DEER PRODUCTION IN TROPICAL AND SUBTROPICAL ENVIRONMENTS

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1. INTRODUCTION

The history of Australian farming over the last 150 years is a saga of European farming systems applied in an Australian environment. The lesson of history has been that these European farming systems do not readily transfer because they are so environmentally dependent. It should come as no surprise, therefore, that deer farming systems developed in New Zealand also require major modification for Australian conditions. This is particularly so in the tropics and subtropics.

The Australian tropics are delineated from the subtropics by the Tropic of Capricorn. This runs through Rockhampton and Longreach. However, the southern boundary of the subtropics is less clearly defined. For the purposes of this paper I am assuming that it is the rest of Queensland plus coastal New South Wales north from about Sydney.

2. TROPICAL AND SUBTROPICAL ENVIRONMENTS

2.1 Climate and Pasture Growth

The key features of subtropical climates are hot summers and mild winters. However winter frosts do occur in many areas. Rainfall is typically summer dominant but highly variable. Many agriculturalists coming from temperate regions underestimate the impact of this high variability, and also the effect of high evapotranspiration. Recent climatic data for the University of Queensland, Gatton, which lies 90 kilometres west of Brisbane at latitude 27^{O} 36', is shown in Table 1.

TABLE 1: Climatic Data, 1986-1989, for University of Queensland, Gatton

January Daily Maximum (°C)	32.1	
July Daily Maximum (°C)	20.6	
July Daily Minimum (°C)	7.1	
Days/annum > 35°C	17	
Frosts/annum	11	
Daily wind run June to Ausust (km/day)	111	
Rainfall (mm/annum, range)	839	(541-1079)

The high summer temperatures of the subtropics mean that temperate grasses (C3 species) such as ryegrass *(Lolium sp)* and cocksfoot *(Dactylis glomerata)* do not persist. The most important grasses are the C4 tropical species, including both native grasses and African imports such as kikuyu *(Pennisetum clandestinum)*. However all of these tropical grasses are frost susceptible and winter temperatures are typically too low to allow significant growth. It is one of the ironies of the subtropics that although the climatic winter is short and mild, the agronomic winter is much longer than in colder climates such as New Zealand or Gippsland, Victoria. For example, in late August and September when Victorian and New Zealand pastures are growing rapidly, most Queensland pastures are brown and dormant.

There is also a widespread misunderstanding amongst temperate agriculturalists about pasture growth in the tropics. Winter temperatures are certainly less limiting than in the subtropics, but winter rainfall is almost always inadequate and summer rainfall is unreliable.

The agronomic outcome of these climatic features is similar in both the tropics and the subtropics. The grasses grow very fast for short periods and then go to seed. For the remainder of the year the feed is a standing crop of hay with low protein and low metabolisable energy. The exception is where there is irrigation, but these areas represent only a small proportion of the total area.

2.2 Parasites

One compensation of the harsh climate is that some of the internal parasites of deer do not prosper. Accordingly, most deer farmers do not use anthelmintics. Lungworm are uncommon to the extent that most deer develop no immunity. This can be important if these deer are subsequently shifted to colder climates.

External parasites can be a problem in all tropical areas, and also in subtropical areas east of the main dividing range. Three major species of tick are the cattle tick *(Boophilus microplus)*, scrub tick *(Ixodes holocyclus)* and the bush tick *(Haemophysalis longicornis)* which is often called the New Zealand tick despite its Indian origin. Deer of temperate origin are susceptible to all three species and tropical deer are susceptible to the scrub tick.

2.3 Light/Dark Ratios

Southern Queensland has a mid-summer day length (sunrise to sunset) of 13.5 to 14 hours, declining to 10 to 10.5 hours in winter. This is sufficient to entrain the circannual breeding cycles of the temperate species. There is unpublished evidence for red deer from about latitude 26^{o}S, suggesting that antler casting and calving can both occur earlier than in higher latitudes, but this is not occurring on all farms. We have no evidence on the breeding cycles of temperate deer when farmed in the true tropics.

2.4 Feed Requirements and Feed Supplements

The mild winters have a marked effect on feed requirements. At Gatton we calculate our winter feeding requirements for red deer on the basis of:

$$ME = 0.55LW.^{75}$$

where ME = metabolisable energy in megajoules
and LW = liveweight in kilograms

This compares to the Invermay (New Zealand) derived estimate of $0.85LW.^{75}$ (Fennessy et al, 1981). The Gatton estimates are derived from measurement of supplements provided to a group of externally penned animals. These figures have been validated in the field over the last five years.

The availability of feed supplements varies greatly both within the tropical and subtropical zones, and also in comparison to more southern regions. A key feature of coastal tropical areas is the availability of molasses. In parts of the subtropical zone summer grains (e.g. corn, millet and sorghum) and winter grains (barley and wheat) are available at very competitive prices. In other parts of both the tropical and subtropical zones all supplementary feeds are extremely expensive. In those areas where grain is readily available, then feedlot type systems are feasible.

