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Deer Master Report to the NZ Deer Industry February 1999

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Introduction

Deer Master is a three year Research and Technology Transfer Programme undertaken by the South Canterbury and North Otago Deer Farmers Association.

Background information on the specific activities and issues such as structure and funding have been reviewed in a previous Deer Branch Proceeding [1]. The purpose of this paper is to discuss the investigations/trials and results relating specifically to the topics of:

1. "Herd Conception Profiling"
2. Conception date as affected by both age of the hind and body condition score.
3. Conception rate of single sire larger mating mobs.
4. Vitamin B12 investigations.
5. Parasitism

1. "Herd Conception Profiling"

Rectal ultrasonograghic scanning has been an integral part of the Deer Master programme. Scanning with the 5mHz scan head is the only practical method available to determine age of the foetus in deer at 35-65 days of gestation (late May and repeat on scan negative hinds in late June).

By way of background a significant number of the Deer Master properties have high conception rates in mixed age hinds (e.g. 95-100%).

The identification of those relatively few dry hinds is valuable but the value of scanning can be greatly enhanced by ageing the foetus as well.

Ageing is accomplished by making specific anatomical measurements of the ultrasound image of one or more specific landmarks of the conceptus. The tables for converting anatomical measurements into age have been compiled and published by Revol and Wilson, Massey University [2]. The outcome of individually ageing each conceptus builds up a "Herd Conception Profile", unique to that property (Figure 1).

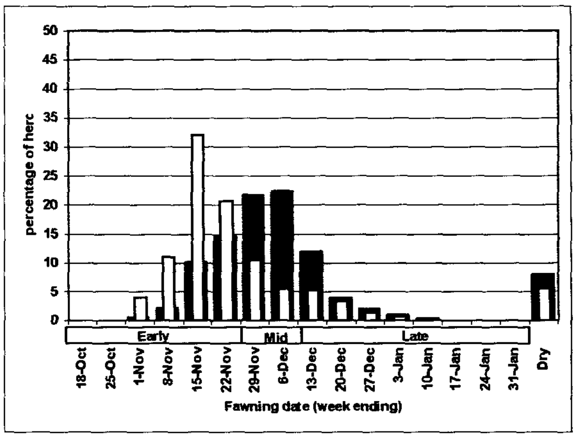
This profile can then be used to gauge both herd and individual age group performance within that year, between years as the Herd Profile continues and compared to other properties in a bench marking process.

Rectal Scanning and restraint of the hind in a crush has not been associated with foetal losses. Indeed the Deer Master Programme can only attribute *in utero* losses over the whole period of pregnancy to approximately 1%. The following sections of this paper outline the use of Herd Conception Profiles. The graphs are based on Kaplan Meirer analysis.

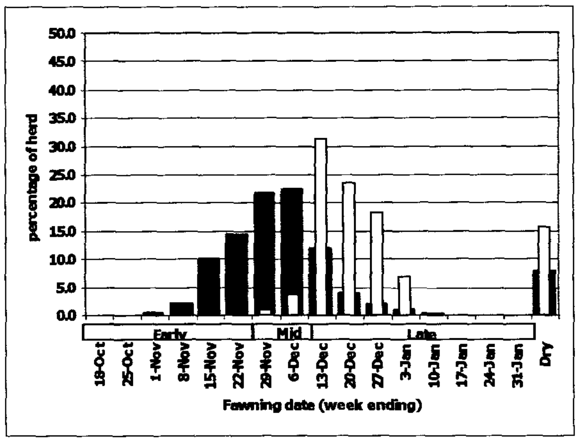
These profiles can be used by the farmer to evaluate where their herd performance lies in relation to other farms. In this way, the potential for improvement can be quantified in more precise terms than by using pregnancy percentages only. Thus, pregnancy profiling uses the dimensions of both time and quantity. The influence of calving date on weaning weight is well known. If it can be demonstrated that a median calving date can be advanced by 7 days, it can be predicted that the median weaning weight would be approximately 2.5 kg heavier in optimum grazing conditions. This would equate to an increase of approximately $6-7 per weaner, independent of the pregnancy percentage *per se*.

