

ANTLER DEVELOPMENT AND HARVESTING

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Summary

- Antlers are deciduous bony structures arising annually from the frontal bone of the skull of male deer. The cycle of development is linked intimately with the annual cycle of testicular testosterone secretion.
- Commercial velvet antler removal is performed 40-45 days after casting to obtain "A" grade product. Yields range from 250 g (0.54 lb) from 2-year-olds to 500 g (1.1 lb) from 6-year-olds.
- Waste velvet antler removal, to ease handling management, is generally performed after the summer solstice (80-120 days after casting) to avoid nuisance regrowth.
- Polling of potential sire bucks is performed by cauterisation of the primordial pedicle at 5 months of age (25 kg or 55 lb liveweight).
- All velvet antler removal and polling necessitates the application of analgesia. However, hard antler lacks innervation and may be removed without analgesia.
- Management of full-antlered bucks requires special attention to reduce injury to other deer.

Introduction

Antlers are grown by the males of most deer species. They are temporary bony structures arising from specialised regions on the skull, the pedicles. They differ from horn in that they are regrown annually (in most species) and, in their mature state, are composed of inert bone (calcium phosphate) rather than keratin (ie. hair tissue).

Antlers serve a function in sexual display and territory defence, and their shape and size are determined by a number of environmental and genetical factors. Overall antler shape is species specific and genetically determined. Fallow deer differ from most other species in that their antlers are typically palmated (see Figure 7.1). In fact, this was the main reason for consigning fallow deer to a different genus (*Dama*) from red deer, Wapiti, etc (*Cervus*) even though they have many other similarities.

Harvesting of velvet antler from fallow deer is not of major economic significance in New Zealand and, in most farming operations, antlers are considered to be of nuisance value only. They are generally removed prior to the rut each year. Intact, or simply as hard buttons (ie. following velvet removal), antlers can lead to considerable management problems due to the aggressive nature of bucks during the breeding season. This chapter discusses the biology of antler development, commercial antler harvesting and other aspects of antler management.

The antler cycle

Fallow deer antlers are cast and regrown annually. Figure 7.1 illustrates the antler growth cycle of a mature fallow buck. Casting of old antlers (or buttons) occurs in late spring in response to a marked

reduction in testicular secretion of testosterone. At this time, the junction between the pedicle and the coronet (base of the antler - Figure 7.1) weakens due to the action of various enzymes, to the extent that the weight of the antler is often sufficient to cause separation. Both antlers are usually cast within a few days of each other. As buttons are considerably lighter than full antler, they frequently adhere to the pedicle for one or two weeks longer than is normal, even to the point where they eventually sit on top of newly growing antler tissue.

Generally, however, new antler tissue does not become apparent until 3-4 days after the old antlers have been cast. By day 7 from casting, the newly developing antler is apparent as a soft velvet swelling about 0.5-1.0 cm (0.2-0.4 inch) thick and by day 20 there is clear differentiation of the brow tine bud and the 4-5 cm (1.6-2.0 inches) long main beam. By about day 35, the tip of the 12-15 cm (4.8-6.0 inches) long main beam shows a distinct swelling that soon leads to the emergence of the trez tine (fallow deer generally lack a bez tine). The trez tine bud is fully apparent by day 50, and there is a pronounced flattened swelling occurring at the top of the main beam. Over the next 50 days, there is a rapid development of the palmation and further elongation of the brow and trez tines. By day 100 there is usually an indication of speller points (see Figure 7.1) differentiating on the rear and top edge of the palm. These spellers become fully differentiated by day 120. By this time, the brow and trez tines have reached their ultimate length, and mineralisation of the whole antler is progressing rapidly. Between days 120-140 the antler retains its velvet covering but there is little outward sign of growth. However, during this time, antler mineralisation is nearing completion due to the influence of increasing testicular secretion of testosterone.

