

Invermay Agricultural Research Centre
Private Bag, Mosgiel, New Zealand

K.R. Drew

May 1976

In recent years there has been a good deal of discussion about the exploitation of game animals in many countries, and particularly in Africa (Ledger, et al, 1967; Tribe and Pratt, 1975). Advocates of game ranching in Africa extol the virtues of indigenous mammals in preference to introduced ones such as cattle and sheep. Greater meat harvest per unit area from game when compared with cattle and minimal disease problems are the major arguments advanced in favour of game ranching. Problems of animal ownership, management, disease and hygienic slaughter have led Parker and Graham (1975) to state that "...in the long run, cropping truly wild, unowned and uncontrollable animals is at best a transient phase interrupting a trend terminating in domestication or extinction". In New Zealand, which has no native mammals except two species of bat, the farming of one introduced animal (red deer) is competing with other introduced and more traditional species such as sheep and cattle.

CAPTIVE OPERATIONS AND DEER FARMING SYSTEMS

The experience gained by people who hold a few deer as tourist attractions prompted some farmers to capture feral animals and place them in fenced enclosures. One method of capture was to lure animals from the forest through gateways into fenced areas. These traps were fitted with trip wire gates which were sprung by the entering deer. A second method of capture evolved from the use of helicopters to retrieve carcasses. A tranquiliser gun was fired from the helicopter and the drugged animal recovered for transport to a deer farm. Losses by this latter method were initially high but improvements in technique and perseverance by operators have now reduced the loss ratio to a minimum (Wallis and Faulks, 1976).

In order to gain a permit to hold and farm deer it is necessary for a farmer to comply with regulations such as the construction of an acceptable perimeter fence. Several problems of a regulatory nature in the emerging venison industry prompted the formation, in 1975 of the New Zealand Deer Farmer's Association. (For the Association's objectives see attached).

In recent years the slump in world beef prices has provided a real stimulus for the serious consideration of deer farming and, with the favourable experience in running some deer intensively at Lincoln College (Coop and Lamming, 1976), together with management advances in handling deer in the field (Pinney and Kilgariff, 1976; Brookes, 1976), the demand for breeding hinds has become intense.

The earliest deer units were located on relatively low fertility native grassland, an environment somewhat similar to the summer habitat of the feral deer. The requirement for a regulation two metre high fence resulted in high fencing costs in relation to carrying capacity in such an environment. Although the animals will survive quite well in these conditions the natural potential productivity of the animal may not be realised. More recently there has been considerable interest in the feasibility of farming deer on first class agricultural land. Fencing costs per stock unit are reduced and the maximum per animal and per hectare performance can be exploited.

DEER RESEARCH

The Forest Research Institute of the New Zealand Forest Service has made extensive studies of feral deer. The emphasis, however, has been on measuring the effect of the deer population on native vegetation and on methods of control.

In 1968, Lincoln College acquired 14 red deer for observation under intensive farming conditions. These wild deer and their suckled progeny never became tame and could not be easily handled. Some hand reared tame deer were easily handled but their suckled

progeny were wild. Over five years the average calving percentage was 90% and calf mortality to weaning 7.5%. Mean liveweights of yearling stags and hinds were estimated to be 90 kg and 70 kg respectively and venison production per hectare was calculated to be similar to that from sheep and cattle (Coop and Lamming, 1976).

In 1973 the Invermay Agricultural Research Centre was able to establish a herd of 90 breeding hinds on hill country and on first class agricultural flat land. Both areas have been substantially subdivided and have solid sided yards for animal handling. The objective of the continuing project is to investigate in detail the feasibility of farming deer on high fertility pasture and to study the management, behaviour, nutrition, reproduction and carcass characteristics of the red deer.

Initial handling experiences at Invermay with the breeding herd, which had been trucked 240 km without problem from a deer farm of undeveloped native grassland, were very unsatisfactory. The animals were nervous, damaged fences and refused to be herded into a central raceway running through the farm. Within six months however, the deer were amenable to shifting by both men and dogs. This was partly due to the animals becoming familiar with the new environment, and partly because of the patience and persistence shown by the people working with the deer (Drew & Kelly, 1975). Once into the yards the animals could be readily handled providing they could not see out onto the farm.