It is proposed that adoption of pregnancy profiling presents a significant opportunity for vets to add value to the process of pregnancy scanning.

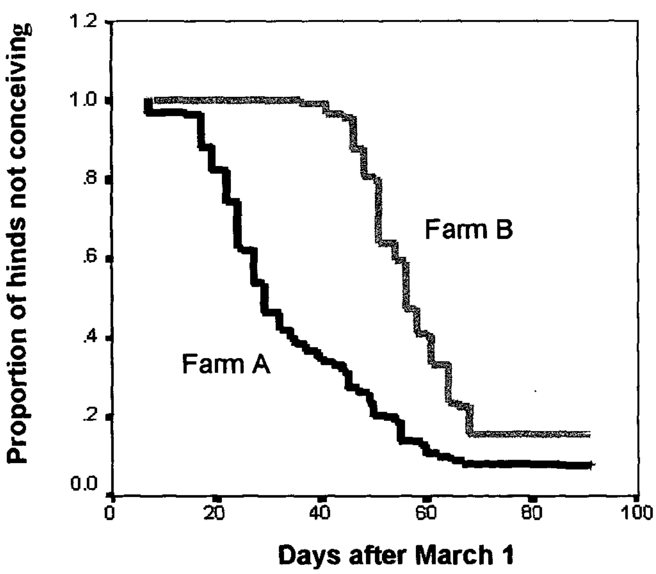
Figure 1. *Comparison of two extreme Herd Conception Profiles from different farms for the 1997 & 1998 years from the Deer Master Information, comparing Conception Percentage and Time after 1st March. (% of deer conceiving within each time period (open bars) compared with averages of all farms).*



Farm A



Farm B



Conception pattern for the 2 herds in the previous bar charts

Farm	Mean conception date	*n*
A	Apr 1	425
B	Apr 30	114

2. Conception date as affected by age of hind and body Condition Score

The data set developed by Deer Master records data down to the individual hind/stag level. Other schemes have been developed which record data at a herd level, but the value of individual animal data becomes apparent when analysing variables such as age affect on conception variables.

Deer Master over the three years of activity has adopted the Body Condition Score System as developed by Audigé *et al* (1998).

This scale measures the body condition regardless of body weight by objective appraisal by palpation, on a score of 1-5, with 5 being the highest score for condition.

Hinds are routinely scored pre-calving, pre-mating and at other intervals dependent on Deer Master farmer members such as post mating at scanning time.

2.1 Age of hind effect on conception

Figure 2.1 *Herd Conception Data Profile over time of all hinds during 1997 and 1998 on one property from Deer Master data, separated by age. This graph shows the proportion of hinds conceiving at various time intervals from March 1.*

