PRACTICAL REPRODUCTIVE MANAGEMENT OF FARMED FALLOW DEER

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INTRODUCTION

Reproductive management of farmed fallow deer is aimed primarily at optimising environmental performance of the does, and secondarily at increasing genetic merit of the herd. The present high commercial value of breeding fallow does in Canada highlights the need to ensure maximal reproductive rates. The proportion of offspring reared each year is the single most important criterion of on-farm performance and profitability. Therefore, deer farmers should pay careful attention to reproductive management of their herd.

REPRODUCTIVE CYCLE OF FALLOW DOES

A perspective of the annual reproductive cycle of the fallow does is required in order to understand factors that may limit their performance. The following summary has been adapted to northern hemisphere environments which, because reverse photoperiod cycles, re six months out-of-phase with southern hemisphere environments.

The fallow doe is highly seasonal in its breeding pattern, with first estrus (heat) occurring in mid-October (Autumn). All does in a herd will exhibit first estrus within a 12-14 day period that corresponds to the rut. Does that fail to conceive to first estrus can exhibit regular 21-22 day estrus cycles (i.e. estrus exhibited once every 21-22 days) for a further 5-6 months and, thereafter, are anoestrous/anovulatory (non-reproductive). However, most does conceive to their first estrus in October, and following a long gestation of 234 days, produce their fawns in June. Fallow does are almost invariably monovulators and twinning is very rare.

REPRODUCTIVE CYCLE OF FALLOW BUCKS

Fallow bucks exhibit remarkable annual cycles of testicular development, spermatogenesis and liveweight. These cycles involve recurrent annual fluctuations in fertility. Fallow bucks are essentially infertile in late spring-early summer (March - June) when they are growing velvet antler and acquiring large fat deposits. Towards the end of summer (July - August) the tests start to develop in response to decreasing daily photoperiod. This leads to reinstigation of spermatogenesis, androgenesis, neck muscle hypertrophy and rapid mineralization of the antlers. As the rut approaches bucks tend to become aggressive and solitary. Their annual liveweight peak occurs about one month before the rut. During the rut, bucks dramatically alter their behaviour patterns in pursuit of oestrous does. This includes a marked decline in feeding activity and an associated 25-30% loss of liveweight over the 2-3 week period of the rut. Bucks regain very little of this liveweight over the subsequent winter months, and remain reproductively active for 5-6 months. The return of spring is associated with major metabolic and reproductive changes, including testicular "shut-down", fat accretion and antler casting.

More detailed descriptions of doe and buck reproductive cycles can be obtained in "Progressive Fallow Farming" [Proceedings of a course on Fallow Deer Farming held at Ruakura Agricultural Centre, February 23-26, 1988].

REPRODUCTIVE WASTAGE

Many fallow deer farmers know only that weaning percentages of their does are lower than desired. They often do not know at which point in the breeding cycle that the reproductive wastage is occurring and usually attribute the poor performance to low fawning rates due to failure of conception. This was exactly the situation encountered when I first started monitoring reproductive rates on farms in New Zealand. Farmers were insistent that many of their does were failing to become pregnant. However, close monitoring revealed that conception rates were high (95 - 100%) and that the losses occurred after conception.

Let us now look at different stages of the reproductive cycle in relation to potential reproductive wastage.

Ovulation

Failure of does to ovulate seems to be a fairly rare phenomenon, even in pubertal (16-month-old) does. It would appear that does are reasonably tolerant of environmental stresses in terms of ovulatory responses. However, even under the best environmental circumstances, multiple ovulation appears to be rare. Therefore, ovulation rates are measured in terms of population ovulation rate rather than individual ovulation rate.

The optimum (and probably achieved on most farms) is 100% of does mono-ovulating. It is interesting to note that short-term stress stimuli around the time of ovulation has not been shown to inhibit the occurrence of ovulation, although in some individuals it may delay ovulation by a few hours. This became apparent in a number of studies in which does were blood-sampled at 2-hourly intervals for 72 hours around estrus and ovulation. This clearly indicates that infrequent disturbance of does during the rut, even including occasional yarding at this time, is unlikely to have any major effects on ovulation.

The most likely factor to adversely affect ovulation is a combination of lactational demands and poor nutrition. This will be discussed later.