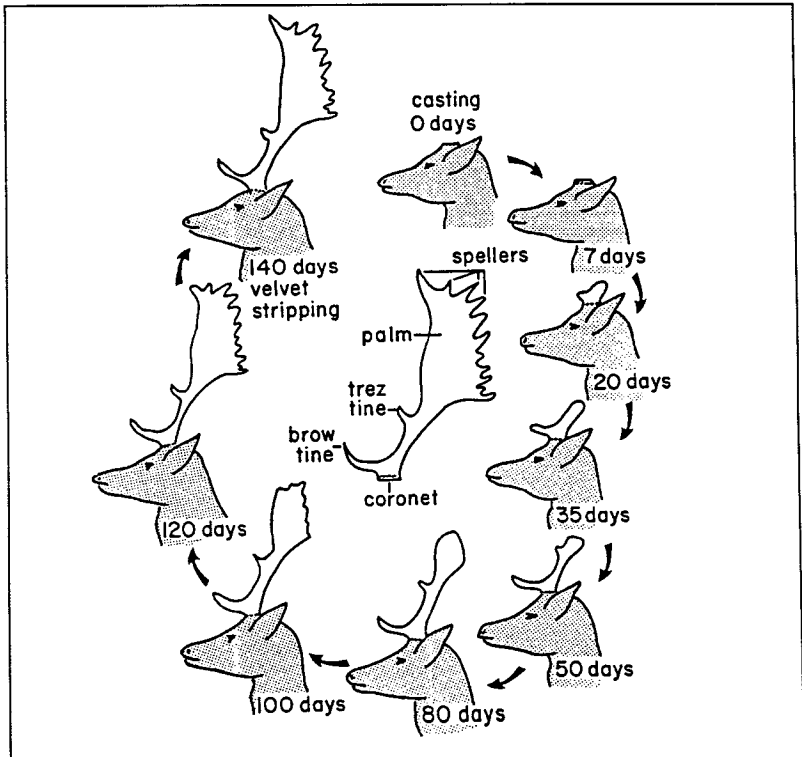


Figure 7.1: The antler growth cycle of mature fallow bucks.

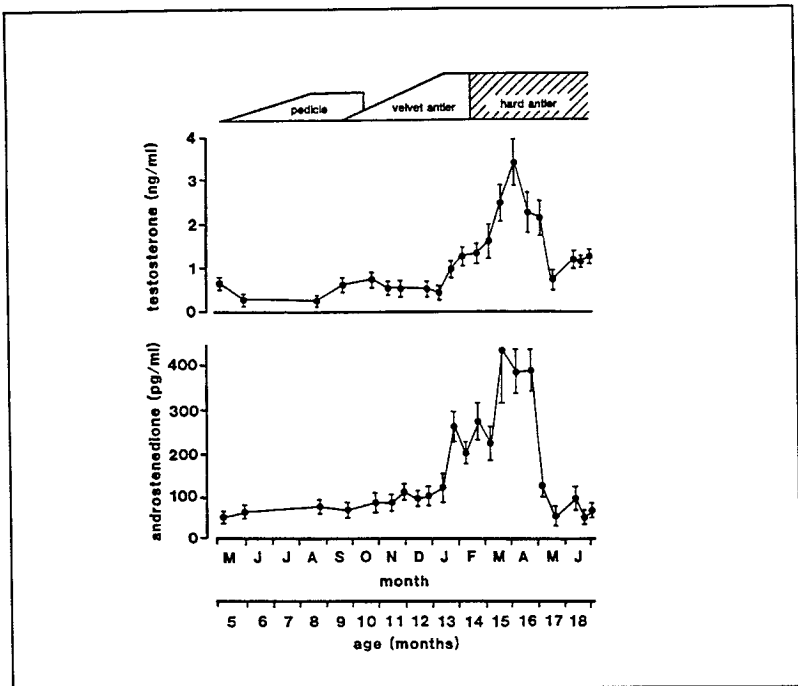


Figure 7.2: Schematic representation of pedicle and antler development of young fallow bucks in relation to actual changes in mean (\pm s.e.m.) plasma androgen concentrations between 5 and 18 months of age ($n=21$ bucks) (Asher 1986).

The outer velvet layer is stripped at about day 140 (late summer). The stripping occurs rapidly and is usually completed within two days. The mature antlers are retained throughout autumn and winter, to be cast again in the following spring.

Antler size generally increases in each successive year; starting from short (2-30 cm); 8.8-12 inches) unbranched spikes in the first year, to heavily palmated, multi-tined antlers by full maturity (8-12 years).

