

DEER FARMING IN AUSTRALIA

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INTRODUCTION

The commencement of a new animal industry is not something which occurs every day, and it brings many problems and unanswered questions. Development periods are filled with dramatic changes, excitement, heartaches and much thought. For those involved in the embryonic Australian deer industry all these things are true.

New Zealand pioneered the deer farming industry in the late 1950's and it is estimated that there are over 100,000 deer on New Zealand deer farms today. The Australian industry is modelled along the same lines with many of the New Zealand practices and much of the organisation being duplicated. However, it is estimated that only 6,000 to 7,000 animals are behind fences in all the Australian States.

Seventeen species of deer were introduced to the Australian environment in the early part of the 19th Century, as a game resource. Today only six survive (Bentley 1978), and one or another species inhabits the fringes of most major cities of Australia. The general public is largely unaware even of the existence of deer in this country (Taylor 1971).

The philosophy of utilising another animal in an economic grazing system has to be reviewed. Some conservationists see deer as a threat to the habitat of native animals, while others see deer as a game animal to be managed accordingly. Even if wide-spread deer farming became popular in this country, it is unlikely that escapees would form a nucleus for a rabbit-like plague; the animal's size alone puts it at risk from hunters (Keep 1979). Animal preservationists and liberationists are prejudiced against the concept of farming deer as they consider the domestication of a wild animal is contrary to the animal's welfare.

Some farmers would utilise deer as a means of diversifying income from traditional livestock production; they see a bright economic future for the varied products available from the animal, and seek access to the limited wild population for breeding stock. Hunters perceive this to be a reduction in the numbers available for recreational hunting.

The responsibility for deer farming is currently being considered by government bodies in the areas of animal health, conservation/wildlife, vertebrate pest control and overall industry control. There are as yet no nationally-based legislative objectives.

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One of the first problems encountered in the establishment of a new industry is the collection and documentation of relevant information. There is a wealth of information on deer handed down in folklore and published over the centuries (Anderson 1978). Generally speaking, however, much of this information is relevant to wild deer and many of the productive parameters one normally associates with animal production are therefore not available, e.g. the relationship between photo-period and hormone levels on antler development or reproductive cycles is not fully understood in some species.

The first step in the collection and documentation of relevant material was the publication of "Gold on Four Feet" (Anderson 1978). This was followed by a Situation Report from a working party to the Animal Production Committee (Couchman 1980, in press), which highlighted some of the problems facing the developing industry.

For example, Government agencies are asked to provide developmental assistance to interested investors and participants. This in itself creates problems such as the training of staff to a suitable level to be not only competent in their work, but to be accepted by the industry pioneers as being able to provide efficient extension services.

The following papers are presented to acquaint agriculturalists with those aspects of deer production which provide the basis of a fast growing, economically attractive, alternative grazing industry, one which, however, still has many developmental problems to overcome in Australia.

AUSTRALIAN DEER FARM PRODUCTS AND MARKETING POTENTIAL

R.C. COUCHMAN

VELVET ANTLER

while increasing stock numbers, farmers are still able to obtain a cash income through the sale of live animals and velvet antler. Currently prices for live animals range from \$700 for fallow does up to \$2,500 for red hinds. Velvet antler is the young, growing antler of the male of the species. During its growing phase the antler is covered with a fine hair coat which resembles velvet. When the antler is harvested it is frozen, and sold to Asian traders in this state. It is then cooked, dried, sliced and is sold on the Asian pharmaceutical market at a current retail price of \$1,000/kg.

While the price to the producer for unprocessed, frozen velvet antler remains above \$75/kg the industry will be based on velvet antler production, and it will be unprofitable to slaughter male animals for venison. The value of velvet antler varies depending on its grade and the species from which it was obtained. It is graded subjectively by the buyers and is down-graded if scarred, badly cut, damaged or harvested after it has grown past the optimum shape. This is considered indicative of excessive calcification. It is therefore important to harvest at the correct time. Prior to the dramatic drop in velvet values in December 1979 (up to 30%), caused by events in South Korea, A Grade red deer velvet fetched \$242/kg at the farm gate, while A' Grade fallow velvet fetched only \$198/kg.

