ADVANCED CALVING IN DEER : PRACTICAL ASPECTS

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1. INTRODUCTION

Considerable research effort, both in the UK and New Zealand, has been devoted to establishing practical and reliable techniques for advanced calving in farmed deer. There are several potential techniques for this purpose, and these have been reviewed extensively in previous Deer Branch Course Proceedings (Nos. 2-5).

This paper reviews briefly the techniques available for advanced calving and then discusses many of the practical and husbandry aspects of advanced calving. Further results of recent trial work are also presented.

2. TECHNIQUES FOR ADVANCING OESTRUS

2.1 Progesterone/PMSG

The use of intravaginal slow release progesterone devices (usually CIDRs), followed by parenteral administration of PMSG has proven to be a reasonably reliable technique for advanced calving (Asher, 1985; Bringans and Lawrence, 1988; Fennessy and Fisher, 1988; Fennessy *et al*, 1986; Fisher and Fennessy 1987; Fisher *et al*, 1986; Moore and Cowie 1986). This technique also results in synchronisation if intravaginal devices are removed at the same time This can create stag management problems if large numbers of deer are to be advanced at once. Not all deer respond to this regime, and pregnancy rates to induced oestrus appear to be lower than those achieved with natural oestrus. However, this technique has some advantages. It can be applied at short notice, the date of onset of oestrus is predictable and it is a simple procedure to follow. The costs will vary depending on the size of animal, numbers of animals, mileage etc., but would approximate $13-$17 per deer. The number of days advancement should not exceed the stag's physiological capability to perform fertile service. Hinds which do not conceive to the induced oestrus usually conceive to subsequent natural oestrus.

2.2 Progesterone/gonadotropin-releasing hormone (Gn RH)

This technique has been described by Asher (1985) and Duckworth and Barrell (1988). The releasing hormone was given by infusion and is therefore not a practical procedure to perform on farms. Furthermore, while the ovulation rate was satisfactory few hinds expressed oestrus and therefore few hinds became pregnant. There is recent anecdotal evidence to suggest that Gn RH injection with PMSG may enhance ovulation rate and/or synchrony of oestrus.

2.3 Melatonin - oral

Several authors report administration of melatonin mixed with concentrate supplementary feeds (Adam 1985; Adam *et al*, 1984; Adam and Atkinson 1986, Fennessy *et al*, 1986). Melatonin is given late afternoon, usually commencing prior to the summer daylight solstice. Success depends on consumption of supplementary feed by all animals, and this rarely occurs. Feed needs to be supplied at a given time each day, and at that time of the year supplementary feeding on most deer farms is not carried out. Therefore for management reasons oral melatonin is not a suitable option in most situations.

2.4 Melatonin implants

The recent manufacture of subcutaneous melatonin implants ("Regulin", Regulin Ltd , Australia) has given rise to intensive investigation of the effectiveness of this product in the research and field environments (Asher *et al*, 1988; Fennessy and Fisher 1988; Fennessy *et al*, 1986; Fisher *et al*, 1988; Fisher and Fennessy 1987; Wilson *et al*, 1988). This product has the advantage of being simple to administer and from trial work appears reasonably successful. To date this product is licensed as a veterinary-only product for use in deer in New Zealand and probably will be commercially available for the 1989 season. Therefore its cost to the farmer is unknown at the time of writing.

The main disadvantage of implants is the need to repeat treatments at 30-day intervals for three treatments. It is currently licenced only for yearling deer. Difficulties are experienced with some stags with the last treatment as they are sometimes rutting by that stage.

2.5 Dark-light manipulation

Housing deer indoors under artificial lighting regimes can be used to manipulate the onset of the breeding season. However, this is unlikely to be a feasible option for farmed deer in New Zealand.

2.6 Stag effect

2.6.1 Roaring

McComb (1987) found that oestrus in hinds could be advanced by exposure to the roaring noise of stags which was broadcast through a speaker and amplifier system. Presumably, therefore, stags which commence to roar early may influence the onset of oestrus in hinds. This effect appeared to be approximately 6-10 days.