Development of first antlers

Pubertal development of fallow bucks occurs within the first 16 months of life. During the first winter and early spring (6-9 months), the gradual increase in testicular size is associated with increasing blood androgen (eg. testosterone) levels (Figure 7.2). This stimulates directly the growth and proliferation of primordial cells on the frontal bones of the skull, eventually resulting in the development of the pedicles between 6-8 months of age (Figure 7.2). The first antlers arise and grow from the mushroom-like pedicles at about 8-13 months. The eventual size of these antlers (spikes) is directly related to liveweight at 15-16 months of age. Bucks below 35 kg (77 lb) may develop spikes only 1-2 cm (0.4-0.8 inches) long, whereas 55 kg (120 lb) bucks may develop spikes up to 30 cm (12 inches) long.

Fallow spikers or "pricketts" generally strip the outer layer of velvet 2-3 weeks earlier than adult bucks.

Effects of castration

As testicular androgens are required for the initiation and development of pedicles in the first year, castration prior to puberty will invariably arrest pedicle growth and consequently prevent antler growth. Typically, prepubertally castrated bucks outwardly resemble does (apart from the obvious presence of the pizzle).

However, post-pubertal castration does not prevent antler growth. As pedicles are already fully developed by puberty, the effect of later castration is to cause precocious casting of any hard antler, due to the rapid decline in blood testosterone concentrations. In the absence of testosterone, the velvet antler will never completely mineralise; therefore the annual antler cycle is abolished. Typically, the velvet antler eventually forms an amorphous mass, often termed "peruke" antler. Administration of exogenous testosterone to post-pubertally castrated bucks causes rapid mineralisation of the antler, eventually leading to complete stripping of the outer velvet layer. However, the hardened antlers are cast once the testosterone is cleared from the blood stream, and the velvet antler will start to grow again.

Antler removal

For management reasons, antlers are normally removed from fallow bucks run on intensive farms. Some farmers argue that there is no place for full-antlered bucks on well managed deer farms. Indeed, one should be ever respectful of the damage that can be inflicted on other deer and handlers by an aggressive buck in full antler. Such aggressive behaviour becomes particularly apparent during yarding, when the instinctive response during the hard-antler phase (early autumn-late winter) is to re-establish dominance ranking by attacking surrounding animals. While this behaviour is not automatically negated by antler removal, it is certainly modified and potential damage reduced.

1. Velvet antler removal

If velvet antler is to be removed, either for commercial gain (ie. saleable velvet) or simply for ease of management, it must be done under humane conditions and veterinary supervision. For ethical and legal reasons, the animals must at the least receive local anaesthesia.

Saleable velvet is usually harvested in early summer, about 40-45 days after casting (see Figure 7.1). At this stage of development the trez tine has yet to differentiate from the main beam. Cut-velvet weights range from 250-500 g (0.5-1.1 lb) per buck but is seldom worth more than \$30-\$40/kg because of its small size. However, later-cut fallow velvet (ie. >50 days) is longer, but generally too mineralised to be of any value.

Because saleable velvet is cut at an early stage of development it is usual for regrowth to occur. Ideally this should also be removed before the bucks become aggressive in late summer/early autumn.

If velvet antler is to be removed-to-waste (ie. not for sale) it is preferable to remove it later in the season (ie. after the summer solstice) and at a later stage of growth (eg. 80-120 days) to decrease the incidence of regrowth. However, many handling systems have forms of restraint that are too narrow for bucks carrying wide racks of antler (eg. after 100 days of growth) and it may be necessary under these circumstances to cut velvet antler earlier.

Spikes from yearling bucks should be removed in mid-summer (early January in NZ). Earlier cutting will lead to considerable regrowth, requiring further cutting. If left too late, the bucks will be very aggressive towards each other. Remember that yearling bucks tend to harden their antlers 2-3 weeks earlier than mature bucks.

2. Commercial velvet yields

There has recently been serious consideration given to commercial velvet harvest from fallow deer bucks. This has been evident from the widespread use of sires of Danish and Hungarian origin, breeds reputed to have genetically superior antler production (see Chapter 8). The economic value of velvet antler production in this species has yet to be assessed. There is little doubt that returns to farmers will be related to the quality of the product harvested.