The market for velvet antler is seen to be strengthening as increasing affluence in Asia and a decline in deer numbers from traditional areas (Chaplin, 1977) puts pressure on existing supplies.

Enquiries from Asian buyers and processors over the past twelve months confirm the interest in Australian-produced velvet antler, and indicates that they are willing to set up plant for processing the product in Australia when sufficient quantities warrant it. Australian production last year, to test the market for velvet from Rusa and Fallow deer, was only 150 kg. The present production potential is 775 kg, which at current prices would be valued at \$130,000.

VENISON

The local venison market is not being adequately serviced. Because of the pressures of building up stock numbers and velvet antler production, producers are not slaughtering deer. The only venison on the market is derived from minimal legal slaughterings (to test consumer acceptance), and illegally-marketed venison from deer shot in the wild.

It has been estimated that current turn-off from farms (if in a slaughter phase) could produce only 500 carcasses of approximately 40 kg each. In consumer terms this would supply 1% of Australia's population with one meal of venison per year.

Venison is a high-price meat which would initially be consumed in the hotel/restaurant sector, and is seen to be easily promoted. Australian producers have had requests for exports of 1,000 tonnes at a price of \$4.75 per kg. This order, if it could be filled, would gross producers \$4.75 million. Competition exists from New Zealand, which is having a similar build-up and velvet antler phase, and will enter the slaughter phase earlier than Australian producers.

BY-PRODUCTS

Various by-products are obtained from deer. Their value is dependent on sex and species but can realise \$60-\$75 per head. Most of these products, except for hides, edible offal and hard antler, are used in the oriental medicine trade. As with velvet antler the market potential for these products is seen to be strengthening. Organised marketing of by-products appears unlikely in Australia until such time as the industry enters a slaughtering phase.

The legal aspects of taking, processing and marketing these by-products are not clear. One of the problems associated with by-product marketing is the gathering of a sufficient quantity of each variety, to make the marketing effort and sales worthwhile.

CHARACTERISTICS OF RED DEER (*Cervus elaphus* L.) RELATED TO THEIR PERFORMANCE AS FARMED ANIMALS

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Experience in management, coupled with research in New Zealand and Scotland (e.g. Blaxter et al. 1974) has identified characteristics of behaviour and performance that are important considerations in farming red deer. This paper summarises aspects of management, nutrition, meat production and reproduction related to intensive farming of red deer in New Zealand.

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MANAGEMENT

An understanding of the nature and behaviour of red deer is basic to successful on-farm management. Transitional management strategies for taming and training wild captured deer onto a farm management system are necessary. The familiarity of the deer with the fencing and yarding system and a quiet approach minimises the occurrence of trauma when animal handling is necessary. Electric fencing has proved successful for grazing management, but two metre-high fences are necessary to contain stags at mating and for the perimeter and laneway fences. Yards should have solid sides, with a small covered area for animal handling.

Weaning of calves away from wild captured hinds facilitates the development of quieter farm-bred stock. On intensive farms calves are usually weaned in late March before mating commences in early April. Young deer are very susceptible to lungworm (*Dictyocaulus viviparus*) and should be drenched at weaning and at 21 day intervals thereafter until October, with movement onto clean pasture after drenching for maximum protection. Good feeding over winter is essential for the health of the stock, particularly the calves, and as discussed later for stags. Removal of the stags' antlers each year is necessary to protect humans, fences and to prevent stags goring each other when they become aggressive for the rut. Due to the high prices paid for velvet antler, antlers are generally removed in the growing 'stage just before division into the top or royal tines occurs. Stags are tranquilised and a local anaesthetic given to the two main nerves at the base of each pedicle (Adams 1979). Tourniquets which are applied around the pedicle before the velvet antler is sawn off just above the forming coronet should be removed after no more than 30 minutes.