2.6.2 Presence of the stag

Moore and Cowie (1986) reported that exposure to a vasectomized stag for approximately 15 days before the onset of a normal rut resulted in an advance in the onset of oestrus by approximately 6 days. Wilson *et al*, (1988) observed advancement of conception date in hinds that had been exposed to rutting stags in association with melatonin-treated advanced hinds In that situation there were differences between stag groups in the degree of advancement in untreated hinds. This suggested a stag effect. Furthermore, Fennessy and Fisher (1988) made similar observations using melatonin-treated and untreated control hinds.

The effect of both treated vasectomized and treated entire stags on the advancement of oestrus is currently the subject of an extensive study by the author

2.7 Plane of nutrition/hind condition

Loudon *et al*, (1983) observed that the onset of oestrus in hinds which were on a high plane of nutrition was earlier than that of hinds on the low plane of nutrition Mitchell and Lincoln (1973) reported earlier conception in deer in good body condition than in those in poor condition. These authors also proposed that body condition accounted for year-to-year fluctuations in timing of onset of the breeding season This has important implications for the deer farmer, as it is likely that hinds which are in good condition and on a high plane of nutrition prior to and during the rut will generally conceive earlier than those on a low plane of nutrition, or those in poor condition.

2.8 Weaning date/lactation

Guiness *et al*, (1978) observed that hinds not rearing a calf conceived on average 7 days earlier than those which were rearing a calf. Furthermore, Clutton-Brock *et al*, (1981) observed that hinds rearing a male calf conceived on average 11 days later than hinds rearing a female calf, suggesting that the higher lactation required for male calves delayed the onset of oestrus. Loudon *et al*, (1983) observed higher prolactin levels in hinds that had been suckled more frequently as a result of a low plane of nutrition and suggested this as a mechanism for the "lactation anoestrus" effect. I am not aware of any experimentation in this country to investigate the effects of early weaning *versus* late weaning, but it is probable, given the above, that weaned hinds would conceive earlier than lactating hinds. This certainly has been the practical observation of many farmers.

2.9 "Sympathetic" oestrus

There is a suggestion that by the advancement of oestrus in part of a herd using melatonin or progesterone/PMSG will cause a number of in-contact hinds to come into oestrus earlier in synchrony with the hormonally advanced ones This may be possible but evidence for this effect has been compounded by the presence of a stag, and therefore the "hind-on-hind" effect cannot be distinguished from a "stag-on-hind" effect. Further work needs to be done to confirm this effect, as it has important implications for advanced calving methods.

2.10 Combinations

For practical management purposes a farmer should pay particular attention to feeding level pre- and during the rut, and to early weaning If data proves the stag effect this, too, would be a cost-effective method of advancing oestrus. However, the advances using these techniques in combination probably will not match those achievable by hormonal manipulation. The cost-effectiveness of each procedure or combination is also an important consideration.

3. RATIONALE FOR AND ADVANTAGES OF ADVANCED CALVING

3.1 Feed supply and demand

Feed demand for lactation is more than double that for maintenance. To achieve that level of intake both quantity and quality are important The pasture production pattern for most parts of New Zealand is for a peak to occur late October to early December. After the peak of pasture production, if pasture control is not adequate seed-head formation occurs and pasture quality drops. Furthermore, in many areas of New Zealand moisture is limiting to pasture production during January and February, and therefore growth rate and quality diminishes drastically. Therefore in many areas feed deficits arise during February and early weaning and supplementary feeding is necessary. The latter is a costly process but failure to do so results in poor weaner growth and poor pre-mating hind bodyweights.

Compare the season for parturition in deer with that of cattle and sheep. In the latter the dam is increasing lactation in synchrony with increased pasture production and high pasture quality. Therefore, to better fit the feed supply and demand curves for deer farming, advanced calving would be advantageous for feed management and subsequent animal performance.

The following graphs (Fig 1) outline the effect of advancement of calving by 30 days in matching the feed supply and demand pattern in the Manawatu.