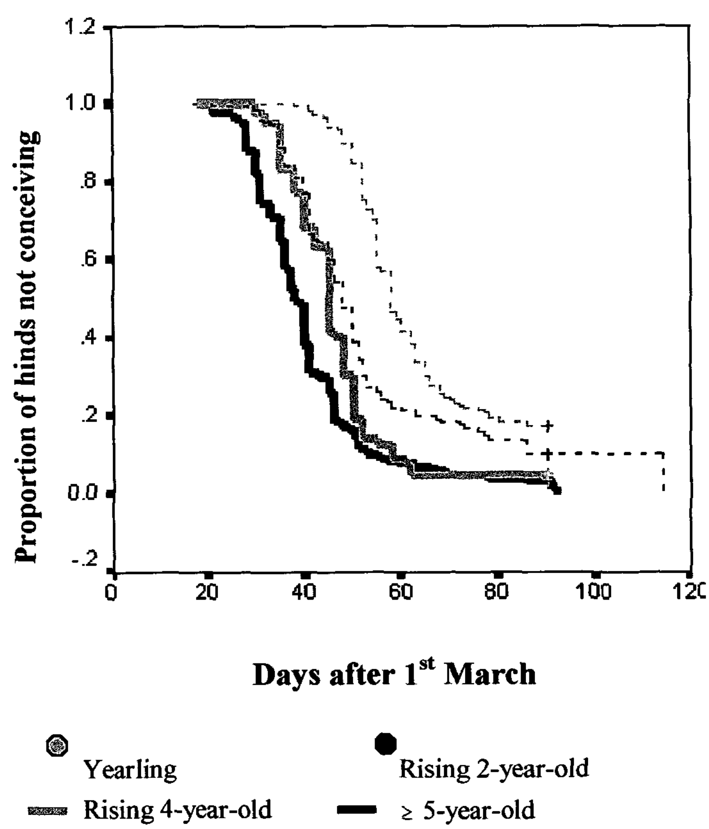


Table 1. **Mean conception date and % for deer of different ages on one farm (the conception profiles for each age group are presented in Figure 2.**

Age	Mean conception date	Dry	*n*
R2YO	May 2	35 (17.4%)	201
R3YO	Apr 24	16 (9.5%)	169
R4YO	Apr 16	4 (5.1%)	79
MA	Apr 10	14 (3.1%)	449

The data set contains approximately 900 red hinds and resultant scan information over two years of 1997 and 1998.

The effect of increasing age being related to earlier average conception date is highlighted by this particular data set and analysis.

Not only does data confirm the well recognised delayed average conception date of first calvers (rising 2 years) but also shows the effect of age categories, being clearly different with rising three year, rising four year, and older (mixed age) hinds. After the age of rising four years all the hinds are simply classed as mixed age and within this group further analysis can not be done for this particular data set.

2.2. Body condition score effect on conception date

With the progression of body condition scores the average date of conception is advanced and conception rates increased. The most obvious difference in conception date lies with the rising 2-year hinds. A body condition of 4 or more in rising 2 year hinds resulted in an enhanced average conception date. This is in contrast to data of Audigé *et al.* (1998).

It must be recognised that this analysis focuses only on one point in time and not the dynamic change in score that maybe occurring. As well the analysis ignores any flushing effect achieved through what may be a very short period of appropriate nutrition

Figure 2.2 *Conception Profile over time of all hinds during 1997 and 1998 on all Deer Master properties with appropriate data separated by body condition score (0-2.5: ---- ; 3-3.5: ▬; 4-5 ▬ at mating).*

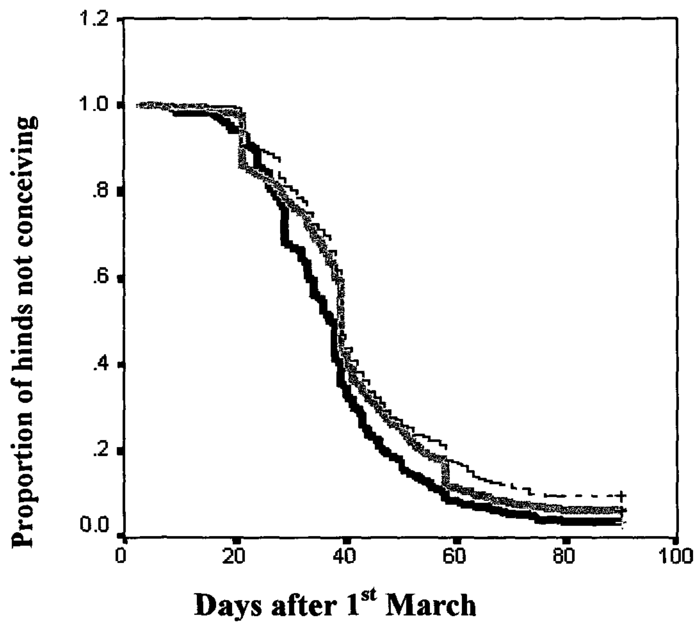


Table 2. Mean conception date and % for adult and rising 2-year-old hinds in each body condition score category (graphed data of conception profile for each category in Figures 2.3 and 2.4).

