REPRODUCTIVE PERFORMANCE AND WASTAGE ON FALLOW DEER FARMS

R.C.MULLEY and A.W.ENGLISH

Fallow deer (Dama dama) have been farmed successfully in Australia for many years now and this species still constitutes the bulk of the Australian deer herd. They have proven to be hardy and adaptable to a wide range of climatic and management conditions, and have achieved consistently high levels of productivity on most farms. Although fallow deer have been shown to be highly fertile, both in the wild (Armstrong *et al.,* 1969, Baker 1973, Chapman and Chapman 1975) and on farms (Fitzi and Monk 1977, Reinken 1980, Asher 1986, 1988, Mulley *et al.,* 1987), weaning performances for farmed deer have often been disappointing (Asher 1988, Mulley *et al.,* 1990a). The reasons for reproductive failure remain obscure in many cases.

This paper presents production data collected from commercial deer herds over several breeding seasons and examines some of the causes of reproductive wastage.

Fawning Rates

The fawning rate for does on 47 farms over six consecutive years ranged from 75.0% to 96.4% with an overall mean of 88.8%, and the weaning rate ranged from 65.0% to 89.1% with an overall mean of 81.4% (Table 1). Both the fawning rate and weaning rate varied significantly between years ($p<0.001$). The majority of fawns (>90%) were born between 24th November and 18th December each year, and all fawns were weaned pre-rut in mid-March.

The fawning and weaning rates are higher than those reported for deer on farms in northern New Zealand (Asher and Adam 1985), but similar to recent data for wild deer in parks in England (Putman and Langbein 1990), and indicate that up to 19% of does either fail to conceive or fail to rear a fawn each year. Recent evidence (Mulley unpublished) suggests that failure to conceive may be an increasingly important component of reproductive wastage in farmed fallow deer.

Fawning rates in 2-year-old does are reported to be lower than those of adult does (Chapman and Chapman, 1975). This is possibly because some rising 2-year-old does, particularly those does that were born late in the fawning season 2 years previously, do not reach the critical puberty weight of 28-30 kg (Asher, 1985b) by 18 months of age and therefore either miss one complete breeding season, or conceive at a younger age and at a lower bodyweight than can support adequate foetal growth. Such does go on to produce small, non-viable fawns.

Conversely, Asher (1985b) has reported that fawning rates for 2-year-old does are comparable to adult does and suggests that this is probably because they are well above the critical puberty weight of 28-30 kg at the time of mating on New Zealand farms. The mean pre-rut weight of rising 2-year-old does in the present study is also well above the suggested critical level (Asher, 1985b), and the fawning and weaning success of this age group was comparable to that of adult does. Although 2-year-old does have performed relatively well in this study, the proportion of 2-year-old does in a herd should be considered when assessing reproductive wastage. The age of does on survey farms and most observed farms in this study were not known.

Variations in reproductive success between farms and between seasons in this study are consistent with New Zealand data (Asher 1985b; Asher and Adam, 1985). Factors such as heatwaves, persistent heavy rain during fawning, undernutrition of heavily pregnant and lactating does, age of does and management of fawning and lactating does all require careful consideration when assessing poor weaning performance. In addition,

Table 1 Reproductive performance of fallow does on surveyed and observed farms for 6 consecutive fawning seasons

	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	Total
Survey Farms							
Estimated number of NSWDFA members with fallow deer	76	62	56	51	53	57	
Number of questionnaire respondents	6	5	2	15	12	-	40
Total No. of does	176	143	11	461	346	-	1137
Min. fawn %	88.8	86.1	75.0	89.7	88.0	-	88.2
sd	12.4	13.8	35.4	10.3	11.5		14.6
Weaning %	86.4	81.0	65.0	85.4	80.3	-	83.3
sd	11.1	19.9	21.2	12.1	13.3		15.5
Observed Farms							
No. of farms	4	3	3	5	3	4	22
No. of does	219	205	238	407	414	491	1974
Min. fawn %	89.4	93.9	91.3	75.0	96.4	89.6	89.3
sd	18.6	1.8	3.4	32.8	5.0	12.6	12.4
Weaning %	79.3	89.1	77.5	68.4	85.2	85.1	80.8
sd	15.3	9.3	11.5	29.4	2.1	12.8	13.4
Total							
No. of farms	10	8	5	20	15	4	47*
No. of deer	395	348	249	868	760	489	3111
Min. fawn %	89.1	90.0	89.6	82.4	92.2	89.6	88.8
Weaning %	82.9	85.1	75.1	76.9	83.1	85.1	81.4