Conception

As with ovulation rates, conception rates (i.e. initiation of pregnancy) do not appear to be generally limiting with fallow deer. However, there are occasional horror stores of a large proportion of does in a herd not getting pregnant. Invariably this relates to the use of infertile bucks or poor management of mating groups during the breeding season.

Abortions

Pre-natal losses of fawns through abortions are probably more widespread than is presently recognized. This was certainly the case of the monitored farms in New Zealand. The first problem with abortions is the failure by the farmer to recognize the problem exists, due to difficulties in detecting aborted fetuses and does that abort. Very close daily examination of monitored herds revealed a high incidence (> 10%) of does aborting during the 2nd-3rd trimester of pregnancy. At this late stage of pregnancy, abortions were difficult to find because of their small size (30 cm long, 100-250 gm weight) and the fact that the does often consumed all of the placenta and much of the fetus! Earlier abortions would be almost impossible to detect. As the abortions are normally seldom detected, it is probable that the overall role of prenatal mortality in reducing reproductive performance in fallow deer has been under-estimated and under-stated.

Peri-Natal Mortality of Fawns

Present data indicates that fawn deaths within 7 days of birth is the single biggest factor contributing to reproductive wastage in farmed fallow deer. This fact often goes overlooked when farmers have a policy of "long-range observation" or "non-intervention" during the fawning season. Often, the only indication of any fawn losses within a herd is found in the subsequent winter when tiny piles of bones are seen in the short-cropped grass.

Post-Natal Mortality of Fawns

Deaths of fawns after 7 days of birth are generally unusual apart from occasional misadventures. However, occasional outbreaks of various infectious diseases have occurred in recent years and have had a devastating impact on weaning rates on a small number of farms.

INCREASING THE HERD'S OVULATION RATE

Within the fixed framework of monovulation amongst individual does, the emphasis on increasing the herd's ovulation rate must be on reducing the number of does that completely fail to ovulate. There are several points to note here:

1. The actual incidence of truly infertile (i.e. barren) does is undoubtedly very, very low. For example, of 70 "triple-dry" does (i.e. does that had not reared fawns for 3 consecutive years) identified and slaughtered (June 1985 to July 1986) from a total herd of 4000 does (i.e. 1.8% of that herd) only 10 (14% of triple dry does or 0.25% of the total herd) were not pregnant at slaughter. Of these 10, five were truly barren (vestigial ovaries and uteri) and five had vaginal blockages (encysted fetuses) but were ovulating. Needless-to-say, should a barren doe be identified within the herd, she should be slaughtered as she is of little value apart from the return on her carcass. One clue that might help to identify the occasional barren doe is that they are generally very large (60 -70 kg).

2. Environmental influences that, in any one year, may increase the incidence of ovulation failure in a proportion of does within the herd are likely to have their effects mediated through severe losses in liveweight prior to the rut. For example, lactation during severe summer drought can reduce the does body weight to the point of emaciation. This is likely to lead to anovulation if it persists through to autumn. (Lactation per see, while it may have a direct hormonal inhibitory effect on ovulation in primates and a modifying effect in cows, does not seem to directly block ovulation in fallow does, but the effect of lactation on liveweight can be dramatic when feed supply is limiting.)

   Measures to prevent this situation arising during drought years include; (a) supplementing does with additional feed and (b) weaning fawns from their dams at least 3 weeks prior to the start of the rut (thus disrupting lactation and allowing does to invest nutrients back into their own tissues).

   An actual example of this policy was demonstrated on a farm in New Zealand with over 400 mature does and was suffering from a severe drought in the summer and autumn of 1984. The lactating does were becoming emaciated and a decision was made to wean the fawns in mid-March and to continue a high level of feed supplementation to the does (i.e. 500 g maize grain/doe/day). As a result, doe liveweights increased on average by 5.5 kg in 3 weeks prior to the rut and a subsequent fawning rate of nearly 100% (and weaning rate of 89%) was achieved in the following summer.

However, it must be reiterated and stressed that ovulation failure does not appear to be the major overall factor behind low reproductive rates in New Zealand.