NUTRITION

Deer show very marked seasonal growth patterns whether they are on feral range, grazing on high producing farm land, or managed in feedlot conditions (Drew 1976; Blaxter *et al.* 1974). The animals appear to have been conditioned over the centuries to a spring-summer phase of very rapid growth and an autumn-winter period of minimal or negative body growth. Table 1 shows data which are typical of farmed red deer at Invermay. Females reach 90% of their mature live weight one year earlier than males and both sexes show little growth during autumn and winter.

TABLE 1 Typical body growth of Invermay farm-bred red deer

Age	Live weight (kg)		Proportion of mature live weight (%)	
	Males	Females	Males	Females
At Birth	7.4	7.5	4.2	7.5
6 months	48	45	27	45
9 months	50	48	28	48
15 months	92	74	51	74
21 months	89	72	49	72
2½ years	126	84	70	84
3½ years	157	94	87	94
4½ years	171	100	95	100
5½ years	180	100	100	100

Hinds will typically lose or barely maintain live weight over winter, but will rapidly gain weight during spring when there is abundant high quality feed. With calving not commencing until early summer, there is relatively little difficulty in meeting prenatal feed requirements. In fact some care needs to be taken to prevent over-fatness and the risk of difficult births with large calves. Hinds should be set stocked for at least eight weeks from the onset of calving because disturbances during and soon after calving can lead to animal mortality (Kelly and Whateley, 1975). Because calf growth rate from birth to weaning is largely a function of maternal milk production, it is important to provide immature pasture of high digestibility in the calving paddocks. However, swards capable of maintaining high levels of milk production will often fail to provide adequate cover for new born calves. In this situation areas of the paddocks can be fenced to exclude the hinds, but by keeping the bottom wire 40cm above ground level calf movement is permitted. The rank feed within the fenced areas will be used as a 'hide' by almost all the calves.

The nutrition of stags is greatly influenced by their extreme seasonal appetite. As the autumn approaches, voluntary food intake falls to low levels and remains depressed during the rut. The consequences of poor nutrition following the rut are continued substantial live weight loss which over the autumn-winter period may reach 25% of the autumn weight, a delay in casting of the old antlers in spring and some reduction in the new season's velvet antler growth.

MEAT PRODUCTION

Deer have much to offer as meat producers because they have a high rate of growth, a high carcass:live weight ratio and a very low proportion of fat in the carcass. The whole deer carcass has a protein content of 20-21% and a fat content of 6-12% (Table 2). These figures are very favourable when compared with commercial sheep and cattle carcasses whose fat content is commonly 20-30% of the weight.

When young male red deer were set stocked in 1975/76 and 1976/77 on ryegrass - white clover pasture, at the rate of 31/ha over the 6 months of spring and summer, the pasture was maintained at 2-5 cm in length and the animals produced 1,235 kg of liveweight gain/ha or 740 kg of carcass gain/ha. This is about 50% more meat/ha than weaner cattle would produce from similar pastures over the same period. Deer appear to be most effective converters of pasture into edible meat.

TABLE 2 Carcass weight and chemical composition of pasture-fed male red deer

Age (months)	Live weight (kg)	Carcass weight (kg)	Dressing percentage	Chemical fat (% carcass)	Protein (% carcass)
6	44	24	54	7.3	21.4
12	70	41	59	5.7	21.8
18	88	52	59	6.0	21.5
27	123	76	62	11.9	20.7

REPRODUCTION

Red deer are seasonal breeders, having an intense period of mating activity in late autumn (April-May) with a subsequent calving during late November-December (233 days gestation). In the stag during late summer there is a rapid hypertrophy of the neck muscles with associated changes in the mane, development of a distinctive rutting odour and increased agonistic behaviour to other stags and man. During the roaring and subsequent rutting (mating) season the stags attempt to herd hinds into a harem, and spend considerable time and effort in maintaining their dominance over the harem against the efforts of other stags.

Harem-forming activity generally disappears by early June. Testosterone levels are closely associated with these pronounced seasonal changes in activity. The mean concentrations of plasma testosterone in six stags sampled at monthly intervals over the breeding season are summarised in Table 3, showing an increase to peak levels at about the rut with a return to basal levels within two months.