* Some of the observed farms are represented in more than one year, thus reducing the total number of farms in the study from 62 to 47.

NB Some does are represented in more than 1 year for data from observed farms, and possibly from survey farms.

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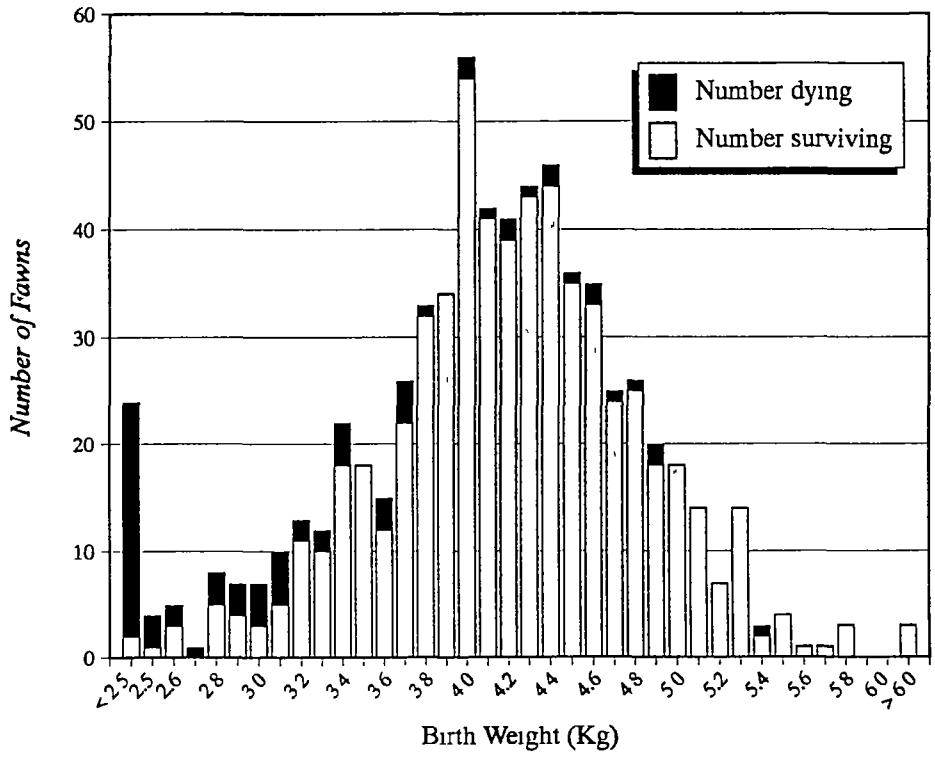
Table 2 Categorisation of necropsy results for fallow deer fawns dying perinatally

Classification category	Number of necropsies	% of total necropsies	Mean birthweight (kg)	M :F ratio
1A	16	11.1	1.99 ± 1.05 (9)	6 : 3
1B	6	4.2	3.80 ± 0.48 (4)	3 : 0
1C	7	4.9	3.43 ± 0.87 (7)	5 : 2
1D	4	2.8	1.38 ± 0.25 (4)	1 : 3
2	3	2.1	3.80 ± 0.14 (2)	1 : 1
3	11	7.6	3.31 ± 0.88 (7)	5 : 2
4	62	43 1	2.86 ± 0.84 (22)	10 :12
5	7	4.9	4.20 ± 0.80 (5)	3 : 2
6	14	9.7	4.02 ± 0.62 (6)	4 : 2
7	2	1.4	2.90 ± 0.71 (2)	1 : 1
8	12	8.3	- -	3 : 2
Total	144	100.0	3.01 ± 1.07 (72)	42 :30

FIGURE 1



sporadic attack from predators, outbreaks of disease and infertility or sub-fertility of breeding bucks can be responsible for catastrophic weaning performances that are difficult to explain if careful monitoring of breeding herds is not maintained.