Reproduction

Deer in many localities may not calve for the first time until aged three years, and on the island of Rhum (Scotland), 40% of mature hinds failed to breed each year (Mitchell, 1969). Good nutrition can overcome these problems and work at the Rowett/Hill Farming project in Scotland (Blaxter et al 1974), Lincoln College (Coop and Lamming, 1976), and at the Invermay Research Centre (unpublished) has shown that calving percentages of about 90% can be expected with the hinds first calving at two years of age.

The stocking of deer at the high density of around 20/ha on good farm land with minimum cover might be expected to show up some problems at calving in relation to territoriality. Kelly and Whateley (1975) reported the Invermay first deer calving (1973) results where 18 dead calves were recorded out of 67 born. Eleven of the 18 were found to have died within four days of birth from moderate to severe trauma. The injuries were inflicted by the hinds and probably only a small number of "rogues" were involved. This behavioural problem almost certainly came about through unfamiliarity with the farm, since the herd had been at Invermay for only six weeks before calving.

With one possible exception no deaths from trauma were recorded in 1974 or 1975. Although there was a 21% calf mortality during the first few days of life in 1974, mis-mothering was the main cause of death and in 1975 the neonatal mortality was down to 5%. It was particularly impressive that Invermay hinds calving as two year olds in 1975 gave a 91% calf drop.

Stag management during the mating season is an important feature of deer farming. At Invermay one stag has been seen to be dominant over two others and taken the whole group of 46 hinds into one harem. Calculations from date of calving have indicated that almost all calves born in that group came from matings during the period of single animal dominance. In another Invermay experiment one stag in a single sire group mated with 32 of 35 hinds during the season and only one female returned to service (Kelly, unpublished).

According to these observations, the fertility of the dominant stage must be a most important consideration because a disastrous or very late calving would follow from the use of an infertile dominant male even if several stags were run with the hinds. Semen testing of stags at the start of breeding would be a sound practise.

In its natural habitat the red deer calf remains well hidden most of the day for at least the first week of life. After that time the young animals will frequently run with the herd of hinds. The frequency of calf deaths from severe beatings by hinds 1973

prompted a 1974 investigation of the effect of cover in calving paddocks. Although calves up to one day old were often found in an exposed position, older calves were always found in shelter until they joined the herd (Kelly & Drew, 1976). In spite of the availability and use of cover in 1974, calf mortality was only marginally lower than in 1973. Post mortem analysis in 1974, with one possible exception, did not show death due to calf beating. Mis-mothering appeared to be the main cause of death. Human scent on the calf, from handling at or soon after birth for tagging and weighing purposes, may have contributed to the death rate. Only two of the nine fatalities were in calves handled with gloves, the remainder being in calves weighed by the operators not wearing gloves (Kelly & Drew, 1976). Neo-natal mortality was reduced to 5% in 1975 by not weighing calves at birth and by keeping other handling to a minimum.

Growth and Development

Growth in farmed deer is seasonal. From birth until five months of age weight gain is rapid. During the winter period growth rate is severely reduced even when feed of high quality is freely available (Blaxter et al 1974). Following winter the animals have a magnificent appetite and grow very fast through the spring and summer, this phase terminating, particularly in stags, with the onset of the breeding season. The interrupted growth pattern observed in Scotland (Blaxter et al 1974) has also been found at Invermay, although male animal weights at 15 and 27 months of age seem to be about 15 and 20 kg respectively heavier than similar Scottish deer. Figure 1 shows the growth rate of three groups of Invermay deer from weaning to 27 months of age. The autumn-winter plateau is very pronounced in spite of unlimited grass available to the grazing groups. One group of deer was kept enclosed from 6 to 27 months of age and fed a pelleted diet comprising 55% barley, 35% lucerne and 10% linseed meal. It is interesting to observe that onset and rate of spring growth was almost identical to that measured in deer grazing improved pasture. The growth curve of young hinds shows the same shape as in the male but about 20 kg lower.