The cost of supplementation can have a major influence on the appropriateness of particular livestock management systems.

3. THE ALTERNATIVES

In the Australian subtropics there are four species that can realistically be considered. Red deer *(Cervus elaphus)* and fallow deer *(Dama dama)* are temperate in origin. Rusa deer *(Cervus timorensis)* and chital *(Axis axis)* are of tropical origin. In the tropical zone the commercial choice is restricted to rusa and chital.

3.1 Red Deer

Deer farming in southern Queensland developed with red deer, and in 1991 about 8,000 red deer are farmed there. Significant numbers are also farmed in coastal New South Wales.

In the case of Queensland, the presence of farmed red deer has largely been an accident of history resulting from the presence of feral herds in the Brisbane and Mary Valleys (Bentley, 1978). Hinds were captured from the wild, and stags of different bloodlines were purchased from zoos and wildlife parks. More recently, there have been imports of red deer from New Zealand, but not in large numbers as has occurred in the southern States. Most of the imports to Queensland have been stud type deer of known origin from England, Germany and Yugoslavia. At least six farmers have successfully imported and implanted embryos.

The red deer in coastal New South Wales are a mixture of New Zealand and Queensland animals.

Many of the early Queensland red deer farms were on poor quality land close to the feral herds. Performance was variable, but many farms achieved weaning rates of only 50%. Hinds did not reach puberty until 27 months. At times these Queensland animals have been criticised as lacking in genetic merit, but most of the criticism has been misplaced. The problem was (and on some farms still is) feed quality.

At the University of Queensland, Gatton College (formerly Queensland Agricultural College) we established a red deer herd in October, 1984 with rising yearling females that weighed only 40kg. These came from six different farms and were typical of what was being farmed. We placed them on irrigated pasture and they have performed magnificently. For the last five years we have averaged 89% weaning rate (calves weaned divided by all hinds including yearlings at the previous mating). This has been despite the disruption of ET and AI programs. Our female progeny average 80kg when mated at 16 months and stags average over 100 kg prior to slaughter at 15 months. In the early years we found no need for anthelmintics, but in the last two years hinds have received one oral drench in

the autumn and weaners have been drenched twice. Since herd establishment we have lost one hind from dystocia, two stags from fighting and misadventure, and one stag was put down with a broken leg. We have never lost an animal to disease. During that time the herd has increased from 25 to 170.

We are currently stocked at 25 animals per hectare (a combination of 350 red and rusa deer), and to maintain production we feed grain as required. We realised early on that there is no money in hungry deer, and that this applies particularly with red deer. The message with red deer is very simple: either spend the money to feed them, or if this is uneconomical get rid of them.

Although the message about red deer and feed quality is very simple, it has not been well understood. This is in part because Australians have observed red deer in New Zealand where feed quality is much more consistent. Red deer are by nature a browsing type animal that selects a high energy diet. However they can also function as grazers where the metabolisable energy content is high. In New Zealand their feed requirements can usually be obtained from pasture; in the tropics and subtropics this is often not so.

A further problem with red deer arises from their feed selectivity. If grazing tropical pastures they will selectively graze the legumes. Unfortunately, tropical legumes cannot withstand heavy grazing and they soon die out.

Our experience at Gatton is that the subtropical climate is no disadvantage as long as there is available shade. Indeed the warm winters are a definite advantage in terms of both reduced feed requirement and increased growth rate in young stock (Woodford et al, 1990). The potential problems of red deer in this environment relate not to the climate, but to nutrition.

Given the nutritional problems associated with red deer, it might be inferred that they are not a suitable animal for the subtropics. This is not correct. Rather, they should be farmed in specific areas and using farming systems that allow them to exhibit their potential.

In future I believe we will see increased farming of red deer on the eastern Darling Downs in the vicinity of Toowoomba. This is a grain growing area that is free of ticks and has low humidity. It is an area that livestock producers refer to as somewhere that animals "do well". Animals moved there from the coast "shift well", and it is "healthy stock country". In the same way that large beef feedlots are sited in this area, I believe we shall see deer being paddock finished on grain. There is evidence that red deer can convert grain based feeds to venison with similar biological efficiency to feedlot beef production (Woodford and Dunning, 1988), and there are no major practical problems. Specialist velvet herds are also likely to increase in this area.

3.2 Fallow Deer

There are probably less than 1,000 fallow deer farmed in Queensland and several thousand in subtropical parts of New South Wales. The lack of fallow in Queensland arises from a lack of feral animals to form an industry base. Fallow evolved in Mediterranean climates and should therefore be better suited to hot summers than are red deer. They certainly show less tendency to seek shade, and they may be able to better utilise feed of sub-optimal quality. However the nutritional research to verify this has not been done.

