

## What has made deer farming in New Zealand so successful?

The importance of venison quality, understanding the industry, the market and the biology of the animals

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In recent years a worldwide interest has developed in controlled production of the red meat venison from indigenous or exotic species of deer in many countries. In most cases this means more than the random selection of suitable animals, often young males, from a population contained within a large area of natural terrain. Harvest is a means of balancing numbers and natural food supplies, at some economic profit. Rather, deer farming is the controlled feeding, breeding and selection of the most appropriate animals for slaughter, at a time when their growth rates, ultimate size, or time of the year fits a marked demand and specification and a productive opportunity for the farmer.

New Zealand has developed deer farming systems based on the modern practices of traditional livestock grazing management that have allowed «exotic deer species» like the European red deer, and the fallow deer, to be farmed in numbers now approaching a million animals on 5,000 varied farms from an embryonic beginning in the early 1970s.

An important number of historical features have been precursors to this rapid development. The industry has an investment of \$1 billion (NZ) in animals, fencing and handling systems, and in slaughter, processing and exporting facilities, with industry returns in the June 1990 year of \$84 million, a greater than 10 fold increase in only 20 years.

### History

Red deer were systematically introduced into New Zealand's natural range since early English-Scottish settlement from 1861 until the 1920s for sport hunting and recreation. In a country with no native herbivores, no predators and abundant natural vegetation, deer numbers grew rapidly aided by favourable climate, protective legislation and hunting control. New Zealand deer were an internationally renowned trophy antler herd in the 1930s but their growth was unchecked and numbers reached pest proportions in the 1950s.

Combined with the now questionable practices of overgrazing and fire to promote new growth, in the natural high country vegetation for sheep and the secondary forest growth was extensively damaged by deer. The deforestation allowed extensive erosion from rapid run-off of rain and snow melt. This created such concern with agencies involved in land protection and in agriculture and forestry that deer were declared a noxious animal in 1951 and an eradication programme began. The Government employed many professional hunters as well as a «bounty system» where private hunters were paid for the deer which they shot. The only value was venison for domestic consumption from sport hunting. New Zealand, dominated as it is by the export of primary products, benefitted from the wisdom and innovative skills of a few individuals. They, aware of the large consumption

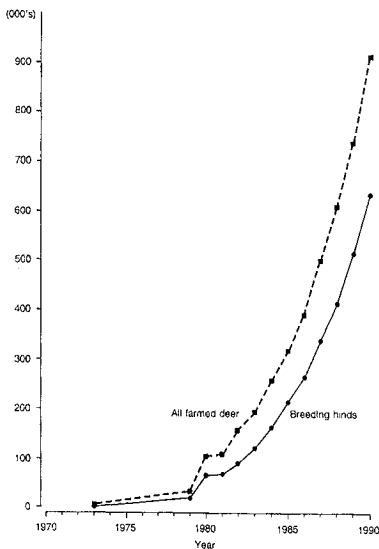


Fig. 1. Growth in farmed deer numbers.

of game meat in Europe, principally West Germany (which today remains the single largest market in volume and return) began a concerted recovery and processing business, exporting shot venison in frozen form in the four primal cuts: saddle or loin, hind legs, shoulders and neck and rib trim. Export peaked at 4500 tonnes in the early 1970s with returns which were comparable to traditional meats. The venison recovery business expanded in sophistication and volume through the use of aircraft and recovery helicopters in an innovative and now classic story of wild game recovery.

The obvious extension of the feral recovery industry and the attendant game packing houses and export markets was to relocate this fast dwindling resource onto the farms nearest the feral range and continue to supply a game ranch product.

Throughout the feral venison recovery industry a small and highly profitable market for the other more exotic deer products existed,

principally that of velvet antler in varying stages of growth, the tail, eye, teeth, sinews and pizzle sought by the Korean pharmaceutical business. Early deer farming focused on meat production but by 1976, when the price for velvet antler had begun to rise, the emphasis shifted away from meat and investment money began to flow into the industry. The wild deer were captured by a great variety of means, (bulldozing, dart tranquillizing, netted from helicopters, trapped on the ground) and relocated to typical sheep farms and intensively stocked, at up to 6-8 animals per hectare, confined by a high wire fence, and managed under the most modern of pasture based farming techniques. The deer successfully mated, produced live, healthy calves and suffered no apparent diseases or stress during that operation.

