The Farming of Deer

AN AGRICULTURAL SCIENTIST'S PERSPECTIVE

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Making predictions can be a dangerous business, — if they're unpalatable, one can be thrown into prison or ostracised but this audience is more likely just to laugh. However making predictions is essential if we are intending to make sensible business decisions, especially if the return is likely to be long term as is the case with any investment in agriculture. Consequently this paper has been thought provoking for me at least.

BACKGROUND

Whenever scientists talk about improving efficiency I detect a certain nervousness among the audience along with a few sniggers about all this theory — but quite simply it is the only basis by which to improve financial returns in the long term. At the moment in New Zealand we seem to be going through a phase where it is fashionable to denigrate science and research, while economists and marketers are being deified.

But back to efficiency — by efficiency I mean output per unit of input. For meat production it is kg of carcass output per kg of feed input. Therefore with grazing animals you can:

* genetically improve your animals so that they make better use of pasture, and
* alter the management so that a greater proposition of the pasture grown is used productively.

The reason for improving efficiency is to increase the return on investment because gains in biological efficiency in the appropriate areas will improve financial returns. As a scientist I should be able to give you guidelines on how to improve efficiency if the marketer can tell me what the important features of the end-product are. The other part of my task as a scientist is to get the desired improvements while not shutting out the possibility of improvements in other areas when they become necessary.

This paper looks at some of the possibilities for the future and concentrates on a few areas where I see real potential for development over the next few years.

VENISON

The long term viability of any meat production system is dependent on two main factors:

* knowledge of consumer demand and the ability to profitably fabricate the required products, and
* the ability to produce the raw material economically and to quality specification.

In general terms, the requirements of the more sophisticated markets for meat are that it be lean, tender, attractive, nutritious, consistent, convenient and natural. The market for venison is at the top, high value end of the market, which takes only top quality product and demands the highest standards of quality control and quality assurance programmes. Also high value markets for meat usually prefer fresh or chilled rather than frozen product — hence the importance of new developments in processing and packaging. These new developments extend well beyond portion cutting and vacuum packaging to up market pre-packaged or pre-cooked meals, concentrating on high quality foolproof products. Therefore my task here is to look at some of the possibilities for improving our ability to produce the appropriate raw material for the processing part of the industry to use profitably.

The farmer's objective is to be able to produce this raw material economically and therefore we have to look at ways of producing the right type of animal as efficiently as possible. While long term changes may be effected through breeding, short term changes can be effected by changes and developments in management techniques;

I propose that the appropriate raw material (i.e. carcass) for the processor will be one that is:

* **lean** — with a high meat to bone ratio
* **uniform** — so that its response to processing is predictable — i.e., that it be appropriately tender following post-slaughter treatment and that its shelf-life under chilling can be safely and accurately estimated
* **available** — when required, and of the appropriate size to both minimise slaughter costs at the same time as to maximise market opportunities and price for the end product.

Each of these factors will now be considered in more detail.

Leanness

The main factors affecting leanness and meat to bone ratio are the proportion of mature weight which the animal has reached at slaughter, its sex and the time of the year when it is slaughtered.

At the same proportion of their adult liveweight, males and females of a species will generally have very similar proportions of fat. This is the case with deer but the time of the year also has a very marked effect as we all know with stags being very lean post rut and through the winter. This means, that when slaughtered at the same carcass weight, hinds will be fatter than stags and New Zealand red deer fatter than wapiti. Consequently if we want a

lean 80 kg deer carcass we only have a couple of choices – a heavy adult red stag post rut or a young wapiti or wapiti hybrid animal.

Although at 50 kg carcass weight we can expect the wapiti to have less fat than a red deer, it will also have more bone. These few points highlight the general principles around leanness. The choice of species will likely depend on the market requirements although the future of portion cutting could have a major impact here, in that the actual carcass size may be much less critical than is apparently the case at present.

However, there is also the variation within the strain or species. Inevitably there will be genetic variation between animals within a herd for the amount and distribution of carcass fat. In the future it may well be profitable to exploit this – relatively simple systems of progeny testing could be set up through deer slaughter plants to record data on carcass weight, fatness and probably meat yield, for those people breeding sire stags.