The first consideration is to prevent damage to velvet antler prior to, and during, its removal. The reactionary nature of fallow deer can lead to considerable antler damage during yarding. This is particularly evident if bucks are forced to enter narrow raceways and crushes/cradles. Some experts advocate the use of general anaesthesia/sedation rather than the physical restraint of crushes/cradles (Mulley & English, 1991). This generally involves hand delivery of injectable drugs while small groups of bucks are maintained within a darkened room. Further analgesia of the antler is effected by injection of lignocaine/xylocaine at sites around the pedicle.

More recently, a number of commercial operators have developed crushes/cradles with short, wide access ports. The devices themselves are usually wider than normal restraining devices used more routinely for other classes of stock. While such restraining devices eliminate the need for chemical immobilisation, it is still absolutely necessary to induce local antler analgesia.

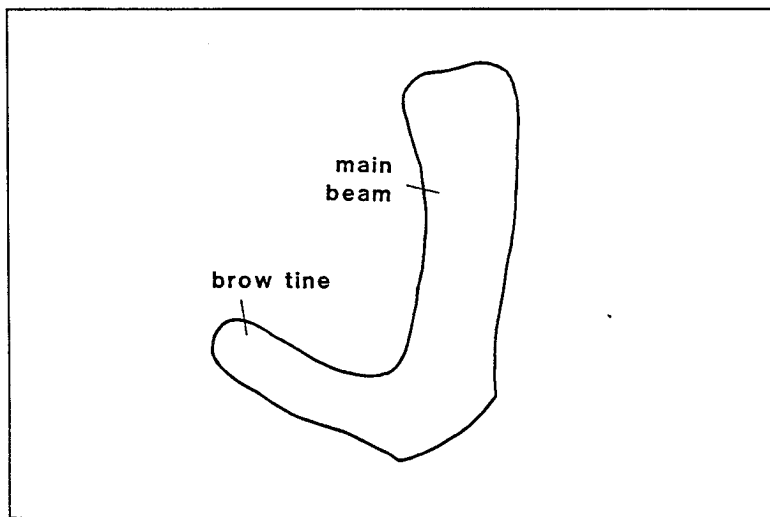


Figure 7.3: Diagrammatic representation of fallow deer velvet antler at the "A" grade stage (40-45 days post-casting).

Following the induction of local analgesia, each antler is cut 1-2 cm above the coronet using a surgical saw with teeth 1-2 mm in length. It is usual practice to apply a tourniquet below the coronet immediately before antler removal. The tourniquet is usually removed within 20 minutes of antler removal.

The criteria for "A" grade fallow deer velvet has recently been standardised for NZ and Australia, as indicated in Figure 7.3.

In a recent study in Australia by Mulley & English (1991), it was found that the weight of "A" grade velvet antler from fallow bucks increased annually until a peak at 6 years of age (Table 7.1). Velvet antler weight approximately doubled between 2 and 5 years of age. The mean length of time between antler casting and development of A grade velvet for fallow bucks was 45 ± 3 days (\pm s.d.)

Table 7.1: The mean (\pm s.d.) weight and length of velvet antler harvested from fallow bucks of known age (Mulley & English, 1991).

Age (years)	No. of bucks	Antler weight	Antler length
2	110	246 \pm 50 g (0.54 lb)	13.4 \pm 2.6 cm (5.4 \pm 1.0 inches)
3	35	282 \pm 64 g (0.62 lb)	14.2 \pm 2.1 cm (5.7 \pm 0.8 inches)
4	25	365 \pm 54 g (0.80 lb)	14.1 \pm 1.9 cm (5.6 \pm 0.8 inches)
5	32	445 \pm 82 g (0.98 lb)	16.4 \pm 1.0 cm (6.6 \pm 0.4 inches)
6	15	486 \pm 72 g (1.07 lb)	16.3 \pm 0.5 cm (6.5 \pm 0.2 inches)
7	5	365 \pm 43 g (0.80 lb)	12.7 \pm 0.8 cm (5.1 \pm 0.3 inches)
8	5	333 \pm 36 g (0.73 lb)	-

During this study 27/227 (11.9%) of deer handled through the yards for velvet antler removal had damaged antlers as a result of yarding. Of deer with damaged antlers, 4/27 (14.8%) had damaged both antlers. Most of the antlers damaged during handling of bucks were from 2-year-old animals. These bucks are usually more nervous because of their relative lack of habituation to the process of yarding compared with older bucks.