Harem formation is an important consideration in the management of farmed red deer about mating time. In large hill paddocks (>100 ha) harem sizes are similar to those under free ranging conditions (e.g. Rhum Island, Scotland). On Rhum Island, Lincoln and Guinness (1977) reported that for a group of 110-172 animals comprised of similar numbers of males and females, harem size of the six most successful stags ranged from five to 19 hinds. The number of calves sired by the most successful stags was estimated at between six and 12 in a single season. Such information from free ranging animals undoubtedly influenced early deer farmers in their decisions on the number of stags to be joined with hinds, many using one stag for every two to 15 hinds in the herd. However, observation on herds run in paddocks of 10 ha or less (Bray and Kelly 1979, and unpublished data) indicate that the mating load will be unevenly distributed between stags and not that suggested by the stag:hind ratio. When fewer than six stags were present one stag monopolised almost all of the hinds (herd sizes observed < 196 hinds), whereas when more stags were present harem formation broke down but disproportionate mating loads still existed. The number of hinds in a harem therefore appears to be a function of both number of stags present and possible area for dispersal. Calving records indicate that stags are capable of successfully mating at least 50 hinds in a breeding season, but that given the opportunity harem size can exceed sexual capabilities with resultant sexual exhaustion and an effect on calving performance. Such behaviour needs to be considered in management at mating.

The onset of the breeding season for hinds run at Invermay is early April, with most animals apparently capable of having two to three oestrous cycles of 18 days duration during their breeding season. Delays in joining of hinds with entire stags until late May have resulted in a reduced incidence of oestrus detection (17/20 vs 9/20, $P < 0.05$), but calving rates of these late-mated hinds are high (89%). Red deer are monogamous, and attempts to induce multiple births by hormonal treatments have been unsuccessful (Kelly and Moore 1977). Calving percentages of hinds mated at 16 months of age are largely dependent on live weight (Kelly and Moore 1977).

TABLE 3 Plasma testosterone concentrations (ng/ml) and physiological status from January to September in six year old stags

Time of sampling	Testosterone conc.		Status
	Mean	* (S.E.)	
11 Jan	1.7	(0.6)	velvet
8 Feb	2.5	(0.5)	velvet-hard antler
8 Mar	13.8	(1.2)	start of roaring
4 Apr	38.5	(9.4)	roaring-harem formation
7 May	4.0	(1.7)	mid-late mating
7 June	0.3	(0.1)	
10 July	0.6	(0.3)	
7 Aug	0.5	(0.2)	
5 Sept	1.4	(0.5)	three weeks pre- casting of antlers

* value for each stag at each sampling was the average for three samples taken over one hour

ASPECTS OF DEER SLAUGHTER FOR HUMAN CONSUMPTION

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INTRODUCTION

Australian legislation on meat inspection does not cover the slaughter of deer for human consumption, except in Victoria, where the Abattoir and Meat Inspection Act of 1973 was amended in 1976 to include deer in the definition of an animal for the purposes of that Act.

In New Zealand deer slaughtered for human consumption are covered by the Game Regulations 1975, pursuant to the Meat Act 1964. These Regulations, for the purpose of carcass preparation and marketing, distinguish between field-killed feral deer and farmed deer slaughtered in deer slaughtering premises.

It is interesting to note that on 13 November, 1979, the Australian Minister for Primary Industry announced that he had approved amendments to the Export (Meat) Regulations of this country to permit the preparation of field-shot animals as game meat. It was stated that these amendments would permit the harvesting of such species as feral pigs and kangaroos for traditional game meat markets in Europe.

Currently there is no regular slaughter of farmed deer in Australia. This will, however, eventually occur. Early consideration of matters such as slaughter procedures, possible government regulation, the potential market for venison and the peculiarities of deer compared to traditional domestic stock sent for slaughter will be to the industry's advantage.

