# IN DEER FINISHING THE OPTIMAL SLAUGHTER WEIGHT WILL INCREASE AS THE GENETIC PERFORMANCE OF THE HERD IS IMPROVED

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## SUMMARY

A deterministic simulation for deer finishing is developed. The model accounts for the complex interaction of feed requirements, market premiums, growth rates, and strategic drafting systems. The hypothesis is posed that the mean genetic merit of the deer herd will alter the optimal slaughter weight. A difference of 0.2 kg/day in mean growth rate over the finishing period alters the optimal slaughter weight from 106.5 kg to 122.5 kg. It is also shown how the breeding objective's economic values are dependent on the predicted genetic improvement, and the herd's base productive level.
**Keywords:** Deer, management, slaughter weight, genetics

## INTRODUCTION

Intensive finishing systems are being used in New Zealand to farm deer (Fennessy and Milligan 1992). Farmed deer's productive capacity is being enhanced by the use of terminal sires, high quality feeding regimes, and advanced drafting strategies (ie. slaughtering deer at set weights rather than a set age). Likewise, profitability can be enhanced by altering stocking rates and slaughter weights. In particular some finishing units are using a drafting strategy to take advantage of early season price premiums, and limited feed supplies.

To maximise profitability, finishing unit managers have to make a series of decisions, such as determining the number of animals purchased for finishing, and calculating the weight at which animals are slaughtered. These decisions are complicated by the seasonal nature of deer growth (Fennessy *et al.* 1981; Suttie *et al.* 1987) and price premiums for early season production of venison. Because of these complications we know little about optimum slaughter weights and stocking rates for finishing deer, as the optima may depend on the genotype and management system under study. In this paper we examine the complex interactions of feed requirements, market premiums, growth rates, and strategic drafting systems, with the hypothesis that changes in the mean genetic merit of the deer herd will alter the optimal production strategy that should be employed.

## MATERIALS AND METHODS

We assume that the deer finishing unit manager's objective is to choose a threshold slaughter liveweight (w) that maximizes profits from a restricted total feed resource (P). The maximization problem is $n(w) \cdot F(w \mid g, k) < P$ written as:

Subject to

$$Max\ \pi(w|g) = n(w) \cdot \left[R(w|g, pc, k) - C(w|g, pc, k)\right]$$

where n(w) is the number of animals purchased at the beginning of the finishing season. R and C are functions giving returns and costs respectively ($ per animal). F is a function giving the average feed requirements (in mega joules [MJ] of metabolisable energy [ME] per animal) and P is the total feed energy available (in MJ of ME) throughout the whole finishing season on the farm. Scalar w is the threshold liveweight above which animals are slaughtered, while vectors **g**, **pc** and **k** contain genetic parameters, price constants and biological constants respectively. Thus the number of animals on the finishing unit depends on the slaughter weight criterion, because this criterion influences feed costs, and is constrained by the feed available on the unit.

Animals are slaughtered when they reach a particular liveweight throughout the growing season. At the end of the season, animals that have not reached that liveweight are sent to slaughter at their current weight. Average animal returns (R) are calculated assuming that dressing percentage is constant at a constant threshold slaughter weight, and with the venison price function as illustrated in Figures 1A and 1B.

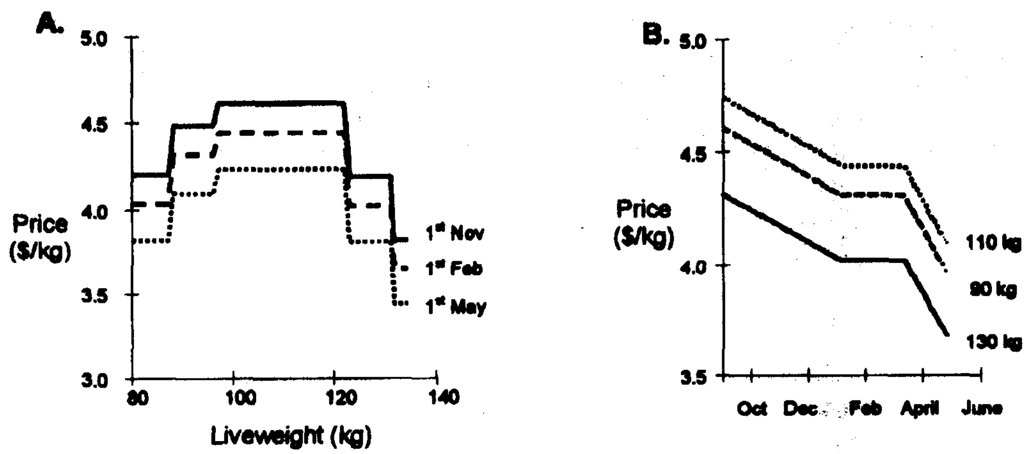


**Figure 1A&B. The relationship between venison price ($ per kg liveweight) and deer liveweight (kg) at the beginning (1st November), middle (1st February), and end (1st May) of the growing season, and the relationship between venison price ($ per kg liveweight) and time for a 90 kg, 110 kg and 130 kg liveweight animal, assuming a dressing percentage of 57%.**

Average animal costs (C) are calculated as:

$$C(w \mid g, pc, k) = \sum_{t=1}^{e} DF(t, g, k) ?\rho_r(t, g, k) ?P_F(t, pc)$$

where $P_F$ is the price of feed which is variable throughout the season. DF is the average feed requirement, on day t, (MJ of ME per animal per day) of the finishing deer, calculated from (Fennessy and Milligan 1992), taking into account seasonal variation in growth rates and maintenance requirements. $\rho_r$ is the proportion of animals not yet slaughtered on day t.