Yearlings had well developed antlers and the spikes of up to 40 cm in length were removed in the hard horn stage because of the

danger to both man and beast. As two year olds some of the Invermay stags grew impressive 12 point heads.

Yield of Meat and Byproducts

Ledger et al (1967) after transformation of some data published by Dasmann (1964) concluded that 3.7 kg carcass meat/ha could be obtained from extensive game ranching in Rhodesia compared with 2.0 kg/ha from cattle when both groups were harvested to remove 10% of the animals each year.

Beef production from improved pasture in Uganda has been investigated by Stobbs (1969) where intensive rotational management of Zebu x Hereford or Aberdeen Angus on 0.2 ha plots gave a best performance of 841 kg of liveweight gain/year. Most farmed areas in East Africa would give much lower production (Antoon de Vos, 1975). No comparable production figures appear to be available for game animals managed in a manner similar to the cattle.

Walker (1955) showed that intensive meat production from sheep and cattle could produce about 300 kg carcass/ha/year. This figure includes the cost of maintaining the breeding stock. At Invermay the mean carcass gain/ha/year over four years in young Aberdeen Angus and Friesian cross cattle has been 443 kg/ha from animals weighing 200 kg in autumn and stocked at 5.4 animals/ha (Monteath, unpublished). Rising yearling mixed sex deer have been stocked at Invermay in 1974/5 at 25/ha on high fertility pasture between August and February. During that time 520 kg of carcass meat/ha (or 868 kg liveweight gain/ha) has been produced. In the 1975/6 season entire and castrate yearling stags were stocked at 35/ha from August until February and in that time produced 800 kg carcass/ha. These figures makes deer production very competitive with sheep and cattle.

In addition to carcass meat, deer produce several by-products which are valuable. The most notable is antler in the velvet which can fetch anything from \$4 to \$35/kg. It is used for medicinal and health purposes mainly in far Eastern countries. Other saleable by-products are skins, ligaments, eye teeth, testicles and tails.

Carcass Composition

Comparative slaughter experiments are in progress at Invermay to measure the composition of liveweight gain from 6 to 27 months of age in male deer raised either in the wild (feral) on improved grassland (grassfed) or reared on a pelleted highly digestible ration (feedlot). Table 1 shows some comparative published data as well as recent Invermay work on the subject of carcass composition.

The protein content of the deer carcass is remarkably constant at $21.3\% \pm 0.3^*$ both in terms of varying age and in feed environment. Although somewhat fatter than feral deer the carcasses from grassfed animals still have a very low proportion of ether extractable fat at 6-7%. This figure is about one third of that measured in ram lambs by Everitt and Jury (1966) and similar to that found in 10 kg feral goat carcasses by Kirton (1970). The bull elk is a large animal that roams extensively and has very little fat (Field et al 1973). Between 6 and 12 months of age the feral deer calf in the South Island may face a hostile winter environment. Mobilisation of fat reserves and weight loss is indicated in Table 1 by a nil carcass growth between 6 and 12 months of age and a fall in carcass fat from 5.7 to 1.3%.

The Invermay deer carcasses have been cut according to commercial export practise into shoulder, leg, rack and ribs + neck. The proportions in each category varied little from $20\% \pm 0.3^*$: $40\% \pm 0.5$: $14\% \pm 0.3$: $26\% \pm 0.6$ respectively. The feral carcasses had slightly heavier shoulders and lighter racks than their grassfed counterparts. Twelve or 18 month old grass or feedlot fed deer carcasses (clean carcass free of head, hide and internal channel fat), were $59.1\% \pm 0.3^*$ of the 24 hr. fasted liveweight. This figure is about 4 units higher than in grassfed cattle and about 12 units higher than in grass fed sheep.