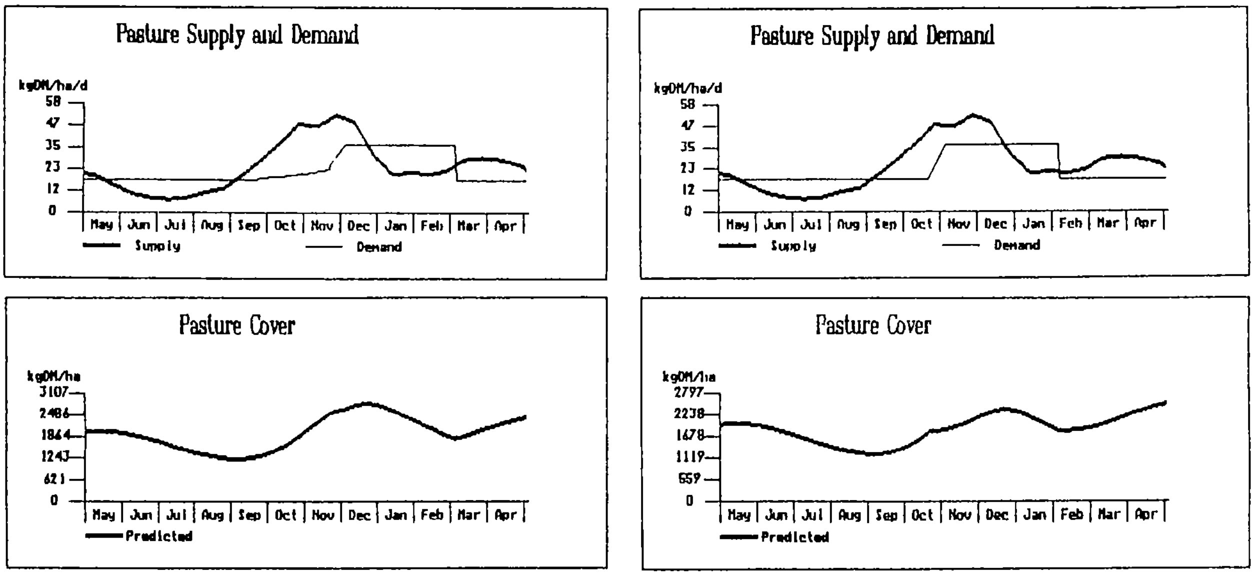

Fig. 1. Pasture feed supply and demand patterns (top) for normal calving and weaning dates (left) and for calving and weaning advanced 30 days (right), and corresponding pasture cover patterns (bottom). This computer prediction model pattern was calculated for 10 hinds/ha, 100% calving, and for a pasture growth pattern based on Manawatu data.

Note: the relevance of advanced calving to match feed supply and demand should be considered on a district-to-district basis, as the pasture production curves vary considerably between regions of the country.

3.2 Venison production and profitability

The northern hemisphere venison markets prefer a product for winter consumption Chilled product is increasing in popularity To supply the market, exporters require a product of the appropriate size (e.g. 50 kg carcase or better) from mid-August to about Christmas. To encourage this the schedule fluctuates as demonstrated in the following diagram:

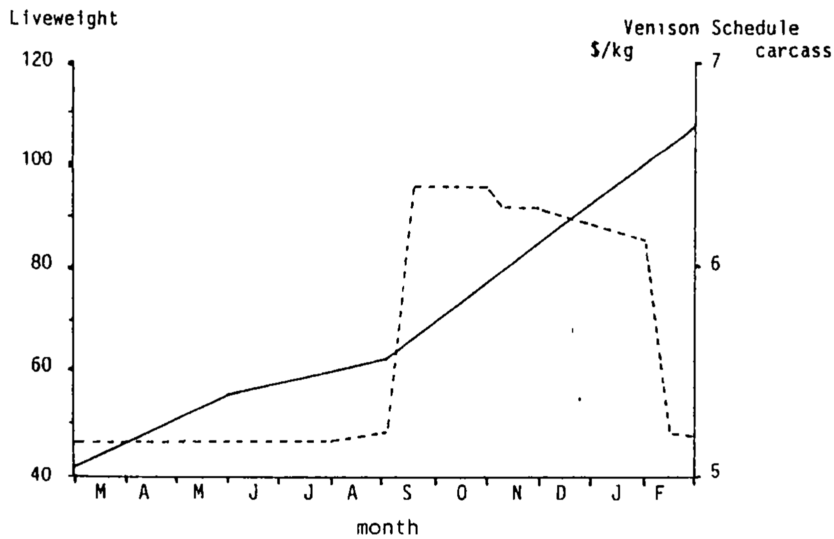

Fig. 2 Venison schedule fluctuation (---) (1987-88) and typical body weight gain curve (——) for red stags to 15 months, demonstrating the mis-match between optimum carcass production (15 months) and venison schedule at that time.