Birth and Weaning Weights

The mean birth weights and weaning weights for male and female fawns were 4.23 kg ± 0.72, 4.01 kg ± 0.61, 21.2 kg and 18.7 kg respectively, with the mean birth to weaning interval being 108.4 days ± 4.9. Fawn birthweights generally approximated 10% of the pre-rut weight of their mother. Growth rates of male fawns from birth to weaning were significantly higher ($p<0.01$) than for female fawns, and the growth rates were significantly ($p<0.01$) different between years. Growth rates for male and female fawns from birth to 12 months of age were 110 g/d and 90 g/d respectively. The sex ratio at weaning was 1:1 over the six years of study.

The birthweight data are similar to those of Asher (1988) who quotes male fallow fawns averaging 3.8-4.2 kg and females averaging 3.6-4.0 kg in the only other significant study of farmed fallow deer. In the present study fawns from 2-yo does approximated 10% of doe pre-rut liveweight as did fawns from older does and this result varies from data of Asher (1988) who recorded that birthweight of fawns from 2-yo does was as little as 7% of the pubertal weight of the dam. It has been clearly established that viability of fallow fawns is directly linked to low (< 3.0kg) birthweight (Asher *et al.,* 1981, Asher and Adam 1985, Asher 1985, 1988, Mulley 1989, Mulley *et al.,* 1990a). It is therefore imperative that adult does be in excess of 40 kg and 2-yo does in excess of 35 kg at joining if their fawns are to have a reasonable chance of survival. This is graphically demonstrated in Figure 1 where it can be seen that 45.1% of fawns weighing 3.4 kg or less at birth do not survive the first week of life, compared with only 4.2% of fawns weighing more than 3.4 kg. Doe pre-rut weight has been shown to increase with age (Mulley *et al.,* 1990a) but fawn birthweight remains a constant proportion of doe pre-rut weight.

Perinatal Mortality

Perinatal mortality was a major cause of economic losses on fallow deer farms in the present study, and is thought to have accounted for between 10% and 20% of fawns born. This figure is derived by subtracting the number of fawns weaned from the number of does mated. However, recent data for conception rates in commercial herds suggests that as many as 10% of does may not conceive in some years. Of the 144 fawns that died and were presented for necropsy (Table 2), low birthweight (<3kg) was determined to be a major contributing factor in almost 50%, with parturient deaths contributing a further 11.1%. A range of other causes of death, including infectious agents and misadventure, made up the remainder.

Hot summer conditions that often prevail in NSW at the time of fawning exacerbated the problem of low birthweight in some fawns in the present study. Provision of shelter in fawning paddocks is essential if the number of fawns dying from exposure/dehydration/starvation is to be minimised. The range of causes of death, and the proportion of fawns dying in the perinatal period were similar to those reported by Asher (1985b), with the exception that very few fawns died from misadventure as a result of fence hanging, and there were no abortion storms resulting from leptospirosis as was reported in the New Zealand study.

Rearing Performance

In a study of 752 does that had between 1 and 8 opportunities to rear fawns there was an increasing proportion that failed to rear a fawn to weaning age as the number of opportunities increased, although most does (93.6%) only failed on one occasion. There was no significant affect of doe age on rearing performance (Table 3) and the relative risk

of subsequent rearing failure, following failure to rear a fawn at the first opportunity, was calculated to be 1.23. Hence it is apparent that rearing failure is not as heritable as in some other species (Haughey *et al.,* 1985).