The entrepreneurs of the industry, convinced of the future of deer farming, were then confronted with an administrative battle to change the legal status of deer from a noxious pest into an animal found typically on any farmland within New Zealand. In 1971 the first licence was granted and by 1975 two further significant events had occurred.

The first was the establishment in 1973 of the Ministry of Agriculture's research programme for deer production under the guidance of nutritionist, Dr. Ken Drew, at Invermay. An enthusiastic and very skilled team of scientists and support staff began working with deer in the most basic sense. Significant early research work included the detailed study of the seasonality of deer production and growth, their nutritional requirements and how the feeding and management systems common to most New Zealand farmers could be adapted to these requirements. Equally as important were studies of the veterinary and health aspects, and complications that intensification might bring to deer, for example, on the lowland irrigated pastures, or fertile dairy pastures throughout the entire range of NZ agricultural geography.

The high nutrient values and health aspects of venison were confirmed and, significantly, the criticism or fears that farmed venison would taste differently or, at the worst, like grass fed beef were dispelled in early clinical analysis and taste testing panels.

The foundation for the current success of a large farmed venison industry was laid during this period and the industry-wide awareness of

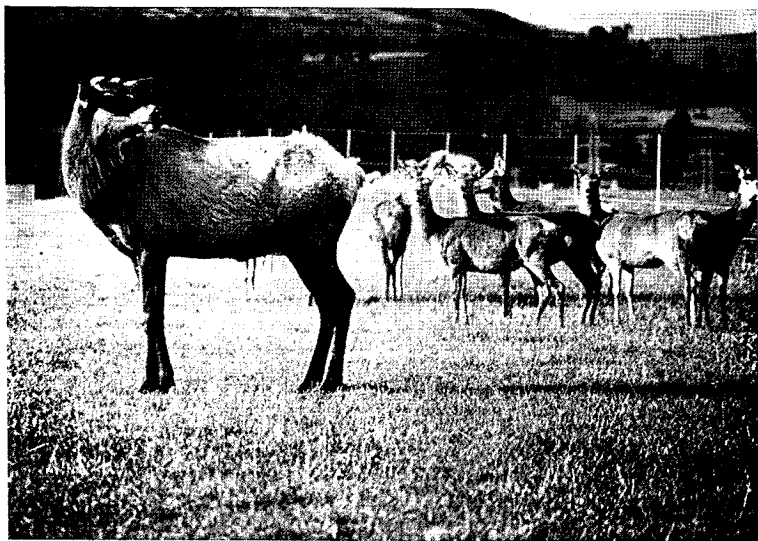


Fig. 2. Red deer hinds and a Wapiti stag in an enclosure at a New Zealand deer farm.

the term *quality* became a focal point for the developing sophistication of the industry both on farm and in the market place.

Final consumer acceptance of farm raised venison at the top end of the market – the hospitality trade – competing with salmon, pheasant, oysters, relies on two basic qualities; tenderness, and consistency of presentation in age, size of cuts, fat content and meat hygiene. Venison is traditionally acknowledged as a fat free meat, and it was critically important for the developing industry to relate seasonal productivity, growth rates, and carcass parameters to those which the expanding hospitality trade markets demanded.

Before discussing in broad terms the aspects of venison quality that now form the base for the successful marketing of venison, the reason behind the rapid development of deer farming throughout New Zealand as a major livestock pastoral alternative is worth amplifying.