The data in Table 7.1 indicate that the average age of fallow bucks in herds developed for velvet production should be 5 years to achieve a sustained maximum harvest and to allow for development of replacement animals before the rapid fall-off in velvet antler yield after 6 years (Mulley & English, 1991).

Several factors will influence the decision as to whether fallow bucks are useful commercially for velvet production. The costs of maintaining fallow bucks to older ages, the reduced value of venison from older animals as culls, and the low yield of velvet from fallow deer compared with red deer require the value of velvet antler to remain high and stable if large herds of bucks are to be maintained for velvet antler production.

3. Pedicle removal

On some fallow deer farms in New Zealand, it has become common practice to remove both pedicles and antlers from yearling bucks that are destined to be sent to the deer slaughter premise (DSP). This involved cutting flush with the skull; such that no projections remain. It must be stressed that this also should be performed under local analgesia, as with all forms of velvet antler removal. It is generally performed in mid summer and is very effective in preventing fighting injuries during yarding and transportation. While the bucks will show no sign of pedicle/antler tissue up to 20 months of age, pedicle removal at 12-13 months of age will not prevent antler growth in subsequent years. In fact, bucks can grow apparently normal antler 2 years after this form of pedicle removal.

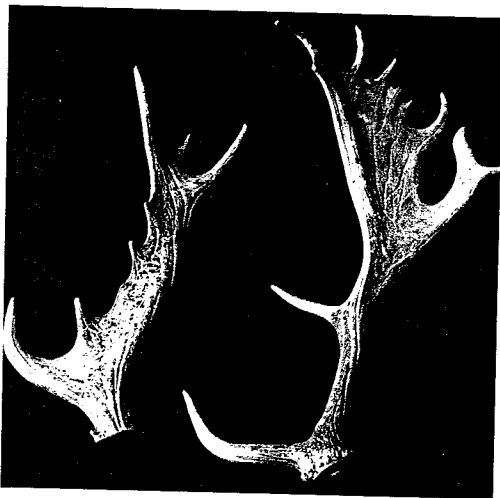


Plate 7.1: Antlers from a European fallow deer (right) and a Mesopotamian fallow deer (left). Note the different degree of palmation and emphasis on the brow tine.



Plate 7.2: A mature fallow deer buck 40 days from antler casting. This represents the optimum time for commercial velvet antler removal.

However, the first subsequent crop of antler (ie. 1 year after pedicle removal) is often misshapen. Clearly, it is difficult to obliterate all pedicle tissue at 12-13 months of age, and they are capable of regeneration.

4. Hard-antler removal

Hard antler is non-living tissue and can be removed humanely without recourse to analgesia. However, bucks in hard antler are very aggressive towards other deer, particularly when being yarded. It is often preferable to have a veterinarian remove velvet antler in summer than to attempt to yard hard-antlered bucks 2-3 months later.

Polling to inhibit antler growth

While removal of pedicles at 12-13 months of age does not inhibit subsequent antler growth, "polling" bucks as weaners (ie. cauterising the primordial pedicles with an electric disbudding iron) appears to inhibit completely and permanently growth of both pedicles and antlers in most individuals. The success of the procedure depends upon the degree of primordial tissue (periosteum) destruction, and this is achieved with considerably less trauma on five-month-old bucks (at approximately 25 kg or 55 lb liveweight) for which pedicle primordia are palpable but not necessarily visible, than for older bucks with clearly visible pedicles. Furthermore, as most weaner bucks will eventually be slaughtered before the onset of aggressive behaviour at 14-15 months of age, only those weaners intended for use as sires need to be treated. It is likely that the top 20% of weaner bucks (in terms of liveweight or any other selection criteria) can be selected at or close to weaning. These are the animals that should be kept as potential sires and are the likely candidates for polling.

The polling procedure, outlined below, is intended for use by veterinarians as it is a reasonably skilled operation that, for ethical reasons, requires the use of local anaesthetics.