3.3 Rusa

Rusa are the second most important species in Queensland after reds. There are probably about 7,000 animals in Queensland and another 1,500 in New South Wales. There are two sub-species, called Moluccans and Javans and these can interbreed. A few farmers have also attempted cross breeding with the larger sambar deer *(Cervus unicolor)*. The role of this cross animal remains uncertain on account of their strength and difficulty of handling.

Farming of rusa deer commenced in Victoria in 1971, but it was not until about 1980 that the first herds were established in the subtropical and tropical zones to which these animals are adapted. The Moluccan herds derived from feral herds released on the Torres Strait Islands in 1912. The Javan herds derive from releases into the Royal National Park near Sydney in the 19th century (Bentley, 1978).

A herd of Javan rusa was established at the University of Queensland, Gatton in 1985 and this herd has expanded to about 180 animals in 1991. This Gatton herd has been used as a basis for documenting the farming capability of the species under subtropical conditions (Woodford and Dunning, 1990).

It has become apparent from both the Gatton herd and privately owned herds that rusa are an excellent species for the production of venison under Queensland conditions. In comparison to red deer they are much less selective and they are grazers rather than browsers. They have the capability to thrive under pasture conditions where reds would fail to perform. Faecal egg counts are consistently lower than for red deer on the same farm (unpublished Gatton College data). Rusa pregnancy rates on most Queensland farms appear to be over 95%, and this is sometimes achieved under feed conditions where reds would give less than 50%. Young females farmed under good conditions will consistently become pregnant at less than nine months.

Rusa deer have circannual cycles of antler growth and liveweight change in the same way as red deer. However, these cycles are independent of climatic seasons. Calving tends to be very concentrated even in situations of non-controlled breeding, with up to 70% of the herd calving within a three week period. Most herds calve in the autumn, but there are exceptions.

Carcass weights from Gatton College Javan rusa have averaged 49 kg at 14 months and over 60 kg at two years. The dressing percentage, calculated as bone-in hot carcass weights divided by non fasted liveweight, has averaged 61% (Red deer at Gatton College typically dress out at 57%).

Rusa deer can be categorised as easy care animals that, under subtropical conditions, will produce venison at lower cost than can be obtained from temperate species. However, rusa deer do have their problems:-

(1) Despite being very quiet in the paddock and easy to muster, they are a robust animal in the yards that is inclined to jump when confined.

(2) Rusa are a large herd animal and can show behavioural stress when in small numbers of less than about ten.

(3) Rusa are susceptible to malignant catarrhal fever. Fortunately this is not a major problem in much of the tropics and subtropics because of the absence of large numbers of sheep which are the primary host.

(4) Rusa produce less velvet than red deer, and it is difficult to restrain the stags without damaging the velvet. The velveting drugs are also much more expensive than those used on red deer.

(5) The new born fawns are cold susceptible.

It has become increasingly clear in recent years that rusa are the favoured species for venison production in the humid tropics and subtropics. Their relationship to the temperate species is analogous to the relationship between *Bos indicus* (e.g. Brahman) cattle and *Bos taurus* (e.g. Hereford) cattle.

3.4 Chital

The potential of chital deer as a venison producing species is high, but this potential has yet to be commercially proven. There are probably less than 2,000 farmed chital deer in Australia, and this will constrain their commercial significance for a number of years.

There is no doubt that chital deer are intelligent, that they can be yard trained and that they produce quality venison. The work at the University of Sydney has led to an understanding of their behaviour and shown clearly that they can be farmed. However, Sydney appears to be too far south for these animals to show their full potential. In Queensland I know of only two farmers who regularly yard their animals, and I am working with one of these farmers to document their production under commercial type farming systems.

Based on their Indian origin and their known ability to thrive as a feral herd in the Charters Towers area, it seems that chital deer may complement the rusa deer by being the favoured species for the dry tropics.

4. FUTURE CHALLENGES

Deer research in the subtropics and tropics has been limited. Nevertheless, the basic principles of appropriate farming systems for these areas are becoming evident. Major knowledge gaps include the production capabilities of chital in these environments. For all four species there is need for nutritional information that relates animal growth rates to feed quality.

The presence of four species creates both opportunities and problems. Opportunities relate to the capability to have animals available for slaughter throughout the year. Problems arise because separate export protocols and classification systems will be required for each species. It would be much simpler if they were breeds, not species.

The industry is currently constrained by the tyranny of distance that characterises most things Australian. The collective ability of the four species to thrive under such diverse environmental conditions is a biological advantage, but geographical dispersion does complicate the post farm gate side of the industry. As production increases, economies of scale will occur in slaughtering, processing and distribution.

Most emerging agricultural industries go through a difficult phase where production outstrips demand in the niche markets, but production is too small to justify the costs of mainstream market development. In 1991 that is the situation of the subtropical and tropical deer industries.

5. REFERENCES

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