The genetic merit of a group of animals at purchase is specified by values in vector **g** which determine the average start weight, growth rate and dressing percentage of the animals to be finished. The economic value of growth rate was calculated from the model by first determining farm profit at the optimal slaughter weight threshold w* with a base level of performance. Genetically improved animals were then simulated with a new optimal weight threshold w** and the improvement in farm profit, expressed per kg/day, was taken as the economic value.

**RESULTS AND DISCUSSION**

This simulation demonstrates that the optimum slaughter weight of finishing deer alters as the genetic merit of the deer herd changes (Figure 2). The optimum price return for deer is in the 96 to 123 kg liveweight range (equivalent to a 55 to 70 kg carcass weight range). The optimum profitability of the finishing unit shown in Figure 2 lies within this range. However the optimum slaughter weight can alter appreciably within this range (106.5 kg to 122.5 kg) if the deer are faster growing by 0.20 kg/day averaged across the growing season. In this scenario unimproved animals grow at a maximum rate of 0.40 kg/day, and a minimum of 0.05 kg/day, while improved animals grow at maximum of 0.60 kg/day and minimum of 0.25 kg/day. If the finishing unit can choose to run terminally sired or pure bred animals then there may be genetic differences between these two genotypes similar to the example given above. These results suggest that crossbred animals should be finished to a higher slaughter weight and with a lower stocking rate than purebred animals.

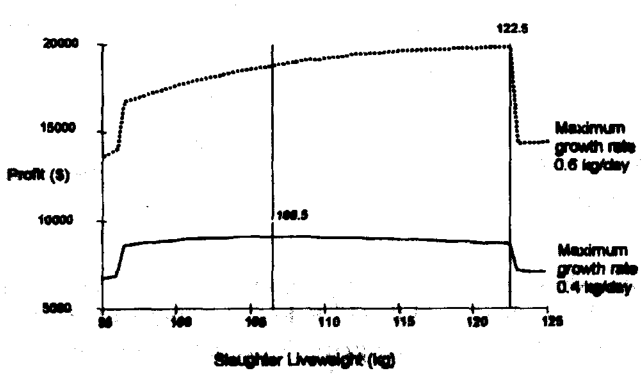


**Figure 2. The optimum slaughter liveweight (kg liveweight) of the farming unit given genetic potentials for maximum growth rate of 0.4 kg/day and 0.6 kg/day.**

Economic values, as defined above, are dependent on both the optimum slaughter weight, and the predicted rate of genetic improvement in a trait. Economic values change as the base genetic level changes (Figure 3), and will also depend whether large breed changes or smaller within breed changes are being considered. Thus in contrast to the usual assumptions made in defining 'widely applicable' selection indices, we see here that the weighting of economically important breeding objective traits is highly dependent upon: the level of production, expected genetic improvement, and the management decisions that optimize the production system.

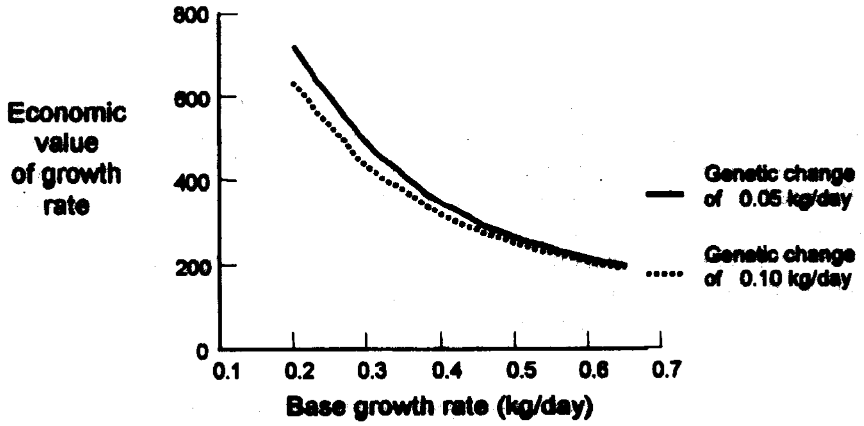


**Figure 3. Economic value for growth rate ($ per animal per kg liveweight gain per day), with alternate base genetic values for growth rates (kd/day) after modeling a genetic change of 0.05 kg/day and 0.10 kg/day.**

The model developed in this paper makes an attempt to combine both genetic and production system variables. Traditionally, economic models for developing breeding objectives treat these variables as independent. Here we have demonstrated that with a predicted improvement in genetic merit the production system should change, and this change will most likely result in a change in the relativity of traits in the breeding objective. Given the results in this simulation we suggest that the role of the modern geneticist be not solely to design genetic improvement programs, but also to monitor and develop optimal production systems.

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