MANAGEMENT STRATEGIES AND HEALTH PROGRAMS FOR FARMED FALLOW DEER IN AUSTRALIA

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INTRODUCTION

The European fallow deer (Dama dama dama) is the predominant species used by the Australian deer farming industry, comprising some 50 percent or more of the estimated 100,000 deer on farms. This predominance has been based more on availability than on any other factor, and this is only now beginning to change with the importation of red deer (Cervus elaphus) from New Zealand. It is now becoming apparent that deer of tropical origin-rusa deer (C.timorensis) and chital deer (Axis axis), have problems coping with colder southern winters, and these deer are increasingly being farmed only in warmer areas. Red deer and fallow deer will therefore continue to be the preferred species over most of southern Australia.

The initial predominance of fallow deer ensured that the earliest studies on farmed deer in Australia were concerned with this species, with the emphasis being on the development and evaluation of management strategies which were suited to Australian conditions. This paper will review the management and performance of farmed fallow deer after some 13 years of research and development.

The major emphasis for the Australian fallow deer farmer has been the production of venison for the domestic market, with almost all the product to date being for the hotel and restaurant trade. There is some potential in the longer term for the development of export markets - but not for several years yet at least. There is little argument that fallow deer are farmed primarily for venison - the species will not be a major producer of velvet antler in Australia. This is not to say that fallow bucks do not produce saleable velvet antler, and in recent years the product has attracted good prices in Australia. However, given that fallow bucks destined for the venison market are slaughtered between 12 and 20 months, there is no velvet antler obtained from these. The removal of velvet antler from adult breeding bucks is common practice in Australia, with continuing emphasis being placed on the animal welfare aspects of the procedures which are used.

MANAGEMENT FOR VENISON PRODUCTION

The factors which determine the profitability of any system which produces meat from pasture or other forages are as follows:

1. The reproductive rate of the herd
2. The growth rate of animals destined for slaughter
3. Carcass quality

The management strategies which have been developed for fallow deer on farms in Australia have sought to address each of these areas, to ensure that the deer have every opportunity to live up to their potential as efficient producers of high quality venison.

It was apparent from the earliest years that most economic losses incurred by fallow deer farmers in Australia have been due to faulty management, and in particular to sub-optimal nutrition. The efficiency and profitability of a fallow deer farm will depend almost entirely on how well the nutritional requirements of each class of stock are met, and this is no different to the situation which applies to all the farmed ruminants. It is important to emphasize that the principles of good husbandry and good stockmanship are the same for all these animals, with only some changes in emphasis - particularly in relation to the restraint and handling of the animals.

Given the diversity of climatic and environmental conditions on the Australian continent, the time of occurrence and duration of pasture shortfalls will vary enormously, both across the country and between years. In any such situation there must be a degree of flexibility in devising management strategies, and in supplementary feeding policies in particular, which will allow the deer to perform as expected. Among the attributes which make fallow deer so attractive as a new form of rural enterprise are their hardy constitution, their low labour requirement on farms and their excellent conversion of forages into a most sought after meat. Furthermore, fallow deer females have very good reproductive potential, and are capable of rearing one fawn annually for at least 15 years. Failure to achieve this last goal has in fact been the single most significant cause of economic loss to many owners of fallow deer.

Reproduction and Growth

The annual cycle of management of farmed fallow deer is determined by the reproductive cycle of the species. It is convenient to discuss the management of females and males separately, in order to produce an integrated management system for a particular farm.

Female fallow deer

The fallow doe is seasonally polyoestrous, with the onset of the breeding season closely controlled by the reducing photoperiod of autumn. The mean length of the oestrous cycle of fallow does in Australia was found to be 21.7 days (Mulley, 1989, with the majority of does conceiving at their first or second oestrus in late April or May. After a gestation of 229-237 days, over 80% of fawns should be born within 6 weeks, beginning in late November. The species is capable of achieving over 90% fawning rates, with the target weaning rate being 85%. Over 6 fawning seasons in New South Wales, a total of 3110 fallow does achieved a mean fawning rate of 87.3% and a weaning rate of 81.9% (Mulley, 1989).