In order to achieve the desired carcase weight at the peak venison schedule the farmer must choose between supply of animals for slaughter at less than 12 months of age, or wait for another 8 months before the next schedule peak, in this instance for a larger carcase The financial gross margins for either 12-month or 24-month venison production depends somewhat on the price and demand for 2-year-old velvet However, it seems reasonable to predict that more and more farmers will opt for the less than 12-month-old venison option.

The growth pattern for young red stags is superimposed on the above graph. If calving is advanced 30 days, weaning weights are up to 10 kg heavier, and it is anticipated that yearling liveweights will be approximately 6 kg heavier This allows the farmer to achieve both a heavier bodyweight and a higher proportion of stock available for slaughter before the schedule price drops. Remember - the schedule price-drop in January can result in an overnight reduction of value ofup to $50 for a 50 kg carcase.

3.2.1 Achieving 12-month venison production

There are six major options available to the farmer to achieve the desired weights for slaughter of young deer from August to December:

(i) Fast growing species -
The Wapiti-type has a clear advantage in this respect used either as a pure-bred or terminal sire over red deer. The latter is biologically the most efficient (Fennessy and Thompson 1989).

(ii) Within-breed genetic selection -
Selection of both dams and sires for superior bodyweight gain. Up to 12 kg mean yearling liveweight difference has been observed between offspring of different sires (Wilson, unpublished).

(ii) Feed -
In general a check in feed at any time between birth and slaughter will result in a reduction in carcase weight and therefore financial return per carcase. Therefore feed quantity and quality are critical. Research is under way to determine the most appropriate feed and feeding regimes for growing deer.

(iv) Advanced calving -
On average, red stag progeny of melatonin treated yearling hinds at weaning weigh 312 gms heavier for each day earlier birth (Wilson, unpublished). However, this bodyweight difference at weaning diminishes as the deer approaches its ultimate bodyweight, i.e. as it

ages toward maturity (Pearse 1988). Therefore it is likely that the effect of advanced calving for heavy venison production is more critical for less than 12-month venison carcases than for 2-year venison production. Considerably more research is necessary to examine the relationship between birth date and timing of optimum slaughter weight. This, of course, is critical to the financial success of advanced calving regimes.

(v) Growth promotion -
The apparent reduction in food intake in young growing stags appears to be under photoperiodic control. Studies are under way to attempt to manipulate growth by altering factors that affect food intake. Another method for growth promotion is the use of hormonal growth promotants However, the latter is not an acceptable farming practice given the requirements of our major markets.

(vi) Combinations of the above five factors -
e.g. a farmer may select hinds on the basis of weight-gain of progeny, use Wapiti-X terminal sires, implement winter and spring feeding programmes which accelerate growth, in combination with advanced calving.

3.3 Weaning stress

Pearse (1988) produced data which indicated that the bodyweight check associated with weaning is felt to a lesser extent in heavier (earlier born) calves than in light-weight (later born) calves.

3.4 Sale of weaners

There is an advantage to the farmer producing deer for the weaner market. Weaner stags are currently sold on a bodyweight basis, e.g. $4 kg/liveweight is the present figure (1989). Therefore a calf born 30 days earlier and weighing 9.8 kg heavier will yield an extra $39.24 to the farmer. A similar calculation can be made for female weaners depending on the price based on 287 gms/day earlier calved (Wilson, unpublished).

3.5 Lactation anoestrus

This effect has been considered in section 2.8 above. Early weaning possible as a result of advanced calving should help reduce this effect, but is relevant only if advanced oestrus is not desired for that breeding season.

3.6 Velvet production

More research needs to be conducted to determine the effect of melatonin treatment of stags as sires for advanced hinds on their subsequent velvet production. In some instances advanced stags undergo a second antler growth cycle and produce two crops of saleable velvet Other advanced stags have had a normal velvet growth and production cycle.

Pearse (1988) reported a syndrome known as "Bolters" which are stags which reach approximately 70 kg or more in their first autumn and grow two sets of antlers in their first 12 months, producing the equivalent of a two year head at 12 months of age While such animals are not common, particularly offspring of 2-year-old hinds, this could be of advantage if velvet demand and prices remain high.