A small percentage of does failed repeatedly to rear a fawn and at slaughter the presumed causes of reproductive failure included pyometron, cystic ovaries, cervical cysts, a vulval neoplasm and salpingitis.

Most doe fawns attained liveweights of between 35 kg and 38 kg by the time that they were mated at 16 months of age, and 88% of these (n=243) reared their fawns to weaning. This weaning rate for 2-year-old does compared with 84% for older does. Carcass weights attained by fallow bucks 12 to 20-months-old ranged from 25kg to 32 kg.

Conception Rates

Diagnosis of pregnancy has rarely been practised on commercial fallow deer farms because of a perceived lack of need in such a fertile animal, and because techniques applied to other domestic species were not as readily adaptable to deer. Calculation of reproductive rates has usually been based on the assumption that most does conceive in any one year, and that subtraction of the number of fawns at weaning from the number of adult does joined gave a reasonably accurate prediction of the extent of neonatal mortality. Recent results using ultrasonography as a tool for early detection of pregnancy (Mulley *et al.,* 1987, Asher *et al.,* 1990) indicate this to be a reliable technique which will now allow accurate assessment of pregnancy rates.

The ultrasound equipment most suitable for use with fallow deer consists of a real-time mechanical sector scanner with a 5 MHz rectal transducer. Positive pregnancy can be ascertained with absolute accuracy beyond 50 days gestation, with positive diagnosis between 30 and 50 days also possible in some animals. Results obtained in 1990 (Mulley and Mylrea, unpublished) on commercial fallow and red deer farms have confirmed the results of Mulley *et al.,* (1990b) that within their reproductive life farmed fallow deer usually have at least one "reproductive spell", and occasionally more. Small well husbanded herds often had high conception rates but large herds had up to 10% of does non-pregnant. These results demonstrate a further area of reproductive wastage that requires immediate investigation.

Conclusions

The management requirements and some performance characteristics of fallow deer are now known. This establishes a basis from which individual farmers can establish realistic production targets and manage their animals in such a way that they achieve their potential as producers of high quality venison.

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Table 3 Lifetime rearing performance of fallow does of known age

Age of does (years)	2	3	4	5	6	7	8	9	Total
Number of does	14	77	43	21	64	18	3	3	243
Rearing opportunities	1	2	3	4	5	6	7	8	
Successfully reared fawn to weaning on all occasions	8	64	25	12	41	7	0	2	159
Failed to rear fawn to weaning on one or more occasions	6	13	18	9	23	11	3	1	84
Failed to rear on two or more occasions	0	5	6	3	9	7	2	0	32

APPENDIX 1

CLASSIFICATION (TO 7 DAYS OF AGE)

CATEGORY 1 Stillborn (not breathed)/Premature

1A Anteparturient death - no evidence of birth trauma (includes abortion and prematurity).

1B Parturient death - birth trauma obvious.

1C Parturient death - no obvious birth trauma.

1D Premature - breathed.

CATEGORY 2 Birth trauma - lungs aerated

Birth trauma - particularly subcutaneous oedema and meningeal haemorrhage. Not suckled, not metabolised fat. May not have walked.

CATEGORY 3 Misadventure

Other trauma. Probably suckled and walked. May have history of accident, e.g. caught in fence. Fat metabolised to varying degree. Includes predation.

CATEGORY 4 Exposure/Starvation

Will have breathed. May or may not have walked and fed. Fat metabolised to varying degree.

Will include low birth weight (non viable) fawns, too weak to suck.

May not be able to separate maternal factors, e.g. actual mismothering (desertion), blind teats, etc. from foetal factors such as low birth weight and environmental factors, e.g. high ambient temperatures.

CATEGORY 5 Mismothering

Maternal factors definitely identified, i.e. death of mother, blind teats, desertion etc.

CATEGORY 6 Infections

Will have breathed, walked and suckled. Positive bacteriological findings with associated lesions.

May have tag = known age.

CATEGORY 7 Malformations

CATEGORY 8 Undiagnosed

Due to decomposition, scavenging of carcases.