lists, weaning reports, 15 month selection lists and stock lifetime summaries.

Second: Quality assurance — to ensure accurate age and health records for each animal. A Deer Slaughter Plant link-up to record slaughter numbers at the end of each day would also provide a quick and accurate picture of the state of the industry.

Third: market access. The EC is proposing that all food imports be accompanied by health information. The only way to achieve this would be through a unique numbering system.

The DDC already has such a system in place, available through the NZDFA national office. Users are given a farm identification and can order brass tags incorporating the number.

Peel Forest Estate breeds two European bloodlines — the German Schulte-Wredes and Yugoslavian Reds. Owner Graham Carr travelled to both countries to choose his bloodstock and by 1986 Peel Forest had amassed a small pure German herd of four stags and 11 hinds.

Conditions in Yugoslavia were more primitive, but two shipments of Yugoslavian stock were imported through Britain before mad cow disease closed the British border.

As a result of an extensive AI programme, Peel Forest now runs 180 German and Yugoslavian purebred stags and 285 pure hinds.

Carr's policy was to sell only stags aged two years and up, but the stud has reached its herd target size so more deer are available to farmers looking to boost herd performance. □

Table 1: Velvet antler production (kg) by age for groups of stags categorised according to their two year old velvet antler production (N = 90)

Rank on two year old velvet product	Velvet antler production (kg) by age 2	3	4	5	Cumulative (2-5 yrs)
Top 1/6	2.18	2.62	2.99	3.53	11.32
Next 1/3	1.55	2.22	2.46	3.12	9.35
Next 1/3	1.20	2.08	2.05	2.85	8.17
Bottom 1/6	1.02	1.80	2.11	2.63	7.69
Overall mean	1.48	2.18	2.42	3.03	9.11
± Std deviation (SD)	0.43	0.42	0.47	0.56	1.60

Table 2: Velvet antler production (kg) by age for groups of stags categorised according to their yearling liveweight (N = 90)

Rank on yearling liveweight	Yearling liveweight (kg)	Velvet antler production (kg) by age 2	3	4	5	Cumulative (2-5 yrs)
Top 1/6	106	1.75	2.29	2.91	3.61	10.06
Next 1/3	101.5	1.51	2.21	2.83	3.09	9.64
Next 1/3	96.6	1.58	2.18	2.63	2.98	8.38
Bottom 1/6	91.1	1.43	2.05	2.67	2.81	8.57
Overall mean	100.5	1.48	2.18	2.72	3.03	9.11
± SD	9.57	0.42	0.47	0.59	1.60	1.60

Summary of comparison

	Strain A Average	Strain A Top	Strain B Average
Stag liveweight (kg)	200	260	260
Velvet weight (kg)	2.5	3.6	3.6
Hind liveweight	110	145	145

Progeny average expected by mating of these stags over average Strain A hinds

	Within strain	Hybridisation between strains
Stags – Liveweight (kg)	200	230
Velvet weight (kg)	2.5	3.05
Hind – Liveweight	110	128

These comparative figures illustrate the general differences expected by following the two alternatives.

However, making the decision to go with the first cross is easy. It is the next step which is difficult. This depends on the objectives. Do you go bigger by mating the hybrid hinds back to the strain B stag or is the whole operation simply to produce faster growing animals for slaughter.