Fawning management

The pregnant fallow does should be in their fawning paddock at least 4-6 weeks before the first fawns are due. It is desirable to administer a booster clostridial vaccine no later than September, with the females then being allowed to settle into their fawning enclosure. At this stage of the gestation they should be on good spring pasture, there being no apparent need to restrict the level of nutrition at that time, as is the case for red deer. If the available pasture is of poor quality or quantity it is critical to provide supplementary feeds such as grains, pelleted concentrates and hay.

Failure to provide adequate nutrition in the last trimester of pregnancy will produce a significant reduction in fawn birthweights, and may result in unacceptable levels of perinatal mortality due to the high incidence of small, "non-viable" fawns - 45.1% of fawns below 3.4 kg at birth did not survive the first week of life, with mean birthweights of fawns in New South Wales being 4.01 kg (SD 0.61)(n=330) for females and 4.23 kg (SD 0.72)(n=348) for males respectively (Mulley et al, 1990).

Perinatal mortality has been the single most significant cause of economic loss to fallow deer farmers. Asher et al (1981) and Mulley (1984) reported perinatal losses of 19.4% and 19.6% for farmed fallow deer in New Zealand and Australia respectively. It is worth noting that this level of perinatal loss (within 7 days of birth) is of the same magnitude as occurs with the other farmed ruminants, and the aim must be to do everything possible to keep the losses as low as possible - accepting that there will be an inevitable loss of say 10% even with the best management.

The Australian experience has been that fallow fawns which survive the first 48 hours of life have an excellent chance of thriving from that point. Apart from misadventure and predation, both of which are largely preventable, there are few disease entities which have been a significant cause of death in growing fawns - although on some farms gastrointestinal helminthosis and necrobacillosis have been of some concern.

Whether or not a decision is taken to catch fawns soon after birth for eartagging and weighing, the fawning doe herd should be observed each day for problems, and for the collection of as many dead fawns as can be found, for necropsy. As long as this process is carried out by personnel with whom the deer are familiar, and that their presence in the enclosure does not agitate the animals, the potential benefits outweigh the risks. In fact, fallow does generally have a low incidence of difficult births which require assistance - below 3% is usual.

If there is no opportunity to record the number of dead fawns which occur during the fawning season, there will be little on which to base assumptions on the possible cause of a low weaning rate, if this occurs. At the very least, the females should be examined in mid-March whether pre-rut weaning is practiced or not, to determine and record those which have failed to rear a fawn - by the "wet-dry" examination of mammary glands. Females which fail to rear a fawn in 3 successive years are probably best culled from the herd.

In the absence of such information, there is a very good chance that no future remedial action will be possible if the weaning rate is well below the target of 85%. Apart from identifying the problem of low-birthweight fawns, which accounted for 43% of 144 perinatal necropsies in New South Wales (Mulley 1989), there is a need to determine whether preventable factors such as misadventure or predation are involved in the death of fawns. The importance of good shelter and shade in fawning paddocks cannot be over-emphasized, as well as the need for fawn-proof fencing.

Apart from a sensible level of surveillance of the fawning females, and the need to occasionally hand-rear fawns which are mis-mothered or whose dam dies, there is little else to do with the does until weaning. If fawns have been tagged at birth, the process of matching dams to fawns can be accomplished before weaning, as long as eartags can be easily read with field glasses.

What must be emphasized is the great increase in the feed requirements of lactating females over their requirements when pregnant. There is a doubling of the daily requirement while lactating, and failure to meet this demand will substantially reduce the growth rate of fawns from birth to weaning. Mulley (1989) found that the mean growth rate of fallow fawns from birth to weaning in March, over 6 fawning seasons, was 136.5 g/d (SD 22.4) for females and 153.1 g/d (SD 30.1) for males. If fawn growth rates fall well below these levels, there is the certainty that many will not meet the target weight for pre-rut weaning (15 kg), and these small fawns are at far greater risk of dying during their first winter. The small or late born fawn will be difficult to grow to the critical weight for puberty in females at 16 months of age (30 kg), or to good slaughter weight for males at 15 months (48-55 kg).