Interest in farming deer from 1976 and onwards was widespread owing, in part, to enor-

mous returns for velvet from the Hong Kong and Korean markets (up to \$200–250 per kg for frozen product). No farm raised venison was produced, indeed the modern systems of slaughter, veterinary inspection and processing had not yet been devised. Helicopter recovery of shot game turned rapidly to a live capture and recovery operation. Farmed and captured deer escalated in value and demand. New Zealand's taxation laws permitted these animals, once valued at \$200–\$250 per carcass, but now as high as \$2,500 per live animal, to be capitalised for accounting purposes at a book value of \$200. The difference in purchase price and taxation value could be declared as a tax write off in other business, be it agricultural or commercial; a new breed of deer farmer evolved. These new entrants, the city based investor, the private individual or corporate businessmen, provided capital for stock and shared the progeny with the farmer who had invested in the expensive land, facilities and management systems. Deer farming came within the reach of the or-

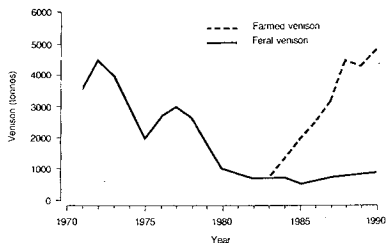


Fig. 3. Venison production in New Zealand.

inary farmer, and a rare combination of skills provided the incentive for further expansion and development.

With such an additional source of finance, business and political experience with, innovation, leadership and risk taking outside that normally evident in agriculture (NZ farming has been until recently been mainly a family unit operation) the emergence of an industry, vertically integrated from capture, to export of products, was assured.

In 1975 the New Zealand Deer Farmers Association was formed by 29 of the first deer farmers (including the leading scientist from the government research programme). This marked the second significant milestone which assured the success of deer farming. *By their own volition and vision members of the industry at all levels took charge of their own development and directions in the market place, in the face of quite hostile political environment.*

In light of comments already addressed in this conference analysing the role of research and the need of an industry, it is interesting to note that we have been fortunate by design to have a very close relationship between farmers, researchers and exporters and the market place, expressed primarily through the NZ Deer Farmers Association activities. The NZ Game Industry Board (GIB), a statutory marketing organisation funded by levies on the products of velvet antler and venison was established in 1985 to co-ordinate the marketing and market development of venison and other deer products. This Board, up until recently, combined equally the interests of producers, processors and exporters with government participation in shaping the direction and market position of

the industry. Recently, the Board's structure was changed to accommodate more readily the producers unanimous desire to control their own destiny, but the complete vertical integration from farm production to market place that unifies our industry still remains. An example of this common purpose, as it relates to the science and research supporting the industry, illustrates the industries responsiveness to market signals.

Deer research programmes have been tabled informally with the NZDFA council and the needs of both groups have been balanced in deciding long term research priorities. The value of basic investigative science is not compromised because the Ministry of Agriculture commits a proportion of funding from the national science programme. Council control does, however, allow quick application of research to immediate and long term challenges in applied areas, as indicated from market requirements. The industry is now required to support research financially.

A recent meeting including all research groups, deer farmers, the NZ GIB, veterinarians and the NZDFA, determined that the immediate industry need was to produce 55 kg carcasses for the chilled and fresh trade in Europe and North America during the months September to November rather than the more favourable February-April period when the natural growth rates and farm management practices are well established and best suit the seasonality of deer production. That objective, truly based

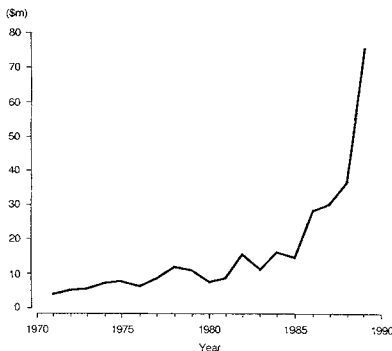


Fig. 4. Export income from deer products in New Zealand.