3. Attempts to increase the incidence of twinning, are likely to be counter-productive. Early studies at Ruakura showed that it was possible to multiple-ovulate fallow does with hormones such as PMSG and to induce twin pregnancies but in no case has any of the twins survived beyond a few hours from birth. Classically, the twins were of very low birth weight and were invariably non-viable.

   Reports of high incidences of natural twinning in fallow deer overseas are all unsubstantiated. In fact, in one German study a large number of fallow does, reputedly with histories of twinning or actual twins themselves, were brought together and mated to bucks reputed to be twins. Over a period of 3-4 years not one twin birth occurred!

FAILURE OF DOES TO BECOME PREGNANT

On a well managed fallow deer unit, all does should be serviced by bucks at their first estrus during the rut. Early studies at Ruakura indicated that 85% of does are likely to conceive to their first mating, with nearly all the remaining does conceiving to their second estrus, 21 days later. This is reflected in the subsequent fawning pattern where 85% of fawns are born during the first peak of births in December (coinciding with June in B.C.) and most of the remainder are born during a second peak of births 3 weeks later.

Failure of does to conceive to the first or second estrus probably reflects problems associated with individual bucks or inappropriate management of does and bucks during the rutting period.

1. It is probable that a small proportion of sire bucks are infertile, sub-fertile or of low libido. Problems arise when using these animals as single-sires without using chasers after the first or second oestrous cycle. Using single-sires with previous histories of siring fawns will reduce this risk, although even this does not guarantee results. Bucks go through the physiological equivalent of puberty every year and there is always the possibility that a buck will exhibit normal reproductive development one year but not the next.

   Unless farmers are absolutely sure that bucks are doing their job, single-sire mating practices should include buck replacement after the first or second oestrous cycle. This is particularly important if using bucks newly imported from the southern hemisphere. These bucks often have insufficient time to "convert" to the northern photoperiod regimen in time for the next rut, and consequently often exhibit poor fertility and libido in the first year.

Bucks that are known to be sterile or sub-fertile should not be used as sires, even when multi-sire mating practices are instigated. It is possible that these bucks will successfully compete for access to oestrous females, mate with them but fail to achieve fertilization. These females are unlikely to be mated by other bucks at the same estrus and, therefore, will not conceive to that estrus.

2. Inappropriate ratios of bucks:does during mating can lead to poor conception rates. Too many bucks (e.g. 1 buck:1-5 does) in an intensive multi-sire situation can lead to excessive fighting between bucks such that oestrous females remain unmated. Observations at Ruakura showed that the interval from the onset of estrus to copulation (mating) in fallow deer was more than doubled when 2 bucks were in close proximity. This was due to incessant fighting between the bucks for access to the estrous doe.

Too few bucks (e.g. 1 buck:50-200 does) can also lead to low conception rates due to failure to service all does. The high natural synchrony of estrus in females can result in coincident estrus in a number of does within the mating group. Bucks may have insufficient libido to service these females within the same heat period.

On the basis of limited data, the following buck/doe ratios are provided as a guide.

Age of sire	Number of does
16 months	10 - 15
27 months	15 - 20
39+ months	30 - 35

When using young bucks it is important to keep older, larger bucks well away to prevent dominance suppression of rutting activity. Conversely, bucks of similar age and size may spend more time fighting than mating if forced into close proximity.

In multi-sire situations, it would be preferable to use large paddocks with numerous geographical features (hills, trees, etc.) so that individual bucks can establish non-overlapping territories. This will reduce the incidence of fighting between bucks.

In single-sire situations, the presence of a fence between bucks will not necessarily prevent fighting. Separation of mating groups by at least one paddocks-width or by the raceway, thus forming a "no-mans land", will prevent fighting and, therefore, reduce buck exhaustion.

ABORTION - CAUSES AND PREVENTION

Several facts about abortions in fallow deer need to be highlighted:

1. The incidence of abortions, although probably somewhat under-estimated on a national basis, is probably regionally sporadic and abortions do not occur on every farm.

2. Known incidences of abortions do not seem to be related to episodes of stress induced by human contact or through yarding. In fact, studies at Ruakura indicate that pregnant does are very tolerant of such stress and it is difficult to induce abortions in fallow deer by such methods.

3. There is a recorded case of an abortion "storm" occurring in a herd of 30 does that had eaten prunings from Macrocarpa trees. This is in accordance with the effects of Macrocarpa toxins on other domestic livestock species. This is a rare occurrence and easily prevented.