Age	BCS	Mean conception date	Dry	n
Adult	0-2.5	Apr 12	286 (9.9%)	2885
	3-3.5	Apr 8	236 (5.0%)	4697
	4-5	Apr 7	55 (3.8%)	1455
R2YO	0-2.5	Apr 24	41 (7.7%)	533
	3-3.5	Apr 22	148 (10.7%)	1390
	4-5	Apr 16	4 (2.6%)	157

Figure 2.3. *Conception profile of hinds ≥ 3 years of age with body condition scores 0.25 (dotted line), 3-3.5 (grey line) and ≥ 4 (black line). (All data, all farms over 2 years combined).*

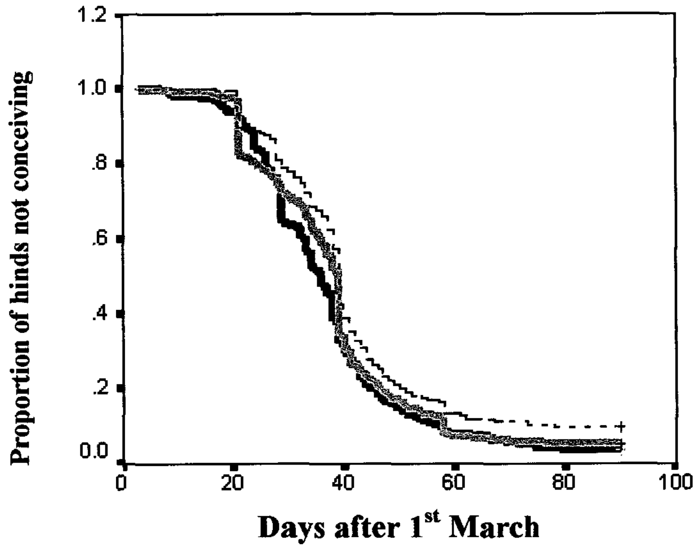
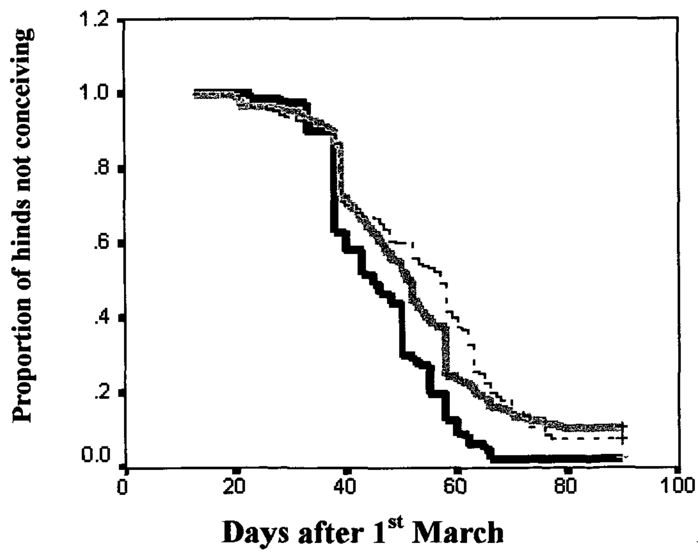


Figure 2.4 *Conception profile of rising 2-year-old hinds with body condition scores of 0-2.5 (dotted line), 3-3.5 (grey line) and ≥ 4 (black line). (All data, all farms over 2 years combined).*



3. Conception rate of single sire larger mating mobs

3.1 Data set description (Figure 3)

Deer Master over the last three years has trialed single sire mating mobs with female herd sizes ranging from 10 to in excess of 120 hinds.

The data set was taken from 86 mating groups with 41 groups in excess of 50 hinds. Included in this data set were hinds that had CIDR treatments but the authors believe that this does not materially change the outcome of this analysis.