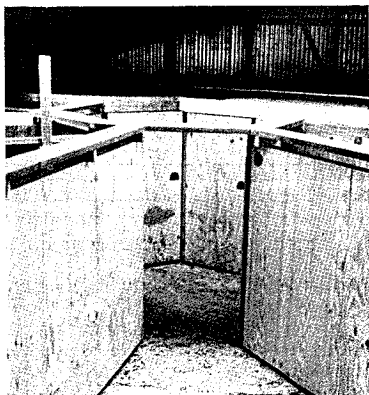


Fig. 5. An indoor facility for sorting animals. Note the plywood sheet walls and the complete absence of door-handles or bolts or anything else on which the animals could snag themselves.

on industry market information, has led to cooperative programmes in the following areas:

1. Agronomists and soil scientists are investigating the species and growth patterns of grasses most preferred by deer, rather than pasture developed for sheep and cattle to increase growth rates and better fit lactational demands of breeding stock.
2. An intensive reproductive and management programme to utilize hybridization between the large North American wapiti and the European red deer and thereby to exploit the efficiency of venison production as fully as possible.
3. Research into the technology of semen collection and storage, artificial insemination and reproductive manipulation.
4. Extensive venison research into the qualities of tenderness, hygiene and long term storage of chilled product ( $-1^{\circ}\text{C}$  to  $1^{\circ}\text{C}$ ), including basic investigation into slaughter and processing systems and the quality assurance requirements of a consistent production.

5. Research into the requirements of venison for transportation by sea freight - hygiene and packaging.
6. Veterinary programmes in preventative animal disease, trace mineral research and animal welfare considerations.

Basic research continues in the areas of advancing calving by manipulation with melatonin and reproductive hormones, twinning potential and in disease identification and control. The list is extensive, multi-disciplinary and involves fallow, red and elk breeds and has already had a major impact on farm production.

The results, news of evolving technologies and of practical farm management solutions are exchanged at producer forums and in an industry magazine as frequently as in the scientific literature.

The industry's success therefore has been boosted by the enthusiastic sharing of information, from basic management skills in feeding, breeding and handling - the «what works and what doesn't» approach, with a common theme in communication; i.e., feedback from the market place about the quality of the product and the timing of its supply to accommodate the market demand.

Researchers not only had to achieve good science, but the techniques employed, particularly in breeding and feeding, had to withstand application on commercial farms, often with a large financial commitment and, therefore, with a need to implement efficient production systems quickly.

The rapid interchange of ideas has meant that farmer innovation was rapidly incorporated as an industry «golden rule» and research did not struggle for credibility.

### Quality venison production

Highest returns are achieved for venison that is exported in a fresh or chilled state and prepared for the hospitality trade, rather than in retail competition with traditional red meats in supermarkets and commodity trading. In terms of venison quality the following seven major factors are crucial critical:

#### *a) Carcass grading system and carcass fatness*

Premium venison quality from farmed red and fallow deer comes from animals less than 2

years of age. There is evidence that venison increases in toughness in older animals and for efficiency slaughter is most acceptable at the end of summer at ages 12–15, or 22–27 months. Some two year old red and fallow deer are even then in danger of being unacceptably fat. A carcass grading system, based on weight and a total tissue depth measurement (the GR or TD measurement in mm) over the 12th rib at a point 16 cm from the spinal midline, is the parameter used to determine overfatness. The producer can be penalised up to 40 % from deer classified as overfat.

Much of the fat (particularly in older stags) is subcutaneous and intermuscular in location, rather than intramuscular. In the prime cuts of saddle and hind quarter, 55–65 % of the fat is distributed subcutaneously and can readily be trimmed but in the forequarters, neck and ribs trimmable fat amounts to 16–30 % of total fat and removed with difficulty.

The marketing solution has been to remove those animals from the slaughter plant by penalty, and presenting them, instead, in mid winter following the post rut weight loss. However, exporters offer a financial incentive for young carcasses.

#### b) Further processing

Venison, presented as a gourmet meat is now often marketed in a «no further preparation form», except to cut into steak, cutlet or medallions. With 54 % of the carcass being represented as saddle and hind leg, further fabrication is

Table 1. Wapiti hybrid and red deer stag carcass composition.<sup>1</sup>

	2 yr red deer	11 month wapiti/red hybrid
n	53	8
Liveweight (kg)	110	116
Hot carcassweight (kg)	63	68
Dressing	57	59
Carcass composition (% cold carcass weight)		
Saddle	15	18
Hindquarters	39	40
Forequarters	19	20
Neck	16	14
Ribs	11	8
Fatness (GR in mm)	10	4.7

<sup>1</sup> From Drew and Hogg, 1990.