Venison Flavour

The traditional game meat shot in the New Zealand mountains and exported to Germany is reputed to have a strong 'gamey'

*S.E.M.

flavour when cooked. A natural question that arose when deer farming began on grassland pasture was whether or not the meat flavour would be different from feral venison. Although Invermay work is at an early stage, preliminary taste panel findings do not show clear differences in flavour between the two classes of meat (Forss, unpublished). For each ration, between animal variability in taste parameters has been high. After ageing and conditioning carcasses by hanging for seven days at 4°C following slaughter, some components have been extremely tender.

Disease in Deer

New Zealand is extremely fortunate in being free of the most serious ruminant diseases such as foot and mouth, rhinderpest and blue tongue. Endo-parasitic infections can become a problem when deer are farmed on an intensive scale. The intestinal worms are easily treated with oral anthelmintics but lungworm (Dictyocaulus viviparus) does not seem to be easily controlled (McAllum, 1976). Tuberculosis and bovine malignant catarrh have been reported in New Zealand and the former is of concern to cattle farmers and as a human health risk. Otherwise animal Health does not appear to be a serious problem to intensive deer farming.

The Slaughter and processing of farmed deer

Until early in 1975 feral deer carcasses were transported from the place of slaughter by a variety of means over a variety of time periods to the many game packing houses. The meat, after cutting and packaging, was exported mainly to West Germany.

During 1975 that market imposed many restrictions in the field of hygiene on the importing of game meat. The most difficult was probably the requirement to chill the carcass to 7°C within 10 hrs. of killing and to reach a registered game packing house within 24 hr. for veterinary inspection. As a result game regulations were passed by the N.Z. Parliament in June 1975. These have consolidated game packing to six plants staffed with Government Meat Inspectors who inspect every carcass and its offal for signs of disease. A distinction in legislation has now been made between "kill" game and "slaughter" deer. The latter applies to

farmed deer where ante-mortem veterinary inspection is possible, while "kill" game refers to all other game situations. Carcasses bearing a "slaughter" deer stamp would be eligible for export to countries that do not allow "kill" game to be imported for health reasons.

Countries such as Australia and U.S.A. could in the future provide an attractive market for significant amounts of "slaughter" venison. The recently formed N.Z. Deer Farmers Association has the responsibility of providing systems which are satisfactory for slaughtering and processing farm deer for export. Progress is being made, and some 500-600 deer were processed as "slaughter" deer early in 1976.

Conclusions

New Zealand has traditionally relied on a favourable grass growing environment, good stock management, and a low cost farming system to produce a large volume of dairy products, wool, lamb and beef. Most of these items are exported to provide 80% of the country's overseas income. In recent years the world's markets for primary products have been very unstable and there have been frequent calls to the New Zealand farmer to diversify into a wider range of products. This has proved difficult but the economics of farming deer for the production of a specialised meat commodity with low fat characteristics look attractive and the marketing prospects are bright. Perhaps we shall go the full circle with deer in New Zealand from a valued commodity in the nineteenth century for aesthetic and hunting reasons, to a ubiquitous pest marked for eradication and finally back to a useful resource to be carefully and profitably managed.

References

- ANTOON DE VOS., (1975). Proceedings of the III World Conference on Animal Production. Ed. R.L. Reid. Sydney University Press. pp. 67.
- BLAXTER, K.L., KAY, R.N.B., SHARMAN, G.A.M., CUNNINGHAM, J.M.M. and HAMILTON, W.J. (1974). Farming the red deer. H.M.S.O. Edinburgh, Scotland. pp. 93.
- BROOKES, R.A. (1976). Prospects for deer farming. N.Z. Society Animal Production. Occasional Publication No. 5. Editorial Services Ltd., P.O. Box 6443, Wellington, New Zealand.
- CHALLERS, C.N. (1973). Assessment and Management of introduced animals in New Zealand forests. F.R.I. Symposium 14, N.Z. Forest Service and Forest Research Institute; P.B. Rotorua, New Zealand. p. 164.
- COOP, I.E. and LAMMING, R. (1976). Prospects for deer farming. N.Z. Society Animal Production. Occasional Publication No. 5. Editorial Services Ltd., P.O. Box 6443, Wellington, New Zealand.
- DASMAN, R.F. (1964). African Game Ranching. Pergamon Press, Oxford. 75 pp.
- DREW, K.R. and KELLY, R.W. (1975). Proceedings N.Z. Society Animal Production. 35: 213.
- EVERITT, G.C. and JURY, K.E. (1966). Journal Agricultural Science (Camb.). 66: 15.
- FIELD, H.B., SMITH, F.C. and HEPWORTH, W.G. (1973). Agricultural Experimental Station; University of Wyoming; Laramie 82071; U.S.A. Bulletin No. 594.
- HOLLOWAY, J.T. (1950). N.Z. Journal of Forestry. 6: 123.