In summary, the most critical period in the year for the feeding of the female herd is during the summer - the last few weeks of pregnancy and the first 9-12 weeks of the lactation. Failure to meet the minimum requirements of the does during these months will result in poor reproductive performance, measured as the number of well-grown fawns in the herd in March. Fallow does have shown that they are capable of easily achieving the target reproductive performance, as long as they are well fed.

Weaning

If pre-rut weaning is not adopted, lactation normally proceeds for at least 5 months, with greatly reducing reliance on the milk of the dam after 3 months. It has become increasingly common in Australia to wean fawns in mid March, about 4 weeks before the onset of the rut - especially on farms where a restricted mating policy is used, with no late fawns to complicate the situation. No fawn below 15 kg bodyweight should be weaned at this time.

The mean weaning weight for doe fawns in New South Wales, over 6 seasons, was 18.7 kg (n=227), while the mean weaning weight of male fawns was 21.2 kg (n=231) (Mulley *et al* 1990).

There is still a degree of disagreement about the merits of pre-rut weaning, and it is probably true that the benefits are less when there is no shortage of high quality pasture on a farm in the autumn and early winter.

The potential benefits of the policy are as follows:

1. The females are relieved of the nutritional burden of lactation, with time for a stabilization of bodyweight well before the rut. This will enhance conception rates to the first service, with a concentration of fawns born in the early part of the fawning season. This will be especially so for the mothers of male fawns. Furthermore, fawn birthweights have been found to bear a direct relationship to the bodyweight of their dam at joining - being 10% of that bodyweight (Mulley et al 1990). This provides a very useful target for female bodyweights at this time, with the certainty that does under 35 kg will have small, non-viable fawns.

2. The fawns can be preferentially fed on conserved pasture or fodder crops, or on concentrates. This not only ensures a good growth rate from weaning to puberty at about 16 months of age, but also provides an opportunity to begin the training and quietening of the young deer which are fed as a group.

It is advisable to vaccinate fawns at weaning with their first dose of polyvalent clostridial vaccine (4 ml), and if necessary to administer an anthelmintic. If they have not been eartagged at birth then this is also done at weaning, and they are weighed to begin a record of their growth rate. The second dose of vaccine is given 4-6 weeks later.

Mating management

Fallow deer achieve very high conception rates, as long as they are in good condition at joining. Pre-rut weaning and preferential feeding are used to ensure that lactating does are at the best possible bodyweight by the middle of April.

The ratio of males to females at mating is generally around 1/25-30, but some deviation from this does not appear to reduce conception rates. If full pedigree information is required on fawns for selection purposes then single sire mating is used. Although male infertility is rare, it is sensible to use a "follower" buck after 6-8 weeks to ensure that no doe fails to conceive because of failure of the initial male.

All bucks should be withdrawn from the doe herd in the middle of June, so that no fawn is born after the end of January. Those which fail to conceive by that date because they are too small are best given a further year to grow to a good bodyweight for joining, when they are certain to conceive early in the following breeding season.

At the conclusion of the mating period the does can remain segregated in their mating groups or not, depending on the number of suitable fawning paddocks which are available. It must be emphasized that the feeding of the pregnant does requires some attention throughout the gestation, even though the most critical period may be the last trimester. About 70% of the birthweight of a lamb is gained during the final 30% (6 weeks) of gestation (Russel 1985), and it is likely that similar rates of fetal growth occur in the other ruminants, including deer. Serious underfeeding of pregnant females early in the gestation may produce low birthweight fawns, due to irreversible effects on placental development (Mellor 1983).

Male fallow deer

Consideration of the management of fallow bucks begins with an appreciation that their actual growth rates, under the conditions provided on the particular farm, must be as close as possible to their genetic potential for growth. The major emphasis should be on the birth of fawns as early in the season as possible, with the provision of optimal nutrition for lactating females - weaning weights are a direct reflection of mothering ability and milk production. A major weight peak occurs at 15-17 months of age, and fallow bucks which are weaned in March at weights of 22-25 kg should attain liveweights of 48-55 kg at 15 months of age. Fallow bucks do not reach their maximum adult bodyweight until their fifth year of life - by the end of summer this will usually be 90-105 kg.