Uniformity

In any premium market a repeatable, consistent, high quality product is vital. While some post-slaughter treatments (e.g., electrical stimulation) re designed to reduce variability, they cannot be expected to produce miracles. Consequently it is important that the carcass and meat products respond in a predictable manner to the various post-slaughter treatments. For example, it is essential that a certain standard of tenderness be attained, and in this respect, genetic variation in tenderness can be expected and therefore breeding programmes may well be worthwhile, but firstly some research would be sensible. Similarly it will be important to define seasonal and age changes in tenderness. The pH to which a carcass falls post-slaughter can have a major effect on both the colour of the meat and on its shelf-life when chilled. Although there is apparently a very low incidence of high pH carcasses with deer, it is wise to monitor pH and be alert for the warning signs. Certainly pre-slaughter stress can be expected to affect meat quality and may be partly genetic. Consequently selection against poor temperament may be worthwhile for this as well as for several other reasons.

Availability

The ability to control the timing of supply of perishable end product to a market is usually a critical factor affecting the price received. This market price is reflected in the price paid to the farmer so that raw material is available at the right time. Currently there are indications that the major requirement for slaughter animals occurs in early spring in New Zealand, although this could be expected to change if we can make a major impact on the hotel/restaurant trade, where there may be a requirement for a year round supply of chilled product. From the point of view of the deer farmer who depends on pasture as the feed supply early spring is not the ideal time for slaughtering deer for two very good reasons:

* in New Zealand's temperate climate, the bulk of the high quality pasture is produced during spring (often 50% of annual pasture production) and
* the natural pattern of growth of deer is such that growth rates are maximal during spring and summer and growth during winter is low or non-existent (depending on age and sex).

Consequently the optimal time to slaughter from a biological efficiency perspective would be at the end of the spring-summer growth period. However even though it's becoming a cliche, the system must be market led. Therefore we have to work out ways of meeting the pattern of demand. Put simply, flexibility is the answer – flexibility in terms of the species farmed, the age at slaughter, the date of calving, to name a few.

FLEXIBILITY

Wapiti and their hybrids with red deer and some of the European red deer crosses offer flexibility in size and age at slaughter. For example if an 80 kg carcass is required in spring it has to be either an adult red stag or a young wapiti or wapiti hybrid. If a 60 kg carcass is required in February it's a red yearling and so on. The choice and the price paid will depend on some of the perceived quality factors such as age.

From a biological efficiency perspective it seems crazy to slaughter an animal just at the time when it is about to start a very rapid growth phase, particularly when it has not grown at all of the previous 3-6 months and it has consumed large amounts of feed just to keep alive. Therefore the challenge is to work out ways to ensure that animals for slaughter in the spring will keep growing through the rut and winter. There are some possibilities:

* slaughter young animals (i.e. born during the previous spring-summer) which do grow over winter, albeit at a slower rate than during spring
* develop ways to maintain growth but **without** using hormone treatments.

For example young red stags will grow at rates up to about 150 g/day for the three months of winter, whereas 16-20 month stags will not grow at all during this period. However, supplementary lighting can be expected to improve growth rates over this period by improving feed intake. Therefore indoor feeding systems or indoor/outdoor combined systems with artificial lighting could be profitable, so long as the price differential justified it.

Although red stags first rut at about 16 months, with the consequent effects on feed intake and carcass weight, there may well be ways of suppressing this rut so that the stags keep growing through this period at least until early winter. While the obvious possibility is castration, it is major surgery at this age and is not advised. However there is some evidence that older stags will suppress this first rut in yearlings so that they don't go off their food at this stage and therefore keep growing. Even so, getting a repeatable effect and developing a practical system wil take some considerable time but still the possibilities are there.

Reproduction

Overall it's in the area of reproduction that I see some of the biggest changes in the farming of deer, namely in altering calving date, twinning and artificial insemination. Altering the date of calving could have a major impact – calving earlier in spring

will ensure that hinds calve when there is ample supply of high quality spring pasture in many areas of New Zealand. Very simple systems, involving short term treatment of hinds and stage with melatonin (the darkness signal), look very promising at this stage.

Twinning is receiving a lot of attention at the moment. While technically possible, the conditions under which twins can be induced repeatably are not known while there are obvious costs in perinatal mortality and in growth rate of calves on the hind. In the future, twinning may well provide a useful additional opportunity for the farmer seeking to improve productivity. However it will be very important to link successful twinning with earlier calving to give calves the opportunity to achieve good growth rates while their dams are grazing high quality spring pasture.