- KELLY, R.W. and DREW, K.R. (1976). Applied Animal Ethology (in press).
- KELLY, R.W. and WHATELEY, J.A. (1975). Applied Animal Ethology. 1: 293
- KIRTON, A.H. (1970). N.Z. Journal Agricultural Research. 13: 167.
- LEDGER, J.P., SACHS, R., and SMITH, N.S. (1967). World Review of Animal Production. 3: 13.
- McALLUM, H.J.F. (1976). Prospects for deer farming. N.Z. Society Animal Production. Occasional Publication No. 5. Editorial Services Ltd., P.O. Box 6443, Wellington, New Zealand.
- MITCHELL, B. (1969). The Husbanding of Red deer. Ed. Bannerman, N.M. and Blaxter, K.L. pp. 16-22.
- PARKER, I.S.C. and CRABAN, A.D. (1975). Proceedings III World Conference on Animal Production. Ed. R.L. Reid, Sydney University Press. p. 109.
- PINNEY, B. and KILGARRIFF, P. (1976). Prospects for deer farming. N.Z. Society Animal Production. Occasional Publication No. 5. Editorial Services Ltd., P.O. Box 6443, Wellington, New Zealand.
- STOBBS, T.H. (1969). Journal British Grasslands Society. 24: 81.
- TRIBE, D.E. and PRATT, D.J. (1975). Proceedings III World Conference Animal Production. Ed. R.L. Reid, Sydney University Press. p. 3.
- WALKER, D.E. (1955). Proceedings N.Z. Society Animal Production. 15: 51.
- WALLIS, T. and FAULKS, J. (1976). Prospects for deer farming. N.Z. Society Animal Production occasional publication No. 5. Editorial Services Ltd, P.O. Box 6443, Wellington, New Zealand.

- WHITEHEAD, G.K. (1972). Deer of the world. Constable & Company Ltd., pp. 194.
- WODZICKI, K.A. (1950). Introduced mammals of New Zealand. Dept. Scientific and Industrial Research Bulletin. No. 98.

Invermay Research Centre
Growth Rate of Red Deer .

