OPTIMISING REPRODUCTIVE PERFORMANCE OF FALLOW DOES

Geoff Asher, MAF, Ruakura

Many fallow deer farmers in New Zealand are still concerned about lower than expected reproductive rates from their farmed does. These concerns first came into focus in the early 1980's when weaning rates (number of fawns alive at 3 months of age per 100 does) on some Waikato and Bay of Plenty farms were less (50-70%) than the often quoted 85-90%. These figures often provoked a negative response within the industry, with some people claiming that low reproductive rates were not universal nor indicative of overall trends. While some established fallow deer farms have good performance records (> 90% weaning rates), performance may be suboptimal on many farms, especially newly established units where owners may be inexperienced and the stock are of variable, often questionable, quality.

The questions that must be asked are:

At what point in the reproductive cycle is the problem occurring?

How can management be altered to minimise such reproductive wastage?

The initial on-farm monitoring in the early 1980's and the later on-station research at Ruakura have shown answers to these questions and provided some positive indicators for improving reproductive performance. The picture therefore, is far from gloomy.

The reproductive cycle of does

A perspective of the reproductive cycle of the fallow doe is needed to understand factors that may limit performance. The following information is only a brief summary for purposes of this discussion. More detailed reading can be found in The Deer Farmer, Vol. 26, pages 53-55.

The fallow doe is seasonal in its breeding pattern, with first oestrus (heat) occurring in mid-April. All does in a herd will exhibit first oestrus within a 12-14 day period that corresponds to the "rut" (Figure 1). Does that fail to conceive during first oestrus can exhibit regular 21-22 day oestrus cycles for a further 5-6 months (Figure 2) and thereafter are "anoestrus" (fail to exhibit any signs of oestrus or ovulation). However, most does conceive at their first oestrus in April, and following a gestation of 234 days, produce their fawns in December (Figure 3). Fallow does are almost invariably monovulators and twinning is rare.

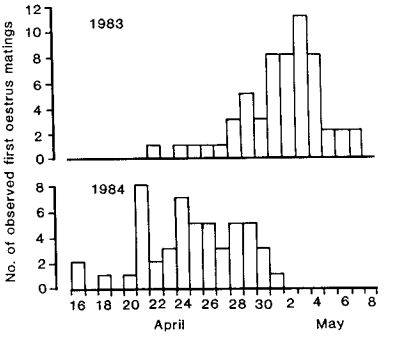

Figure 1: The pattern of occurrence of first oestrus of fallow does at Ruakura in 1983 and 1984.

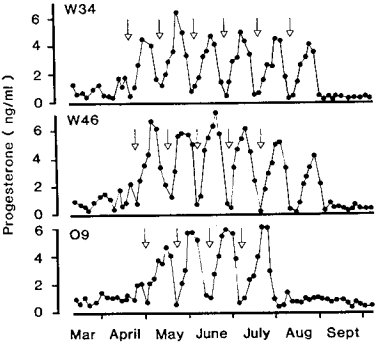

Figure 2: Plasma progesterone levels of fallow does run continuously with vasectomized (infertile) bucks, indicating the occurrence of regular 21-22 day oestrous cycles from April to September. Arrows indicate dates of oestrus (heat).

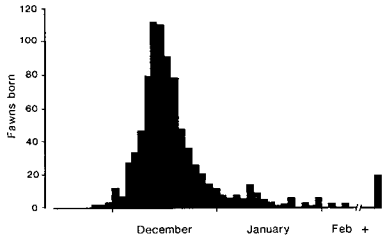

Figure 3: Seasonal pattern of fallow deer births occurring on four Waikato and Bay of Plenty farms between 1980-1984. This pattern appears to be typical for most farms in New Zealand and Australia.

Where does reproductive wastage occur?

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 the reproductive wastage is occurring and usually attribute poor performance to low fawning rates because of failure to conceive. This was the case when we first started monitoring reproductive rates on farms in the Waikato and Bay of Plenty regions. Farmers were insistent that many of their does were failing to conceive. However, close monitoring revealed that conception rates were 95-100% and that losses occurred after conception.