The polling procedure

- : draft individual bucks for polling at 5 months of age or at 25 kg (55 lb) liveweight.
- : pre-heat the disbudding iron (mains electric or battery operated calf disbudding iron with a 2 cm (0.8 inch) diameter concave cutting disc).
- : clip the hair covering the pedicle site to highlight the primordial pedicles.
- : administer a local anaesthetic to the general region of both primordial pedicles.
- : after allowing time for local analgesia to take effect, place the concave disc of the hot disbudding iron directly over each of the pedicles in turn; apply pressure while rotating the disc slightly and remove the resulting wad of skin to expose the bony structure of the developing pedicle.
- : with the cutting edge of the disc, remove the bony pedicle structure flush with, or even slightly below the level of, the frontal bone, making sure to cut away from the animal's eye.
- : complete the operation by cauterising the general area over a 1.5 cm (0.6 inch) radius. It is important to eliminate all primordial pedicle tissue at this stage, otherwise small antlers may develop later in life.
- : no further treatment is required, however, it may be wise to vaccinate fawns against clostridial diseases several weeks prior to treatment.

Polled bucks have been used as sires on the Ruakura Agricultural Centre for the last five breeding seasons. Trials have been conducted in which does and polled bucks have been yarded together up to 80 times during the mating period. During mustering and yarding the bucks did not exhibit aggression towards the does. Needless to say, the successful outcome of these trials was partly dependent upon the ability to yard deer frequently without aggression related problems.

However, polling does not completely inhibit aggression in fallow bucks. Rival polled sires will frequently fight during the rut if they share close territorial boundaries. Furthermore, adult polled bucks in bachelor groups also will have sparring matches during the autumn and winter months. The head to head confrontation of two polled bucks is an amusing spectacle to observe, as the forward momentum often causes one buck to complete straddle its opponent in the absence of locking antlers.

Frequent sparring generally results in little more than temporary, partial baldness. However, some deaths were experienced in a bachelor group of polled bucks that were directly attributable to fighting in the paddock even though they showed little aggression when yarded together. This problem was alleviated by breaking down the bachelor herd structure into buck pairs (in the absence of a large, broken paddock on the Ruakura Deer Unit) for the remainder of winter, as it appeared that groups of bucks were "ganging up" on individuals. This was probably induced by a high stocking rate within small (0.25 ha or 0.5 acre) paddocks, and the fact that all the bucks were of the same age and approximate liveweight, leading to a fragile hierarchal structure. It is highly likely that, given the same conditions, the same problem would have occurred with antlered and velveted bucks.

Single-sire mating of small (<35) numbers of does in each group is probably preferable to multi-sire mating with larger groups of does. Regardless of antler status, this tends to reduce valuable energy being lost defending territories. Also it ensures that top bucks (ie. selected by merit) do actually service does and sire offspring. If multi-sire mating is practised, ensure that each buck has an adequate area for maintaining a defendable territory that does not overlap with that of other bucks. Never run polled and antlered bucks together, especially during the rut. The antlered bucks will always dominate over the polled bucks, and will suppress rutting activity.

If bucks (polled or antlered) are to be removed from mating groups at the end of the main rutting period, maintain them in loose bachelor herds; do not force them into high density herds over winter. It may be pertinent to overwinter them in large broken (eg. some bush cover) paddocks. However, still provide high quality feed, as their body reserves of fat are depleted after the rut.

Present experience indicates that yarding of does in the presence of a polled sire buck presents few problems. However, if a particular buck becomes unusually aggressive it may be wise to eliminate him as a future sire prospect. Even so, it is unlikely than an aggressive polled buck will do as much damage as a buck bearing antlers or vestiges of antlers.

Polling is not the complete answer to eliminating buck aggression problems on the farm. However, it may go a long way to reducing stock injuries during yarding, and as such deserves at least some consideration as a management tool. The success of the technique in permanently eliminating antler growth has yet to be fully evaluated but present indications are that, providing the operation is performed properly, antler growth is eliminated until at least four years of age. If the practice is to be adopted, the polling operation should be performed under veterinary supervision and will be no worse than velvet antler removal.

References

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- Mulley, R.C. and English, A.W. (1991). Velvet antler harvesting from fallow deer *Dama dama*. *Australian Veterinary Journal*, 68(9): 309-311.