4. OTHER CONSIDERATIONS

While there are many positive aspects of advanced calving all implications of this technology must be considered before it is implemented on a given property.

4.1 Cost-effectiveness

To date the cost-effectiveness of the various methods of advancing calving have not been critically evaluated, because more production data is needed from the offspring of advanced hinds. Further, the cost of some treatments (e.g. "Regulin") is not yet known. Financial returns will vary depending on the farmer's objective, eg. weaner sales, 12-month venison, 24-month venison.

4.2 Labour

For melatonin the present technique requires mustering on three occasions for implantation. Labour, therefore, becomes a cost to the exercise.

4.3 Calving spread

Data from field trials conducted by the author indicate that melatonin treatment of hinds results in a spread of the calving pattern in most cases. Therefore management at calving is improved by dividing the herd into early- and late- calving mobs. While the technique for determining stage of pregnancy using ultrasound is now well-established (Bingham *et al,* 1988; Revol and Wilson 1989), there is an added cost to the farmer.

4.4 Stag management

Stags rutting in February, i.e. generally the hottest month, require special care with the provision of shade, shelter and water, to avoid heat stress Further, often stags are in full rut prior to the application of the third melatonin treatment, and this can result in problems for administration.

4.5 Age of hind

Currently melatonin is licensed only for use in yearling hinds There are management problems for most farmers in mustering older hinds with calves at foot Therefore melatonin presently is suitably for widespread use only in yearling hinds Furthermore, Asher *et al,* (1988) showed that treatment of hinds prior to calving resulted in an inhibition of lactogenesis, and therefore interference with the survival of offspring. Thus, if the commercially available melatonin product were to be used in mixed-age hinds, it could only be on those which have already calved. However, in the future advancements in drug administration technology may result in a product which can be given in a delayed release form to overcome this problem.

4.6 Weather

New-born deer appear to be sensitive to cold. Therefore the optimum degree of advanced calving will vary between different regions of New Zealand. There is little point in having hinds calving in October, only to lose them following predictable late October inclement weather.

4.7 Pasture conservation

Many farmers make silage and calve hinds on high-quality silage aftermath. If all hinds on the property were set-stocked from mid/late October, difficulty would be experienced with silage-making. Adjustments in calving management would be needed.

4.8 Feed intake

Heavier animals require higher food intake. This is particularly important during times of feed deficit, e.g. winter, therefore farmers contemplating early calving must budget for higher feed requirements for the weaners in the following winter.

4.9 Behaviour

Pearse (1988) indicated that some early-born calves developed untoward behaviour as yearling stags. Such aggressive behaviour complicates handing and management, and increases the potential for carcase damage as stags are shipped for slaughter.

4.10 Coat changes

The farmer contemplating advanced calving with melatonin should be alerted to earlier seasonal coat changes; e.g. in trial work winter coat has appeared in many hinds as early as late January To date changes in pelage have not been recognised as causing management problems.

4.11 Perception of hormone usage

Many questions have been raised within New Zealand about the use of hormones in deer production. The response of our markets to hormonal induction of early oestrus is not yet known. However, melatonin treated animals would not be going to slaughter. Furthermore, daytime blood melatonin levels approximate normal nighttime levels, and therefore residues would probably be indistinguishable anyway, e g. the carcase of an untreated animal slaughtered at night would have approximately the same melatonin content as the carcase of a treated deer slaughtered during the day

4.12 Stag management

Both treated and untreated stags are necessary. One instance where a melatonin-treated stag was not replaced partway through the rut resulted in a considerable reduction in calving percentage in late-oestrous hinds. It appeared that the stag "lost steam" as the rut progressed, therefore hinds coming into oestrus late did not conceive. This requirement may mean that a higher number of stags needs to be kept for mating purpose on some properties.

A further question arises as to the real necessity to treat stags for advanced hinds This probably will depend on the degree of advancement desired. More research is needed to determine the date of achievement of optimum fertility of untreated *versus* treated stags.

4.13. Stag joining and removal dates

Melatonin treatment regimes commencing late November/early December have resulted in conceptions as early as February 24 (calving October 15). Such early calvings may not be desirable but the farmer could select the desired date of onset of calving and introduce the stag on the appropriate date This would have the effect of concentrating the calving pattern by preventing the outlyer earlier calves. Stag withdrawal at the end of the rut should be undertaken at the usual time for untreated hinds.