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

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

The optimum rate (and that probably achieved on most farms) is 100% of does mono-ovulating. Short-term stress stimuli around the time of ovulation does not inhibit ovulation, although in some individuals it may delay ovulation by a few hours. This became evident in some studies in which does were blood-sampled at 2-hourly intervals for 72 hours around oestrus and ovulation still occurred. This clearly shows that infrequent disturbances 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 affect ovulation adversely is a combination of lactation and poor nutrition.

As with ovulation rates, conception rates are not generally limiting with fallow deer. However, there are occasional horror stories of many does in a herd not getting pregnant. Usually this relates to the use of infertile bucks or poor management of mating groups during the breeding season.

Pre-natal losses of fawns through abortion are probably more widespread than is recognised. This was the case with the monitored farms in the Waikato and Bay of Plenty regions. The first problem with abortion is failure to recognise the problem exists, because of difficulties in detecting aborted foetuses and does that abort. Close daily examination of monitored herds revealed up to 10% of does aborting in August, September and October (2nd-3rd trimester of pregnancy). At this late stage of pregnancy, abortions were difficult to find because of their small size (30cm long, 100-250gm weight) and the does often consumed all the placenta and much of the foetus! Earlier abortion would be almost impossible to detect. As abortion is normally seldom detected, it is probable the overall role of prenatal mortality in reducing reproductive performance in fallow deer has been under-estimated and understated.

Present data indicates that fawn deaths within 7 days of birth is the 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 sign of fawn losses within a herd is found the next winter when tiny piles of bones are seen in the short-cropped grass.

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

Can we increase the herd's ovulation rate?

Within the fixed framework of monovulation amongst individual does, the emphasis on

increasing herd ovulation rate must be on reducing the number of does that fail to ovulate.

The incidence of barren does is extremely low. For example, of 70 "triple-dry" does (does that had not reared fawns for three consecutive years) identified and slaughtered (June 1985 to July 1986) from a total herd of 4000 does (1.8% of that herd) only 10 (14% of triple dry does or 0.003% of the total herd) were not pregnant at slaughter. Of these 10, five were barren (vestigial ovaries and uteri) and five had vaginal blockages (encysted foetuses) but were ovulating. Needless-to-say, should a barren doe be identified 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 large (60-70kg).

Environmental influences that, in any one year, may increase the incidence of ovulation failure in some does, are likely to have their effects reduced through severe losses in liveweight before 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 the autumn. Lactation, while it may have a direct hormonal inhibitory effect on ovulation in primates and a modifying effect in cows, does not seem to block ovulation directly in fallow does, But the effect of lactation on liveweight can be dramatic when feed supply is limiting.

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

In an example of this policy, a farm near Te Kuiti containing over 400 mature does, 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 of 500g maize grain/doe/day. As a result, doe liveweights increased on average by 5.5kg in 3 weeks before the rut and a subsequent fawning rate of nearly 100% and weaning rate of 89% was achieved the following summer.
However, it must be stressed that ovulation failure is not the major overall factor behind low reproductive rates in New Zealand.

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 have any of the twins survived beyond a few hours from birth. Classically, the twins were of low birth weight and non-viable.

Reports of high incidences of natural twinning in fallow deer overseas are all unsubstantiated. In one German study many fallow does, reputedly with histories of twinning or twins themselves, were brought together and mated to bucks reported to be twins. Over 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 oestrus during the rut. Early studies at Ruakura showed that 85% of does are likely to conceive at their first mating with nearly all the remaining does conceiving at their second oestrus 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 and most of the rest are born during a second peak of births 3 weeks later (Figure 3).

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

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 oestrus 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 sure that bucks are doing their job, single-sire mating practices should include buck replacement after the first or second oestrus cycle. This is important when newly imported bucks from the northern hemisphere are used. These bucks often have insufficient time to adapt to the southern photoperiod regimen in time for the next rut, and thus often show poor fertility and libido in the first year.