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THE VENISON MARKET

Claims have been made that feral venison is superior in taste and quality to that of farmed deer. In New Zealand this has led to strict compliance with labelling requirements for their game meat export trade (McNab 1977; Williamson 1977). It might be said that within Australia this supposed taste difference will not be of much importance. Most, if not all of our regular venison supply will be from farm-raised deer. However, in marketing Australian venison attempts at mislabelling the product would be foolish as buyer resistance would almost certainly result.

It is to be noted that findings of recent research at the Invermay Agricultural Research Centre do not support this suggested taste difference (Foss and Manely 1977).

When considering the venison market, thought must be given to the education of the public in the correct manner of handling and cooking this product. Venison by comparison to the meat of our traditional stock animals is a much leaner meat. (Robbin *et al.* 1974; Drew and Greer 1977). As a result, traditional cooking methods tend to "dry out" the venison; to counter this, meat preparation habits of consumers will require changes.

INSPECTION, REGULATION AND SLAUGHTER

Mention has been made of the paucity of specific legislation currently covering deer slaughter in Australia. It can be expected that this will change as the slaughter phase of deer farming is reached. Authorities responsible for the regulation of animal slaughter for human consumption will be reluctant to accept field shooting of farm-raised deer (Rees and Tulloch 1979).

The objectives of a broadly-based meat inspection service should be to safeguard the health of the consumer, prevent fraudulent practice and assist in the development of an orderly meat processing system (Drabble 1960). Deer farmers in Australia can have no argument with safeguarding the consumer from animal-transmitted diseases. Fortunately, the present health status of farmed deer is excellent (Wilson 1979; McCallum 1979; Presidente 1979; Morgan 1979) and this situation is certainly one to be jealously guarded. In regard to particular diseases of significance to public health there have been no reports of muscle cysticercosis, hydatid disease, brucellosis or tuberculosis in Australian deer. Positive brucellosis serum titres and tuberculosis lesions found at slaughter have been reported in deer in New Zealand (Wilson 1979). These latter reports are of concern in relation to that country's bovine brucellosis and tuberculosis eradication programmes. Deer were not initially regarded as domestic stock and hence excluded from the compensation provisions of the eradication scheme.

One other important disease organism is *Salmonella* which has been isolated from clinically-normal farmed deer in New Zealand (Wilson 1979). This organism is a common inhabitant of the gut of all animals (Steel 1963) and can cause food poisoning in man if faulty carcass dressing and inadequate sanitation of equipment and slaughter premises is permitted.

The third objective of a meat inspection service, that of assisting the development of an orderly meat processing system is possibly, at the moment, the most fruitful avenue for deer farmers to pursue with government inspection authorities. There are many difficulties encountered when yarding and transporting deer (Wilson 1979; Moore and Brown 1979). Stress or capture myopathy occurs in deer and is well documented (Wilson 1979; McCallum 1979) as is its effect on meat quality (Bartsh *et al.* 1974). These are valid reasons for discussion of methods of deer slaughter. There is little point in using regular avenues of slaughter, if these result in damage to the product. Mobile slaughter facilities transported onto the farm have been used for deer in New Zealand, and while certainly reducing stress in animals awaiting slaughter, post-slaughter hygiene has not proven to be entirely satisfactory (McNab 1977). Another possibility is the use of small permanent facilities designed especially for deer. The initial costs of such a facility would be high, but such a scheme, if entered into on a co-operative basis, as in the pig industry, could make maximum use of prefabricated abattoir units.

EXPERIENCES IN FARMING RUSA DEER

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The farming of rusa deer is at such a stage of infancy that no worthwhile survey of the practical aspects of their husbandry and management has been committed to paper.

An air of mystery concerning deer and their behaviour has been introduced into the minds of the uninitiated, the intending deer farmer and those with only a peripheral association with farming deer. This mystery has no validity. Both the farmer and the scientific researcher should think, speak and write of deer as individual species; to take the handling techniques appropriate for fallow deer and apply them to red or rusa deer could result in regrettable consequences. The deer is just another ruminant, but one with its own behavioural characteristics and a long-established instinctive fear of man. In a panic situation its supposed intelligence may evaporate completely into instinct for self preservation. The complexity of the animal in the farm situation is further compounded as the seasons of the year change.