4. Serological testing of a number of New Zealand herds with high incidences (10%) of does aborting indicated the presence of recurrent infection with leptospirosis (serotypes pomona and hardjo). No other clinical signs of the disease were observed. None of these farms had any previous history of vaccination and, therefore, the blood titres were from natural infection. No other known abortion-inducing diseases were detectable (e.g. toxoplasmosis, vibriosis, BVD virus, IBR virus, Brucellosis).

   Treatment programmes aimed at removing leptospirosis infection from these herds included streptomycin injections for 5 days (short-term elimination of the bacterium) and vaccination (long-term prevention of re-infection). The result was complete elimination of an abortion problem.

   It is recommended that all fallow deer farmers vaccinate their stock against leptospirosis twice yearly. If a major abortion problem already exists, measures should be taken to treat the does with appropriate antibiotics, quarantine soiled pastures (i.e. spell from grazing for 3 weeks) and initiate a biannual vaccination programme.

5. Should abortions persist in the face of leptospirosis control measures every effort should be made to identify the causal

agent. If all abortions occur to does mated to a particular buck it is possible that the aborted fetuses are genetically abnormal and the buck should be culled. However, such embryonic deaths usually occur at a very young age (i.e. less than 60 days from fertilization) and would remain undetected.

6. In all cases of abortions contact the local veterinarian. It is possible that other infectious diseases occur in the district and that these are responsible for the problem. The veterinarian may be able to conduct tests to determine the causal agent. it is very important to collect fetuses and especially the placenta for submission to the Laboratory.

   If possible, identify does that have abortions, as veterinarians may be able to establish the cause by serological testing of aborting does.

FAWN MORTALITY

Fawn mortality is probably the single biggest factor contributing to low weaning rates of many fallow deer farms. Early studies on monitored New Zealand farms identified the causes of fawn mortality on these properties by retrieval of dead fawns and performing post-mortem analyses (Table 1).

Table 1: Causes of mortality for 161 fallow fawn deaths recorded from four northern NZ farms (1980-1984)

	n	%
Non-viability	40	24.9
Starvation	31	19.3
Dystocia	23	14.3
Misadventure	18	11.2
Gut infection	16	9.9
Throat/jaw infection	11	6.8
Lung infection	6	3.7
In-utero death	5	3.1
Liver infection	3	1.9
Severe hypothermia	2	1.2
Congenital/genetical abnormality	1	0.6
Unexplained	5	3.1
TOTAL	161	100

By far the major category of fawn deaths was "non-viability" and this is probably true of most fallow farms in New Zealand. It simply means that fawns are of insufficient birth weight to walk and suckle. Classically, non-viable birth weights are below 3.0 kg and the fawns are found dead with the soft hoof-tip coverings intact (i.e. have not walk ed).

There is a very strong relationship between birth weight and survival/mortality of fallow fawns (Table 2) with larger born fawns exhibiting lower mortality. It is interesting to note that excessively large fawns (> 5.0 kg) are not necessarily at risk of dystocia in fallow deer, as would appear to be the case in red deer.

Table 2: Relationship between birth weight and mortality of fallow deer fawns

Birth weight (kg)	< 3.0	3.1-4.0	4.1-5.0	>5.0
Fawns born	94	438	281	9
Fawn deaths	56	71	30	1
Mortality rate	59.6%	16.2%	10.7%	11.1%

There are several points that should be noted with respect to birth weight:

1. There is a strong correlation between doe pre-rut liveweight (i.e. early October) and the birth weight of her subsequent fawn. Therefore, there is a relationship between doe liveweight and survival of fawns. This is particularly pronounced for first fawning does (Table 3).

Table 3: Relationship between pubertal liveweight of fallow does and the subsequent weaning rate as 2-year-olds (304 does on one farm).

Pubertal weight range (Kg)	Weaning %
24.0 - 25.5	0%
26.0 - 27.5	27%
28.0 - 29.5	35%
30.0 - 31.5	47%
32.0 - 33.5	54%
34.0 - 35.5	65%

For mature does, fawn birth weights are approximately 10% of the doe's previous pre-rut liveweight (e.g. 40 kg doe: 4.0 kg fawn). However, for first fawning does (2-year-olds) the fawn birth weights are only 7-8% of the doe's pubertal weight (e.g. 40 kg doe: 2.8-3.0 kg fawn).