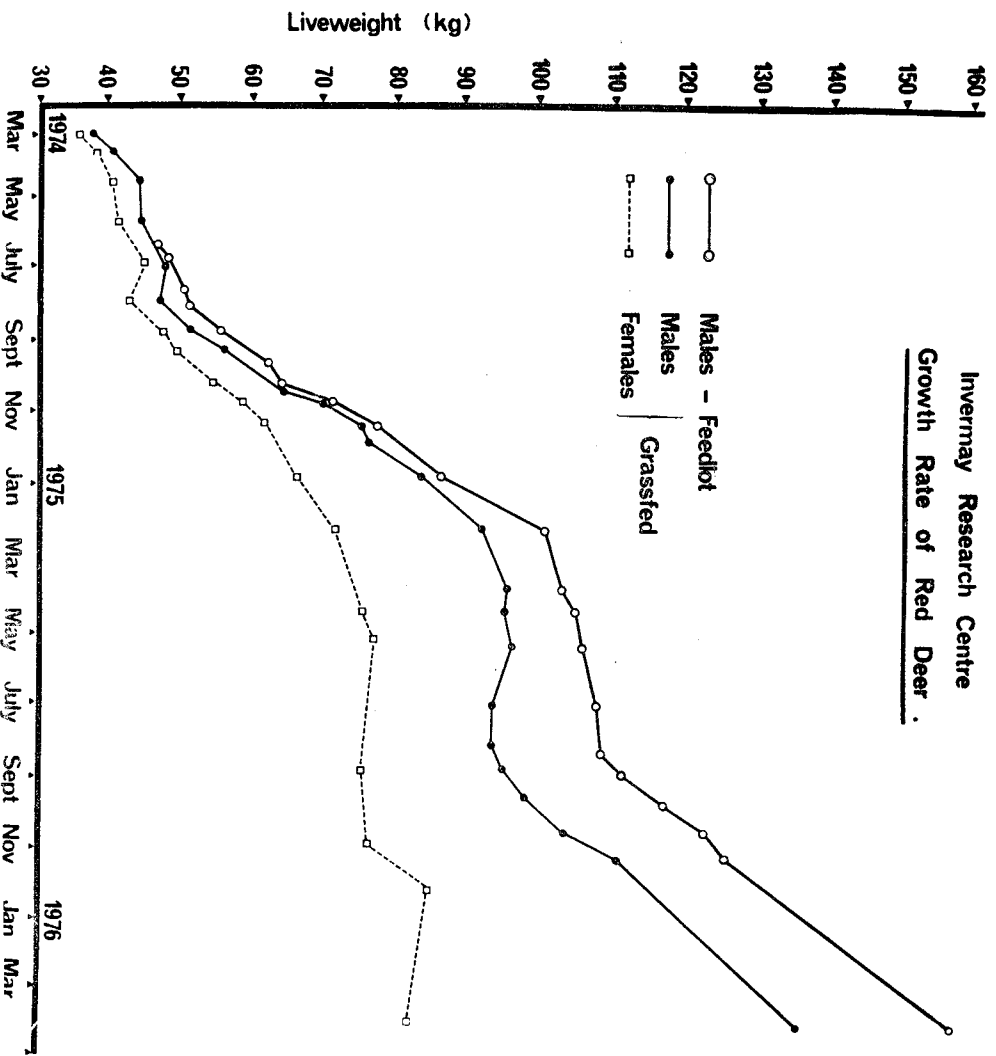


FIGURE 1.

Table 1

Venison Carcass Composition
 Compared with Lamb, Goat and Elk

	<u>Age</u> (mo)	<u>Carc. Wt.</u> (kg)	<u>Chemical Fat</u> (% carc.)	<u>Prote</u> (% ca
Feral ^{a/}	6	28.7	5.7	21.0
	12	27.9	1.3	21.6
	18	36.3	3.0	21.0
Grassfed ^{a/}	6	24.5	7.3	21.4
	12	40.8	5.7	21.8
	18	51.9	6.0	21.5
Feedlot ^{a/}	12	44.4	7.9	21.6
	18	58.4	8.6	20.9
Ram lambs ^{b/}	5	8.3	17.3	18.8
	13	14.6	28.0	16.0
	25	16.6	29.9	15.3
Feral Male Goats ^{c/}	ND	10.0	6.0	18.5
Bull Elk ^{d/}	ND	150	4.5	21.8

a/ each figure is the mean of 5 animals

b/ Everitt and Jury 1966

c/ Kirton 1970

d/ Field et al 1973

ND no data

PRINCIPAL OBJECTS OF THE NEW ZEALAND DEER FARMERS ASSOCIATION

- A. To encourage, promote and improve deer farming in N.Z.
- B. To represent deer farmers in all matters of common interest concerning deer farming and ancillary industries.
- C. To promote discussion and collaboration with Government departments and representatives on all matters affecting the interests of deer farming.
- D. To acquire information on all aspects of deer farming or other matters concerning or affecting deer farmers; to emanate the same among members and to liaise on such matters between members and other interested persons or organisations.
- E. To employ staff and provide services and expertise to members and deer farmers; to promote and carry out research into all aspects and ancillary industries.

Membership of the association is open to all people interested in deer farming and its council has eight members including the president, a vice-president, the secretary and treasurer.

Executive Officer
Mr D.K. Yerex
P.O. Box 11-137
WELLINGTON