Firm rules-of-thumb in handling techniques are difficult to lay down. The farmer should recognise that the deer itself is the best teacher and the lessons it imparts can provide the farmer with the answers to many of his animal management problems.

Feral rusa deer introduced to a farm environment develop a feeling of greater security and lazy tendencies within a few months. However, both stags and hinds are most nervous and least responsive to man under windy conditions. Frequent contact with man at reasonably close quarters marks the first step in domestication. Nevertheless, this is not proving completely possible with introduced feral deer. Complete domestication seems possible only with animals born on the property and with appropriate training and early segregation from their feral-born parents.

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TRAINING TECHNIQUE FACTORS

The farmer taking delivery of feral rusa deer has a special responsibility to those animals, starting with their release from their darkened transport box.

Release should be into a paddock large enough to permit animals a free and unobstructed run of at least 150 metres. Release in broad daylight is to be discouraged. Night release with a waiting reception committee of farm-trained deer seems most successful. An alternative is to release into a darkened building and to hold them under those conditions for up to a week. This compels them to accept man at close quarters.

Man's major deer training allies are noisy machines which arouse the innate curiosity of deer, and fodder. Sheep cubes, cut apples or barley grain are suitable and can be used as lead trails.

Following the rut, and until the stags cast their antlers during November/December, they are the herd leaders. This four month period provides the farmer with his best opportunity to train his herd to accept yarding and other forms of deer movement and to wean off his fawns, then from three to six months of age. With antlers cast, stags become regressive and one or more hinds take over as herd leaders. Until stag herd leadership is reinstated the movement of deer becomes more difficult as hinds are the more nervous, flighty and unpredictable.

Our prime objective was to train our rusa so that we could be able to yard and handle them as, and when we found it most appropriate. Our first muster to yarding operation attempted at night using hand lights was a total failure. The second attempt during the day saw four people in machines and on foot succeed in yarding 70 deer in four hours. Today, two people complete the same operation in as little as 18 minutes in a manner causing little concern to the deer. Attempts to draft and otherwise handle the deer within the covered yards under conditions of subdued lighting have traumatised the animals to an extent which is far from acceptable. Further work will be needed to achieve a satisfactory technique.

WARNING SIGNS, HEALTH AND HUSBANDRY

The farmer must remain alert to any unusual deer behaviour. An animal striking its forefoot on the ground warns other deer of its concern for a possible danger. A sudden, loud bark seems to be the ultimate in warning sounds. It is wise for the farmer to take note of those signs and investigate immediately.

In the field of animal health most of the clues which the shepherd or cattle herdsman would watch for can be applied to deer; scouring,, unthriftiness, an unusual gait, separation from the herd and so on. I do not attach credence to the belief that a sickening animal separates itself from the herd. I believe the animal, being indisposed and lethargic, is left behind by the herd as it moves on.

The same basic rules of husbandry apply to deer as with other grazing stock, e.g. rotational grazing, testing for internal parasites and control, and supplementary feeding at times of feed stress.

THE RUT

In pursuing a twelve-months cycle of deer phases, one starts with the rut and proceeds through antler growth and casting, velvet harvesting to fawning.

The time and activity sequence in a northern Victorian irrigation area sees hardened antlers being rubbed free of velvet late in May and this necessitates tree protection. A further preamble to the rut sees stags adorning their antlers with herbage, and spraying themselves with their own urine. They continue this practice into and through the rut.

Fighting between stags to establish a level of dominance over other stags is important. On our farm, stag fighting has been seen from as early as mid-May although the rut did not start until mid-July in 1978 and late June in 1979. Thus a dominance hierarchy was established before the rut and although the two dominant stags were challenged during the rut the challenges were soon resolved in their favour. Nine days prior to the onset of the 1979 rut the first stag roars were heard. It was during those nine days that the final hierarchy was settled with the heaviest-antlered stag winning. From the onset of the dominance struggle through the entire rut, extending from late June to mid August in 1979, the more active stags showed less interest in eating. In the relatively confined farm situation the master stag did not gather and defend a harem of hinds as appears to happen in the wild.