Artificial insemination (AI) has enormous potential in the deer industry, as it offers great possibilities for a much more rapid rate of genetic improvement. AI is useless if it's only a gimmick – it only makes sense where it's an integral part of a genetic improvement programme.

AI offers the possibility for:

* reference sire systems to compare stags in different environments,
* identification of highly superior stags through progeny testing,
* when combined with group breeding schemes or other systems for screening and breeding from top quality hinds, the opportunity to breed very high quality stags,
* wider use of superior stags, and
* sex selection.

However the difficulties in establishing a commercial AI service are considerable. Currently there is a need for much more research to put any large scale AI on a sound basis. Unfortunately it is very difficult for investors to adequately protect their investment in AI research. Probably the only way is for the AI service to actually own or have exclusive rights to proven top quality stags. In the next few years, though, the availability of methods to separate sexed sperm will provide new possibilities for commercial AI operations.

The use of AI with sex selected sperm offers enormous possibilities for improving the efficiency of meat production from deer, and I see such schemes having a major impact in the industry. Using sex selected sperm producing a high proportion (>85%) of the desired sex would mean that:

* only the very top hinds in a herd would be required to breed replacement stags,
* other top hinds would be used to breed replacement females, and
* the remaining hinds would be used to produce progeny for slaughter.

Artificial insemination with sex selected sperm would open the way for the large scale use of the larger strains of deer and wapiti hybrids as sires to increase the growth rates of slaughter progeny. Such a terminal sire system mating a large male to a small female can produce substantial gains in efficiency. Depending on the age at slaughter, the most efficient system surprisingly may well be the production of females for slaughter. The reasons are simple:

* the perinatal mortality of male calves is markedly greater than with females, and
* the difference in growth rate and efficiency between males and females up to 9-10 months of age is small.

For slaughter at older ages, males may be preferred because of their leanness and growth rate advantages which start to become evident in the spring as rising yearlings.

Genetic Improvement

Successful genetic improvement depends on:

* defining clear simple objectives for the breeding programme, and
* choosing an appropriate characteristic which is simply measured, which is variable within a herd and which will respond to selection.

Selection must be based on performance and eventually the idea that every tenth farmer has one of the top 6 stags in the country will go and specialist sire stag breeders will be recognised. Within such herds, embryo transfer may have much to offer. Using a multiple ovulation – embryo transfer system within a stag breeding herd could be expected to greatly accelerate the rate of genetic progress, particularly when combined with progeny testing of stags, AI using elite stags and large scale screening of hinds to identify the best producers – bloodtyping may also be of assistance here.

Variations

Much has been written about ways of improving the efficiency of a meat production system. The basic theme is simple:

* in a meat production system, the most efficient approach will involve mating a genetically large male to a genetically small female, so long as there is little effect on the calving rate and the survival of progeny.

Such a system has relatively lower food costs for the breeding female with a relatively greater proportion of the total food being used by the slaughter animal. There is a great range of possibilities covering the whole spectrum from red stags mated to sika hinds to wapiti (or elk) bulls mated to "megared" hinds.

Other variations are also possible. For example, the hybridisation of a temperate species of deer (e.g. reds) with a tropical species, such as rusa, to produce a less seasonal offspring in terms of growth pattern may be feasible. Although such hybrids are unlikely to be fertile, as a meat animal they could still have a place depending on the cost of producing them and of course on the quality of the end product.

VELVET ANTLER

Velvet antler production is well suited to being a specialist operation where a farmer can concentrate on it as a major product. Improvements in yield will come with selection (and breeding) and judicious feeding of velveting stags. The likelihood of some sort of objective grading system

will place further emphasis on selection and breeding of stags for a higher quality product. However the big unknown in the velvet scene is whether the product will find a major market in western countries.

CONCLUSION

To me as a scientist and as an investor the future of the deer industry in New Zealand offers exciting possibilities. The marketing situation must develop to maintain investor confidence and provide for real returns to the farmer and the processor. If this occurs, then the technological developments to improve the efficiency of production for the farmer, the quality of the raw material for the processor and the meal for the consumer will make for a most interesting future.