5. THEORETICAL OPTIMUM REGIME

Given the difficulty in treatment of lactating hinds and the labour associated with the three-treatment regime, the optimum melatonin product will be one which can be given by simple administration (e.g. oral or subcutaneous), which has a delayed onset of hormone release; i.e. so hinds could be treated prior to calving and treated only once, and which would release melatonin for a period in excess of 90 days.

Such a product is not yet available.

6. RESULTS OF FIELD TRIAL WORK 1987-89

Preliminary results based on ultrasound age predictions were published in the 1988 Deer Branch Course Proceedings (Wilson *et al*, 1988). The following data is based on the actual calving dates and other observations. (*NOTE: predicted median calving dates were 0, 0, 0, 0, 1 and 4 days different from actual median calving dates for 6 groups recorded*).

Table 1 **Summary of results of advanced calving using "Regulin" implants in yearling hinds.**

	FARM 1	FARM 2	FARM 3 A	FARM 3 B	FARM 4	FARM 5
No. Hinds	**46**	**56**	**53**	**52**	**60**	**44**
Treatment dates	27.11 87 23.12.87 21.1.88	16.12.87 18 1.88 23.2.88	3.12.87 5.1.88 9.2.88		3.12.87 5.1.88 10 2.88	27 11.87 23.12 87 23.1.88
Calving %						
treated	91.3	92.8	100	92	100	95
control	81.8	92.8	96	96	100	64
First calf born						
treated	29.10.88	6.11.88	27.10.88	15.10.88	22.10.88	27 10 88
control	1.11.88	24.11.88	23.11.88	10.11.88	13.11 88	26 11.88
Last calf born						
treated	14.12.88	7.1.89	8.12.88	10.12.88	8.12.88	26.11 88
control	8.1.89	12.1.89	NR	NR	NR	27.12 88
Advance of median calving date in treated hinds (days)	18	23	22	15	12	36

NR = Not recorded but calved after 24 12.88

6.1 Median calving date advance

Data in figure 3 shows typical calving patterns for normal calving 2 y o hinds (1986 and 1987), and those induced with melatonin and those in-contact with melatonin-induced hinds (1988).

In this trial (Table 1) the advance in median calving date ranged from 12-36 days. It should be noted, however, that in all groups treated hinds were mated in the same groups as untreated hinds, and a number of those hinds calved considerably earlier than normally anticipated, e.g. as early as November 1. On one property the median calving date for first-calving hinds in previous years ranged from December 6 to December 15, whereas two untreated control groups on that property mated in conjunction with treated hinds had median calving dates of December 2 and November 19. This represents on average an advancement of between 4 and 25 days over previous years in untreated deer on that property, and an advance of 32-41 days in treated hinds. It is therefore likely that the real advance achievable using melatonin and the regime's use in this trial would result in excess of 30 days advance in median calving date.

6.2 Calving performance

In general the conception and weaning rates were within the normal range. In three of the ten groups studied conception rate was 100%, and in one group weaning was 100%