The 1979 rut saw two stags cover most of the 48 hinds in a little over three weeks. During the fifth week those two stags, although still able to defend their dominance, became lethargic and "sloppy" in their mating activity. This suggested it was time to replace them with fresh stags.

It does seem that the served hind will not stand for another stag. However, younger, eager stags may pursue the served hind fruitlessly for lengthy periods. Younger, less dominant stags are best run as a herd separate from the mating herd.

Female rusa fawns have been thought to conceive as young as eight months, but live weight rather than age seems to be the governing factor. Young males have been seen to complete services at between nine and ten months, although their level of fertility at that age is still unknown.. Sexually mature stags, mostly the younger ones, pursue homosexual activities, particularly when denied access to hinds.

ANTLER CYCLE AND VELVET HARVEST

Three weeks after casting hard antler, and pedicle healing, the new season's velvet antler commences growing.

With staggered casting and a remarkable consistency in the time ranging between 68 days to 74 days, from casting to the ideal velvet stage, a protracted velvet period results. The early velvet produced during the hotter summer months appears to be of better quality than that produced during the cooler autumn months by the younger animals. In practical terms, velvet over a period of nearly four months is less than convenient for the farmer.

Velvet may be done in either the yard or the paddock. For introduced feral deer I currently favour the latter system as training these animals to accept yarding without some panic, and probable damage to velvet, is proving difficult. Yard velveting of farm-bred stags should, however, prove entirely satisfactory.

FAWNING

Fawning overlaps with velvetyn by which time the pregnant hinds have been drafted into a separate paddock. Fawning extends from February to April, with rare random births occurring at other times.

Apart from a small udder developing a few days prior to parturition the farmer has no physical clues to an imminent birth. Hinds tend to separate from the herd for up to a few hours prior to parturition. Difficult births are rare, although not unknown, and rusa hinds are usually good mothers. Overt jealousy between hinds is not common, and hinds known to have had a single birth have been seen suckling two fawns.

The surviving fawn is the most valuable product for which the deer farmer works and all care must be taken. A hidden fawn, suddenly disturbed, will sometimes take flight and often crash into a fence resulting in injury or even death. It is in the farm bred stock that the true future of the successful rusa farmer lies.

CONCLUSIONS

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It is readily apparent that as well as offering diversity and profitability to the farmer in animals capable of being farmed (current estimates in New Zealand are that deer farming is at least twice as profitable as beef or sheep), there are unique events of interest to the scientist. The pronounced seasonal changes in the deer related to nutrition, behaviour, reproduction and antler growth will undoubtedly serve as a sound basis for future scientific effort on their interrelationships and mechanisms of control. The pronounced behavioural and antler changes have already been used as a model to elucidate sex hormone actions (e.g., Fletcher 1974).

It should be realised, however, that this industry has high establishment costs with relatively high risk factors and so returns are high and in line with the amount of risk involved.

On present prices and availability of breeding stock in Australia, it is envisaged that development would take the form of small herds of about 10 hinds initially, and a development period of up to 10 years. These units would be in association with some other enterprise, either livestock or cropping, to provide working capital during the stock build-up period.

Special managerial skills will need to be developed by intending deer farmers and this is seen to be a barrier to the growth of this type of enterprise. The problems of proximity and availability of suitable slaughter facilities, lack of a marketing infrastructure, and lack of clearly defined markets for Australian production, are all seen in the same light.

Within the limitations of stock, finance availability, and land suitability, deer farming has the potential to be both a direct alternative and a diversification possibility to existing forms of animal production. Deer farming is seen as being a potentially-viable agricultural industry compatible with the Australian animal production environment, capable of supplying a luxury meat demand, both locally and overseas, and with a potential to earn overseas income from exports of other associated products.

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