Table 2. Nutrients in 100 g of trimmed feral and farmed red deer leg meat.<sup>1</sup>

	Feral	Farmed	
Age (months)	27	12	27
Carcass weight (kg)	43.1	40.8	75.7
Lean meat (g)	95.6	95.6	88.0
Fat (g)	3.3	3.3	10.9
Minerals (g)	1.1	1.1	1.1
Polyunsaturated fatty acids (g)	0.5	0.3	0.3
Polyunsaturated: saturated fatty acids (P/S)	0.18	0.10	0.03

<sup>1</sup> From Drew and Gogg, 1990.

undertaken to increase return. A leading NZ exporter, Game Meats, pioneered the Denver leg in which the hindquarters are boned out and the individual muscles of the beef type cuts, topside, rump, silverside and shank, are boned out into 8 muscle blocks, desinewed, vacuum packed and chilled. Saddles are boned out into strip and tenderloins and shoulders too are boned out to produce a shepherd's steak.

Saddles sold «bone-in» are precisely measured according to the number of ribs, according to the customer's request, trimmed at an exact distance from the midline and protected with a boneguard and vacuum packed.

#### c) Packaging

Keeping the product cold, clean and covered has allowed the evolution of vacuum shrink wrap (Kryo-vac) packaging systems for the chilled trade, increasing the shelf life of meat to 12–16 weeks when stored at -1°C. Absolute hygiene during slaughter and processing is paramount. Systems of inverted dressing have added to the hygiene control. Little or no washing of the carcass and good sanitation of machinery used in the fabrication of bone-in or boneless venison is important as these areas, if done poorly may inoculate the venison with bacteria prior to chilling and packaging.

#### d) Electrical stimulation, conditioning and aging

Meat tenderness is by far the most important consideration in eating quality, followed by juiciness and texture. The product must not only be hygienic but the consumer must like it. Research work has shown that electrical stimula-

tion (ES) straight after slaughter to accelerate rigor mortis can prevent tough venison due to cold shock in a chiller.

- (1) Electrical stimulation is very effective in improving tenderness, especially in the loin and hind legs. Most systems incorporate a low voltage 80V peak sine wave stimulation for 90 secs 30–60 secs after «sticking» approximately 30 secs after stunning.
- (2) Further enhancement of tenderness is achieved through post slaughter conditioning and aging of the whole carcass. The ideal treatment regime, for product that is to be sold frozen, is holding at 10°C for 24 hours, then a further 24–48 hours aging at 2–4°C before freezing at -18°C.

These effects are more noticeable with stimulated carcasses, suggesting that careful post slaughter aging has an improved effect with animals that are older than 15 or 27 months.

Once delivered to point of sale or consumption, tenderness can also be enhanced significantly by a careful thawing regime. By thawing slowly from -18°C at +4°C, venison quality improves significantly, with the effect most noticeable in young deer, non-stimulated, or in carcasses exposed to low temperatures very soon after slaughter.

*e) Other aspects of venison quality (pH, stress and the Dark, Firm and Dry phenomenon)*

Meat of high pH (6.0 or more) typically has greatly reduced shelf life and is not suitable for extended chilled storage in vacuum packages. Routine pH measurement of slaughtered stock allows the sub-classification of carcasses for fro-

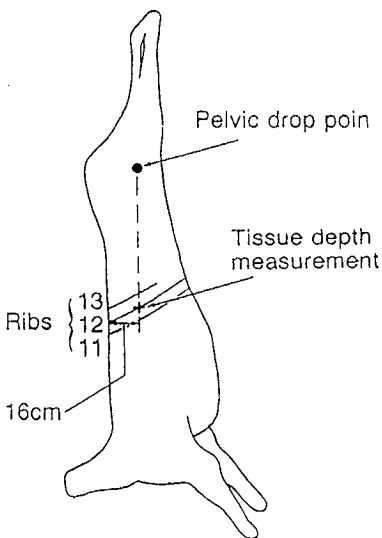


Fig. 7. Site for tissue depth measurement (TD).

zen or chilled markets, although values are generally 5.6–5.7 from red deer and 6.0–6.2 for fallow, and are remarkably constant even after exposure to high levels of stress. However in the retail trade, consumer preferences in most markets are based on redness in colour.