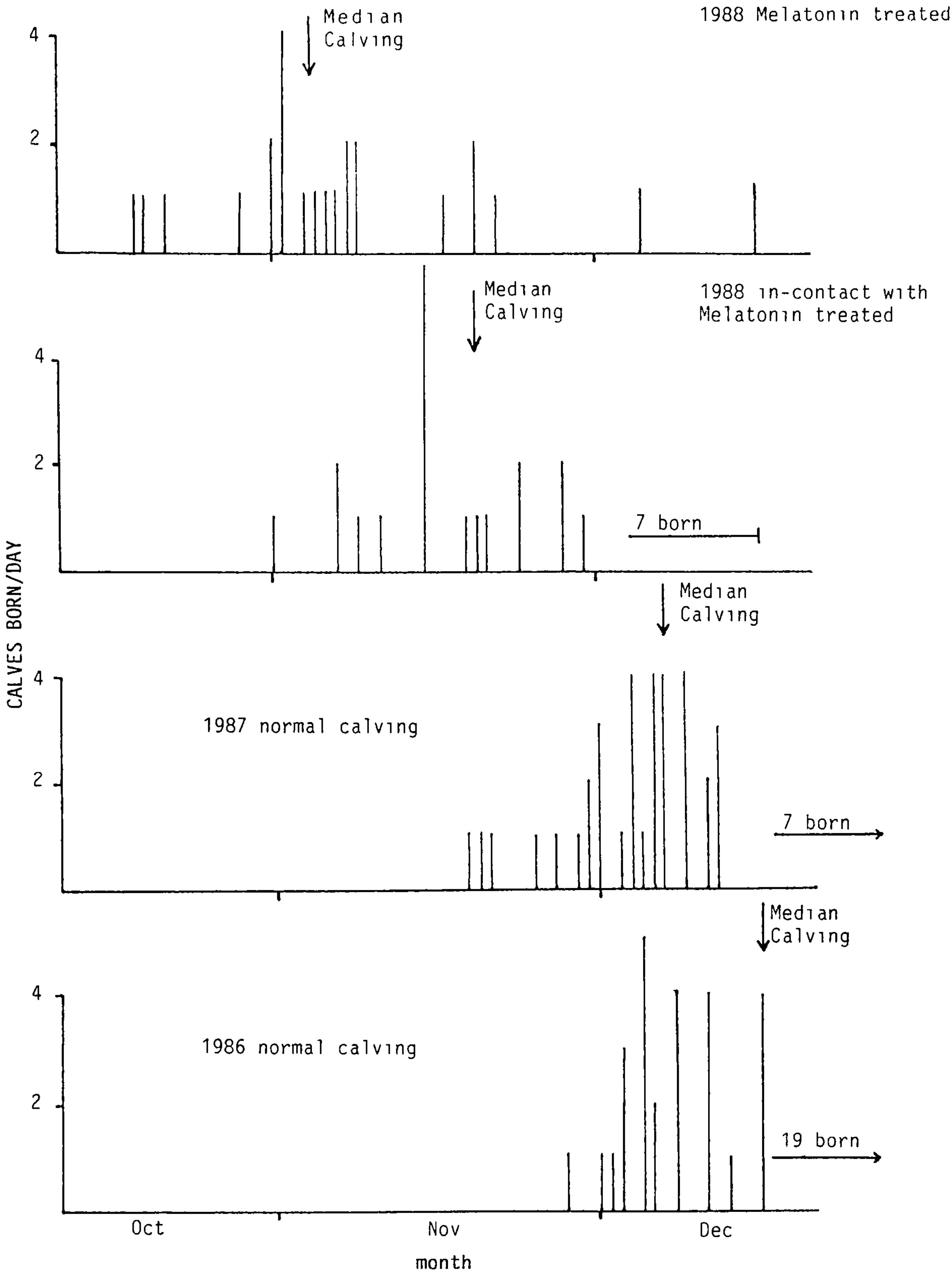

Fig. 3. Calving patterns for 2 y.o. hinds

On one property conception rate in control deer was 64% and weaning in that group was 54.5%. On that farm the stag was not changed and it is likely that as the rut progressed, (i.e. when the control deer were coming into oestrus), the stag was either behaviourally or physiologically incapable of achieving fertility.

6.3 Bodyweight gain

Weaning occurred on different properties at different times, ranging from 17.2.89 to 20.4.89. The mean bodyweight advantage for males at weaning was kg, while for weaner hinds the bodyweight advantage in offspring of treated hinds averaged kg.

7. CURRENT RESEARCH

Field research commenced November 1988 to study the following:

7.1 Effectiveness of a 2-treatment regime for melatonin implants on yearling hinds:

- Group 1 - 3-treatments 30 days apart
- Group 2 - 2-treatments 45 days apart
- Group 3 - Control

7.2 Stag effect

- Group 1 - Treated stags joined early
- Group 2 - Treated stags joined early after 18 days exposure to treated vasectomised stags
- Group 3 - Untreated stags joined early
- Group 4 - Untreated stags joined at normal time

These trials involve more than 2500 hinds and are duplicated on two properties Representatives from each group are to be examined by ultrasound and foetal age predictions made to estimate median calving dates. Weaning weights will also be recorded in 1990.

8. CONCLUSION

Extensive field evaluation of the use of Regulin implants in yearling hinds has proven it to be a successful method of advancing calving in two-year-olds on commercial deer farms

Farmers wishing to utilise this technology need to undertake careful planning to achieve the optimum productivity and financial returns.

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