Just as the period of peak demand for females occurs during their summer lactation, so the period of greatest demand for adult fallow bucks occurs after the autumn breeding season, in winter and spring. Bucks which are over 2 years of age suffer a considerable loss of bodyweight during the 6-8 weeks of the autumn rut. A loss of 20-30% of bodyweight is not uncommon, this being due almost entirely to the utilization of the fat reserves which have been accumulated in the previous summer months (Mulley 1989). It must be emphasized that this inevitable loss of bodyweight does not mean that the animals should not be offered high quality feed, particularly after the initial weeks of the rut have passed. It is essential to restrict the loss of weight to those initial weeks, and to at least hold bodyweights static until the early spring, when substantial compensatory growth begins to occur.

If this principle is not understood, the bucks will continue to lose weight into the winter, with the possibility of deaths from hypothermia and exposure if the weather becomes too inclement.

Antlers

The annual antler cycle plays a major role in determining management strategies, for both the growing deer destined for slaughter and for older breeding stock. If it is accepted that there is no place for full hard antlers on farmed deer, it becomes a matter of examining the options available for manipulating or preventing antler growth.

For slaughter bucks the alternatives begin at weaning, when a decision can be made on the animals which are to be retained for breeding - or at least weaning weights can be the first criterion used to select these deer, supplemented by later bodyweights and growth rates, and by any other selection criteria which may be perceived as desirable, such as temperament.

There is no saleable velvet antler from fallow bucks killed at 15-20 months, the age at which most are slaughtered for venison in Australia. The major consideration is that these young males become increasingly aggressive towards each other, particularly when confined in pens or vehicles, from the end of January. By then the antlers of these "spikers" are rubbed clean and hard, and they simply cannot be yarded for transport and slaughter without the risk of death or serious injury of some animals.

There are several solutions to this dilemma, beginning with the sale of bucks at 12 months of age, before the antler spikes are hard. This should ensure the production of bruise-free venison, but fails to take advantage of at least 2 months of summer growth. In addition, a lower price per kg is usually offered for bucks killed at 12 months of age, reflecting the relative abundance of deer made available at that time, compared to several months later when they are far more difficult to handle.

Unless young bucks are sold at 12 months of age, the hard spikes must be cut off, just above the coronet, as soon as velvet stripping begins in late January. This is readily achieved using large pruning shears, and no analgesia of the antlers is necessary. This procedure will reduce the risk of serious puncture wounds, but does not eliminate the risk of carcass bruising when these young bucks are confined for transport. This aggressive behaviour continues throughout the winter, almost up to the time the antler buttons are cast. If they have not been separated earlier, the yearling does should be drafted from the bucks when the spikes are cut.

The castration of fallow bucks is attracting increasing interest as a solution to the problem of producing bruise-free carcasses during the autumn and winter. Unlike their entire counterparts, bucks castrated at 4-6 months of age have no antlers, and exhibit no aggressive behaviour when yarded or confined.

The most widely adopted procedure has been to apply rubber ligatures to the scrotum at the time of the second clostridial vaccination, 6-8 weeks after weaning and the initial vaccination in March. This regime will ensure that there is no risk of tetanus following castration, and the young bucks are relatively easy to catch and hold for the procedure, compared to later in the year. If castration is adopted in this way, it forces a decision at an early age on those bucks which are to be retained as potential breeders, since obviously these are not castrated.

There is a modest weight penalty with castration, of the order of 10.2% of liveweight at 20 months (Mulley and English 1985). However, this must be measured against the ease of handling of the castrates and the freedom from losses due to bruising. In a much more detailed examination of the effects of castration on the growth and carcass composition of fallow bucks, Mulley (1989) found that castration resulted in a 6.8% reduction in liveweight and a 7.8% reduction in cold carcass weight at 17 months of age. The dressing percentage of both groups was 61%. The most interesting result was that castration significantly reduced the weight of the forequarter but did not change the weight of the hindquarter. Thus, there was no effect on the most valuable cuts of meat, and while producers may lose up to 2kg per carcass by castrating bucks, wholesalers lose nothing in terms of the actual "bone-in" weight of the major commercial cuts.