*f) Quality assurance programme – marketing*

The NZ producers, embracing the concept that the industry should be market led rather than production driven, are responsive to the NZ GIB analysis of consumer, demands for the product and expansion of supply. While the GIB supports some specific production-based research their main thrust is to represent the marketing of deer products in an orderly and customer responsive fashion, although in the producers' interests. Funding is currently at a level approximately 4% of producer receipts.

Current marketing priorities are in West Germany, North America, Japan, the local NZ consumer and marketing is aimed at the chefs and distributors of venison. While individual exporters' brands are preserved, i.e., there is no

Grade	Carcass weight (kg)	Tissue depth limit for overfatness (mm TD)
Prime Quality (lean with good muscle)	AP1 > 70	14
	AP2 50.5–70	12
	AP3 < 50	10

- AF – Undamaged overfat
- AD – Overfat with 1 primal cut damaged
- AM – Manufacturing (damaged, emaciated, aged, discoloured)

Fig. 6. Venison grading system.

generic promotion of «New Zealand Farm Raised Venison» to the exclusion of the individual, they have put in place a quality assurance programme to be represented by the «Deermark» – an internationally recognised quality standard, auditable and able to be awarded, or withdrawn based on performance.

Farmed venison is classified as slaughtered game, and animals are killed and processed in any one of 13 Deer Slaughter Plants. These plants are now involved in a PIC programme (problem investigation and control) developed by the GiB and, once accredited, can use the Deermark symbol as an ultimate guarantee of customer satisfaction. The problem identification and solution system is about to be extended from the slaughterhouse and pre-slaughter transport systems onto farms where damage to carcass and pelts may be occurring needlessly.

In summarising these aspects of success within the NZ deer industry we can note:

- (1) NZ traditional farming skills of pasture based production have been readily adapted to deer farming.
  - (2) The industry has grown with strength through the diversity of its participants, leading farmers, innovative researchers, business investors and leaders and the NZDFA and its membership. All are united in their determination that market signals, rather than farm production demands should shape the development of venison supply and presentation.
  - (3) The frank and rapid exchange of research results, farmer innovation, market information and exchange of experience and ideas within the industry.
  - (4) The overwhelming commitment to quality production.
- Biologically, deer has their own contributing attributes:
- (a) they are intelligent and easy to farm;
  - (b) they are efficient converters of pasture and supplements to venison or to progeny;
  - (c) they thrive throughout NZ varied agricultural terrain on native grasses or improved pasture, and have a healthy and long productive life;

- (d) they have enormous climatic and environmental tolerance, a defined breeding season and predictable calving pattern;
- (e) they are immensely seasonal, and now, when feeding and breeding requirements are well understood in terms of that seasonality, productive growth targets are readily set and achieved to accommodate the market signal;
- (f) they are simple to manage with a minimum of labour and physical inputs.

Finally, the product, game venison is the red meat of the 1990s and beyond – nutritionally lean, fat free, low in calories and cholesterol, high in iron – farm produced at a defined age at a defined weight in modern DSP with rigorous ante- and post-mortem inspection, now supported by the Quality Assurance programme and the Deermark Seal. Our producers are insistent that farm raised venison is marketed as a gourmet food and enjoy returns to match that. The science behind defining quality and in production and management systems has been excellent, both investigative and applied, and in combination with innovative farming has produced a profitable high profile and efficient livestock alternative to traditional agriculture.

The success of the industry therefore is the result of an excellence in application from all areas, in a common goal, the production of high quality farm raised venison, consistent in presentation and supply, enjoying the returns that that objective commands.

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