Logically, therefore, larger does will tend to wean more fawns each year. This certainly appears to be the case for pubertal does. However, for a given weight, pubertal does are likely to produce less fawns than adult does, due to higher fawn mortality from lower birth weights.

2. While the relationship between doe pre-rut liveweight and subsequent birth weight is real, it is not absolute. There are clearly other factors which can influence birth weights of fawns irrespective of doe weights. Many researchers have tried to establish a link between gestational nutrition and birth weight in sheep. Results have been very conflicting but it is generally considered that severe under-nutrition can depress birth weights. Although good research evidence is lacking, it is quite possible that under-nutrition during the latter half of gestation may reduce birth weight of fallow fawns. It has even been suggested that this is a desired management practice in order to reduce the incidence of dystocia. <u>This may be applicable to red deer but is not recommended for fallow deer</u> for two reasons: (a) the incidence of dystocia in fallow deer is low irrespective of birth weight and (b) any depression in birth weight is likely to increase the incidence of non-viable fawns.

   It is recommended that fallow does be fed to appetite with good quality feed during gestation.

3. Hybridization of European fallow deer and Mesopotamian fallow deer is likely to result in increased pubertal and adult doe liveweights of the hybrids. This may have the advantage of increasing fawn birth weights and survival. However, it is also possible that threshold liveweights for the attainment of pubertal estrus/ovulation will increase. Time will tell the role of hybridization in increasing fawn survival rates.

4. Any disease factor that limits production in the herd may also have effects on fawn birth weights and survival. Ensure a healthy herd by maintaining a programme of vaccination (leptospirosis, Clostridial diseases, Salmonella, etc.) and helminthic control.

Fawns that die of starvation/dehydration within the first 3 days from birth are often regarded as having been rejected (or "mismothered") by their dams. On the monitored farms approximately 20% of fawn mortalities were due to starvation. There is clearly a thin line between "non-viability" and "starvation" categories as most non-viable fawns die of starvation/dehydration. However, in the early study on the monitored farms the "starvation" categories included fawns that exhibited evidence of having walked and, therefore, were viable.

Points to note about starvation are:

1. The incidence of fawn starvation through dam rejection may have been slightly exaggerated in the study on monitored farms due to disturbance by humans, especially considering that these does had not previously been subjected to such close contact. The incidence of fawn deaths by starvation on Ruakura is considerably less than on monitored farms and may indicate habituation of the deer to close human contact.

   I do not advocate handling fawns at birth unless the does are well habituated to the farmer and do not appear stressed in the continual presence of people. Providing these conditions apply, there appears to be little problem with tagging and weighing fawns at birth.

2. The incidence of fawn deaths through starvation is higher amongst first fawning does. This probably reflects maternal inexperience and greater susceptibility to disturbance.

3. High stocking intensities during fawning are often associated with unusually high incidences of contact between fawns and other does; sometimes resulting in confusion of dam/fawn bonds that may ultimately lead to eventual mismothering of fawns. this is particularly true for first fawning does.

   Strategies to reduce this situation include reduction in stocking intensity over the birth period (e.g. 40 does/ha is probably too high during the period from 1 June - 25 June: a stocking intensity of < 20 does/ha is more preferable). Also, providing adequate shelter/cover in fawning paddocks will allow parturient does to isolate themselves from the main herd during the fawning/bonding process. Coppices of trees are ideal for this, but even small patches of long grass, thistles and reeds can serve the purpose.

   Reduction of doe stocking intensities during fawning may also reduce the risk of contagious infections spreading amongst fawns.

4. A small proportion of does will always reject their newborn fawns. These behavioural deviants should be culled.

5. Factors other than mismothering/rejection can lead to fawn starvation. Poorly conditioned does may fail to lactate, although it is likely that their fawns will be non-viable anyway. Similarly, does that fawn well outside the normal fawning season often fail to initiate lactation. This includes late fawning does and pregnant does imported from the southern hemisphere that fawn during the southern hemisphere winter. Recent research evidence strongly suggests that failure to initiate lactation out-of-season is due to short photoperiods.