Bucks known to be sterile or sub-fertile should not be used as sires, even when multi-sire mating practices are used. Possibly these bucks will successfully compete for access to oestrus females, mate with them but fail to achieve fertilization. These females are unlikely to be

mated by other bucks at the same oestrus and therefore will not conceive in that oestrus.

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

Too few bucks (1 buck:50-100 does) can also lead to low conception rates because of failure to service all does. This high, natural synchrony of oestrus in females can result in coincident oestrus in some does within the mating group. Bucks may have insufficient libido to service these females within the same heat period.

Based on 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 is preferable to use large paddocks with many geographical features (hills, trees, etc) so individual bucks can establish non-overlapping territories. This will reduce fighting among 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 paddock width or by the raceway, thus forming a "no-mans land", will prevent fighting reducing buck exhaustion.

What causes abortion? Can it be prevented?

Several facts about abortion in fallow deer need to be highlighted.

The incidence of abortion, although probably under-estimated on a national basis, is probably regionally sporadic and does not occur on every farm.

Known incidences of abortion do not seem to be related to episodes of stress induced by human contact or through yarding. Studies at Ruakura showed that pregnant does are tolerant of such stress and it is almost impossible to induce abortion in fallow deer by such methods.

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 similar to effects of macrocarpa toxins on other domestic livestock. This is a rare event and easily prevented.

Serological testing of a number of herds with a high incidence (10%) of does aborting, indicated the presence of recurrent infection with leptospirosis. No other clinical symptoms of the disease were seen. 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 (toxoplasmosis, vibriosis, BVD virus, IBR virus, brucellosis).

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

It is recommended that all fallow deer farmers vaccinate their stock against leptospirosis twice yearly in March/April and July/August. If a major abortion problem exists, measures should be taken to treat the does with suitable antibiotics, and quarantine soiled pastures less than 60 days from fertilization.

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 foetuses are genetically abnormal and the buck should be culled. However, such embryonic deaths usually occur at a very young age (less than 60 days from fertilisation) and would remain undetected.

In all cases of abortion, contact the local

veterinarian. It is possible that other infectious diseases occur in the district and these are responsible for the problem. The veterinarian is able to conduct tests to determine the cause. It is important, if at all possible, to send foetuses and placenta to the Animal Health Laboratory.

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

Causes of fawn mortality

Fawn mortality is probably the biggest cause of low weaning rates on many fallow deer farms. Early studies on monitored farms in the Waikato and Bay of Plenty regions identified the causes of fawn mortality on these properties by performing post-mortem analyses (Table 1).

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

	No.	%
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

What are "non-viable" fawns?

By far the major category of fawn deaths was "non-viability" and this is probably true of most fallow farms in New Zealand. It means that fawns are of insufficient birth weight to walk and suckle. Classically, non-viable birth weights are below 3.0kg and fawns are found dead with the soft hoof-tip coverings intact.

There is a strong relationship between birth weight and survival/mortality of fallow fawns with larger-born fawns showing lower mortality (Table 2). Unlike red deer, excessively large fawns (> 5.0kg) are not necessarily at risk of dystocia.

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%

The range of birth weights observed on monitored farms is shown in Figure 4.

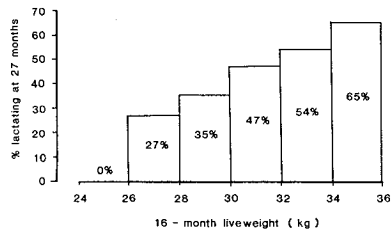

Figure 4: Histogram of frequencies of fallow and red deer birth weights observed on monitored farms in the Waikato and Bay of plenty regions: 1980-1984.

There are several points that should be noted about birth weight.

There is a strong correlation between doe pre-rut liveweight 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 (Figure 5).

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

Larger does therefore tend to wean more fawns each year. This is the case for pubertal does (Figure 5). However, for a given weight, pubertal does are likely to produce fewer fawns than adult does because of higher fawn mortality from lower birth weights.