The sires surveyed were invariably red stags with an age spread from two – seven years. Wapiti/Elk cross sires were also included at a very low percentage of total sires used.

This data set relates to the 1997 and 1998 mating years with 10784 matings. This data set is an updated version of those presented in any previous publications.

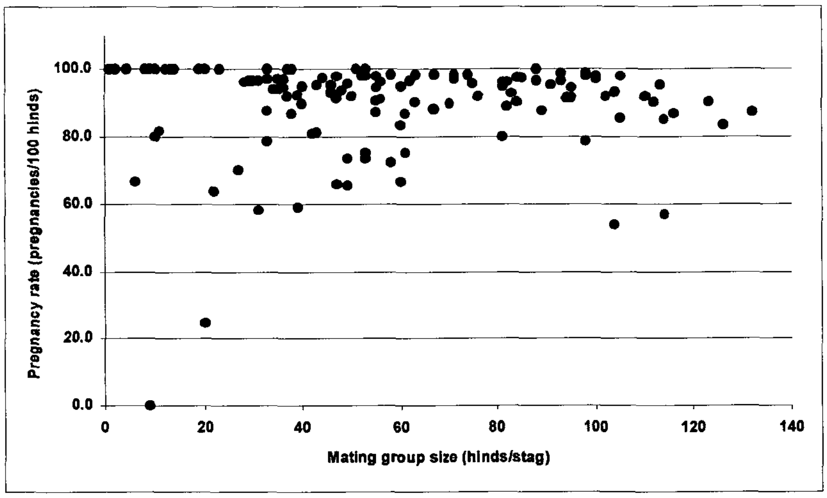


Figure 3. Pregnancy rate of hinds in different sized single sire mating groups for 10,784 hinds over two years from Deer Master records.

3.2 Mating mob size Discussion

Figure 3 demonstrates that hind:stag ratios as high as 100-130 can result in satisfactory conception rates. The conception dates, analysed elsewhere, were not altered.

The risk of a high level of dry hinds in the case of genuine stag failure is a lot higher in mobs of up to 120 than the traditional 30-40. It would therefore be recommended that a back-up sire is used and introduced earlier than the recommended 17th of April if mating soundness problems are suspected.

Confidence is best placed in proven fertile older stags with these larger mobs but two-year-old stags certainly were used successfully in this trial.

Deer Master is uncertain as to what the final ceiling of maximum hind numbers to one stag is. More data is required to confirm trends that may occur as hind numbers increase above 130 per stag.

4. Vitamin B12 investigations

4.1 Background

Sentinel Hinds (10 mixed age, 10 rising 2 year and 10 rising 1 year) have been blood tested biannually at March and October for up to the last three years. Total numbers of animal tests for this data amounted to 1900. Amongst the analytes examined, serum vitamin B12 was included.

The reason vitamin B12 was included related to the previous trials investigating cobalt and vitamin B12 as reported in the deer literature as well as continuing farmer anecdotal evidence of the value of vitamin B12 supplementation in deer.

The results of serum vitamin B12 analysis from the sentinel deer varied considerably (Figures 4.1 and 4.2), within age groups, between age groups and as well as between properties. This data set contains all results from all sentinel hinds for all years, a total of 1900 results.

This raised the following questions;

- Does the field vitamin B12 serum sample accurately represent the animal status as per liver vitamin B12 levels?
- Do transport and associated DSP confinement and other factors alter the serum vitamin B12 levels?
- Does a serum vitamin B12 sample collected at slaughter accurately represent the liver vitamin B12 status?