For adult breeding bucks there are several alternatives for removing or preventing full antler development prior to the onset of the breeding season.

The first option is to remove the antlers as soon as possible after velvet stripping begins, usually in late January. No form of analgesia is

required, the virtually hard antlers being removed with an embryotomy wire saw. The major disadvantage is that the heaviest and oldest bucks will already be aggressive when yarded, and there is a serious risk of injuries to both deer and handlers - this approach to antler removal has little to recommend it.

The most common procedure has been to remove the antlers from fallow bucks when they are in velvet, at a stage when they attract the highest price as velvet antler - this is about 45 days after casting. Given the use of appropriate analgesic techniques this is a perfectly humane procedure which produces a saleable product each year from breeding males (English 1984). Fallow bucks generally cut from 300 g to 600 g of A-grade velvet, and this low yield makes the third alternative, of surgical polling to prevent antler growth permanently, a very attractive proposition for the small number of breeding males which most deer farmers would have.

The polling of fallow bucks selected for breeding is best carried out at 5-7 months of age. It is a surgical procedure which must be carried out by a veterinarian, and is a once-only solution to the problem of antler removal. The extent to which polling is adopted will depend largely on velvet antler prices, and to a lesser extent on the personal preference of the farmer. Procedures for the chemical restraint and anesthesia of deer have been reviewed by English (1988).

Mating management

The breeding bucks should be run with the females for several weeks before the onset of the rut in late April. If pre-rut weaning is practiced then this is a convenient time to separate the does into their mating groups and to introduce the bucks.

As long as the adult bucks have only antler buttons (or have been polled), there is minimal risk of serious injury when aggression does occur. Often of greater consequence with hard buttons is the damage that bucks can inflict on fences when they fight across fencelines, and if it is not possible to separate mating groups by a laneway or paddock, it may be necessary to use electric outrigger wires to discourage such fights. Similarly, extensive damage may be done to shade trees unless these are protected in some way. These problems are much less with polled bucks.

Once mating is completed,and no later than mid June, the bucks are removed from the females and they can then be run as a group until velvet antler harvest. Given the importance of good feeding in these months, it is preferable to keep the adult bucks separate from the weaned males, to ensure that the older animals do not get most of the supplementary feed. It is essential that sufficient trough space be allotted to ensure that all deer in group do get access to feed.

Carcass quality

The third factor determining the profitability of a deer farm is the ability of the production system, from farm to abattoir and on to the consumer, to provide a carcass of the type required by the market. There is little point in achieving optimal reproductive performance in a herd, and

excellent growth rates in young deer, if the final product is not acceptable in the marketplace.

Carcass quality will depend on two quite separate factors;

a. The type of animal which is offered for slaughter

b. The way in which this animal is transported and killed, and the way in which the carcass is handled after slaughter.

The marketing strategies for venison have concentrated on the its gourmet "food of kings" image, and on the leanness of the meat compared to other red meats. There are sufficient data to support the latter claim- for example entire fallow bucks at 17 months of age are extremely lean, with dissectable connective tissue plus fat contributing 3.9% of total carcass weight (Mulley 1989). However, there are sufficient seasonal variations in carcass fatness in deer, especially older deer, to warrant some care in the selection of the type of animal and the time of year for slaughter. In particular, it is vital to determine the relative importance to the consumer of the tenderness of the meat versus the "game" flavour. It is clear in Australia that tenderness is of the utmost importance, and the price received by the farmer for his product has reflected this, with penalties for older, heavier carcasses. The premium fallow deer carcass in Australia is 25-34 kg, from a buck under 2 years old, but this may not be the case for other markets.

The manner in which deer are handled and transported can have a marked effect on carcass quality, as can the methods used to handle and treat the carcass. It is sufficient to say that fallow deer can be taken through to slaughter without problems, given good stockmanship and appropriate handling and transport facilities. The place that castrates have in the production of winter venison from fallow deer should not be overlooked.