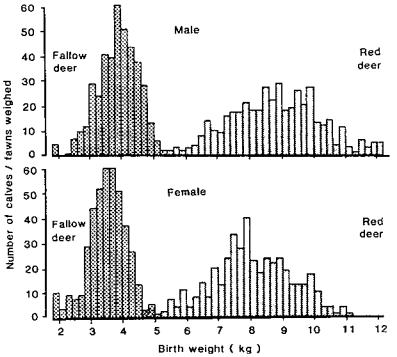

Figure 5: Relationship between pubertal liveweight of fallow does and the subsequent weaning rate as 2-year olds. (Data from 304 does on one farm 1985).

While the relationship between doe pre-rut liveweight and subsequent birth weight is real, it is not absolute. There are 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 conflicting but it is considered that severe under-nutrition can depress birth weights. Although good research evidence is lacking, it is possible that under-nutrition during the latter half of gestation may reduce birth weights of fallow fawns. It has even been suggested that this is desired management practice to reduce the incidence of dystocia. This may be applicable to red deer but is not recommended for fallow deer because the incidence of dystocia in fallow deer is low irrespective of birth weight and 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.

Hybridization of European 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 oestrus/ovulation will increase. Time will tell the role of hybridization in increasing fawn survival rates.

Any disease 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.

Starvation syndrome: dam rejection?

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 about 20% of fawn mortalities were caused by starvation. There is 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 had walked and were therefore viable.

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

We do not support handling fawns at birth unless the does are well used to the farmer and do not appear stressed in the continual presence of people. Providing these conditions apply there are few problems with tagging and weighing fawns at birth.

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

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

Strategies to reduce this include reduction in stocking intensity over the birth period (40 does/ha is probably too high during the period from 1 December - 28 December: a stocking intensity of > 20 does/ha is 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 (we hope the Noxious Weeds

Inspector doesn't read this) and reeds can serve the purpose.

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

A few does will always reject their newborn fawns. These does should be culled.

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 lactate. This includes late fawning (March/April) does and pregnant does imported from the northern hemisphere that fawn during the southern hemisphere winter. Recent research evidence strongly suggests that failure to lactate out-of-season is due to short photoperiods.

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

Dystocia: difficult births

The incidence of fawn deaths because of difficult birth is not 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 national incidence of assisted births 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 difficult to pinpoint causes of fallow deer dystocias. They are not related to excessively large birth weights as most cases fall between 3.2 and 4.4kg. But there is, a tendency for higher involvement of male fawns (about 2:1) particularly with backward presentations (often mistakenly called "breech births").

It is hard to argue that over-fatness or under-fitness of dams results in dystocia. Fallow does seldom become over-fat and, seem to remain physically fit. We can offer no real answers to reducing the incidence of dystocia in fallow deer.

Misadventure: those damn fence hang-ups!

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 commonplace. These deaths are the most easily preventable of all. Nowadays, most farmers recognise the need to fawn-proof the birth paddocks.

It is also important to question why fawns walk through fences. The answer probably lies in "shelter". On the monitored farms most fence hang-ups occurred in netting bordered on the outside by trees. Therefore, it appeared the fawns were seeking shelter outside the birth paddock. Two obvious ways of reducing this problem are to site birth paddocks away from such attractions and provide enough shelter within the birth paddocks.

Infectious diseases

Occasional outbreaks of infectious diseases have been known to decimate fawn populations of 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 sporadic.

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.

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

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

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.

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, remove these animals and reduce contamination of water and pasture.

Hypothermia

Although not a major cause of mortality of fallow fawns on the monitored farms, hypothermia has been a sporadic problem on some farms. Heavy rain soon after birth often results in death of thenew born fawns. The problem is major only if a large number of fawns are born during these conditions. Fawns older than one day 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 before summer. Shelter must be provided for out-of-season fawns, otherwise any advantages of early fawning will be out-weighed by high fawn losses.

Summary

The main factors associated with the weaning rates on some fallow deer farms are abortion and peri-natal fawn mortality. There are management practices that can be adopted to minimize the occurrence of these events and increase weaning rates. However, farmers must first identify where the reproductive wastage is occurring and what are the likely causal factors.