   Farmers should consider hand-rearing fawns born well outside the fawning season.

The incidence of fawn deaths due to difficult birth does not appear to be as high for fallow deer as for red deer. However, dystocias do occur and should be recognised as a major cause of fallow fawn mortalities. While about 14% of recorded mortalities on monitored farms were related to difficult births, only 13% of these involved assisted births. In other words, in most cases of dystocia deaths, the fawn was naturally expelled by the doe. Classically, these fawns looked outwardly normal but had internal haemorrhages caused by severe birthing pressures.

The New Zealand incidence of assisted births (i.e. fawn pulled out of the doe by the farmer or veterinarian) is probably close to 1% or less (1981-1984 questionnaire data).

As with starvation deaths, the incidence of dystocia appears greatest with first fawning does. Most cases of dystocia do not result in death of the dam. It is very difficult to pin-point causal factors behind fallow deer dystocias. They certainly do not appear to be related to excessively large birth weights; with most cases falling between 3.2 and 4.4 kg. There is, however, a tendency for a higher involvement of male fawns (about 2:1); particularly with backward presentations (often mistakenly called "breech births"). It is very hard to argue that over-fatness or under-fitness of dams results in dystocia. Fallow does very seldom become over-fat and, through constant exercise, seem to remain physically fit. We can offer no real answers to reducing the incidence of dystocia in fallow deer.

In the early days of fallow deer farming, when it was common practice to enclose fawning does behind 6 and 12 inch red deer netting, fence hang-ups of fawns was very commonplace. These deaths are the most easily preventable of all and, nowadays, most farmers recognize the need to fawn proof the birth paddocks. It is also important to question <u>why</u> fawns desire to walk through fences. The answer probably lies in "shelter". On the monitored farms it was interesting to note that most fence hang-ups occurred in netting bordered on the outside by trees. Therefore, it appeared that the fawns were seeking shelter outside the birth paddock. Two obvious ways of reducing this problem are to (a) site birth paddocks away from such attractions and (b) provide adequate shelter within the birth paddocks.

Occasional outbreaks of infectious diseases have been known to decimate fawn populations on a few farms. These include infectious enteritis, pneumonia and throat/jaw infections. It is often impossible to predict the occurrence of these problems as they are so sporadic. Several points should be noted:

1. Contact your veterinarian immediately a problem is suspected. Retrieve all dead fawns for post-mortem examination as soon as possible. Pending the outcome of laboratory analysis, the veterinarian will recommend a treatment protocol.

2. Situations have arisen whereby fawns have been treated with appropriate antibiotics within 24 hours of birth to prevent gut infections within the first week of life. This was done successfully and any disadvantages (e.g. mismothering) were far outweighed by the gains made in controlling the infection and reducing overall fawn death rates.

3. Some infectious diseases may be prevented from becoming established by an annual programme of vaccination of does. For example, in New Zealand there are vaccines available for clostidial diseases and certain strains of Salmonella. Establishment of high levels of antibodies in the does (i.e. active immunization) may confer protection against infection in the fawns through ingestion of pre-formed antibodies in the dam's milk (i.e. passive immunization).

4. If an infectious disease does establish itself, reduce the overall stocking intensity in an attempt to reduce contact between infected and healthy animals. Rotation of stock onto clean pastures may also reduce transmission of the infectious agent.

5. Stagnant water may be a possible reservoir of infection, especially if contaminated by other animals (ducks, rats, etc.). Check the watering system and clean if necessary. If a vector animal is shown to be present on the farm, measures need to be taken to remove these animals and reduce contamination of water and pasture.

Although not a major cause of mortality of fallow fawns on the monitored farms; hypothermia nevertheless has been a sporadic problem on some farms. Heavy down-pours of rain soon after birth often result in death of the new born fawns. The problem is major only if a large number of fawns are born during these weather conditions. Fawns older than one day seem to cope well with heavy rain.

Lack of sufficient cover in fawning paddocks may contribute to high losses during heavy rainfall.

Farmers considering advancing the fawning season with melatonin implants must consider the possible consequence of fawning occurring during inclement weather likely to occur before summer. Shelter must be provided for out-of-season born fawns, otherwise any advantages of early fawning will be out-weighed by high fawn losses.