HEALTH PROGRAMS

Fallow deer are hardy animals which have thrived in a wide range of climatic and geographic zones. When considering the health maintenance programs which are required for fallow deer farms, it cannot be stressed too strongly that most problems have had their basis in faulty management.

The species suffers from few infectious diseases of consequence if they are well fed, although there is a list of conditions which have been recorded in Australia - some of which have been the cause of severe losses to individual farmers (Mylrea and English 1990).

Diseases and parasites

The only preventive medicine procedure which is widely used in fallow deer in Australia is to vaccinate against the clostridial diseases, particularly enterotoxaemia due to Clostridium perfringens Type D, and tetanus. Adult females are vaccinated in late pregnancy (usually in September) to ensure that adequate passive immunity is conferred on fawns via the colostrum, with the fawns themselves being vaccinated at weaning in

March and again 4-6 weeks later. In all cases 4 ml of a polyvalent vaccine are used.

Necrobacillosis has been the cause of quite severe mortalities in young fawns, but it has occurred only sporadically. Deaths have occurred in unweaned and weaned fawns, with lesions in the mouth, intestines and central nervous system. There are anecdotal accounts of a commercial Fusobacterium necrophorum vaccine (FRA vaccine - Commonwealth Serum Labs - intended to prevent footrot in cattle) being effective on farms where the disease has occurred in fallow deer. Until more is known of the pathogenesis and predisposing factors involved in these deaths it is not possible to judge the place this vaccine may have in a mix of preventive measures.

Tuberculosis (TB) has not been a major problem to the Australian deer farming industry, unlike the situation in New Zealand and Great Britain. There has been one episode, in fallow deer in South Australia in 1986 (Robinson et al 1989). Given the obvious susceptibility of fallow deer to infection with Mycobacterium bovis, there needs to be a good system of meat inspection and traceback to farm of origin, to deal with any future cases. There is no compulsory TB testing program in Australia, and only South Australia has a compensation scheme now in place.

Helminthosis has emerged as a problem in some groups of weaned fallow fawns, with the tendency for the lower bodyweight members of large groups to acquire heavy burdens of abomasal nematodes. The most common parasite has been Spiculopteragia asymmetrica, and mortalities have occurred. Affected deer quickly lose weight and develop diarrhoea, with faecal egg counts (EPG) as high as 800, compared to the clinically unaffected larger fawns at less than 50 EPG. At necropsy, total worm counts have been as high as 4500. More information is required for precise management of this problem, but it has been possible to reduce further losses by a combination of anthelmintic treatments and preferential feeding of a higher level of concentrates to affected fawns. Initial studies have revealed very low efficacy with benzimadazole compounds, measured in terms of faecal egg reduction tests, but the avermectins have been more effective (Mylrea et al, in press). Light burdens of the lungworm Dictyocaulus viviparus and the tapeworm Moniezia expansa have also occurred in fallow deer fawns, but it does seem that the former causes fewer clinical problems in this species than it does in red deer. Tapeworms in large numbers may contribute to ill-thrift.

There are infectious diseases which are known to cause problems in farmed deer under stress, especially nutritional and weather stresses. The best examples of these in red deer are yersiniosis and malignant catarrhal fever (MCF), both of which have been major concerns in New Zealand. It is noteworthy that fallow deer are apparently much less susceptible to infection with Yersinia pseudotuberculosis than other species - the disease has occurred in Australia in red deer and chital deer (Jerrett et al 1990) and in rusa and rusa/sambar (C.unicolor) hybrids (English , unpublished). MCF has never been recorded in a fallow deer.

Health maintenance programs on fallow deer farms should concentrate on reducing or preventing environmental and social stresses, and above all on a soundly based feeding program.

CONCLUSION

Despite the increasing availability of red deer in Australia, the place of fallow deer in the national deer herd is assured. The species has demonstrated an ability to produce prime venison under a wide range of conditions, with generally fewer health problems than some other species. The presently adopted management strategies will no doubt undergo refinements as time goes on, especially when deer farming is pursued in other places and other climates. The current practices and techniques should provide a very good guide to those who seek to farm fallow deer, anywhere in the world. There is no reason why fallow deer will not achieve all that is expected of them, if a few simple rules are followed.

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