Figure 4.1. *An example of Deer Master data - a comparison of the mean vitamin B_{12} concentration (pmol/l) of **R1YO** hinds (left), **R2YO** hinds (right), and **adult** hinds (bottom) with the group mean (black) for each age group. This data is available for each participating farmer.*

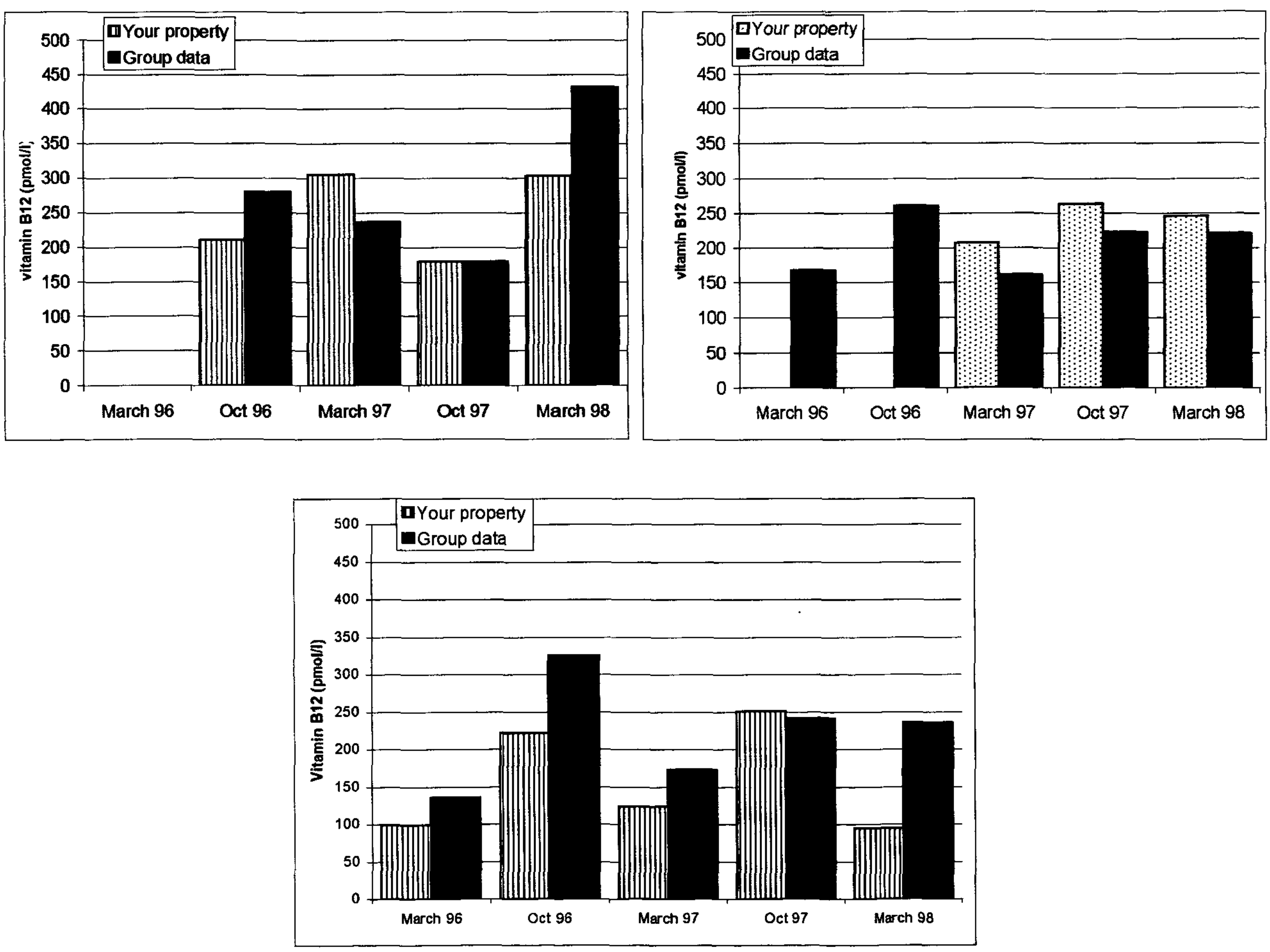
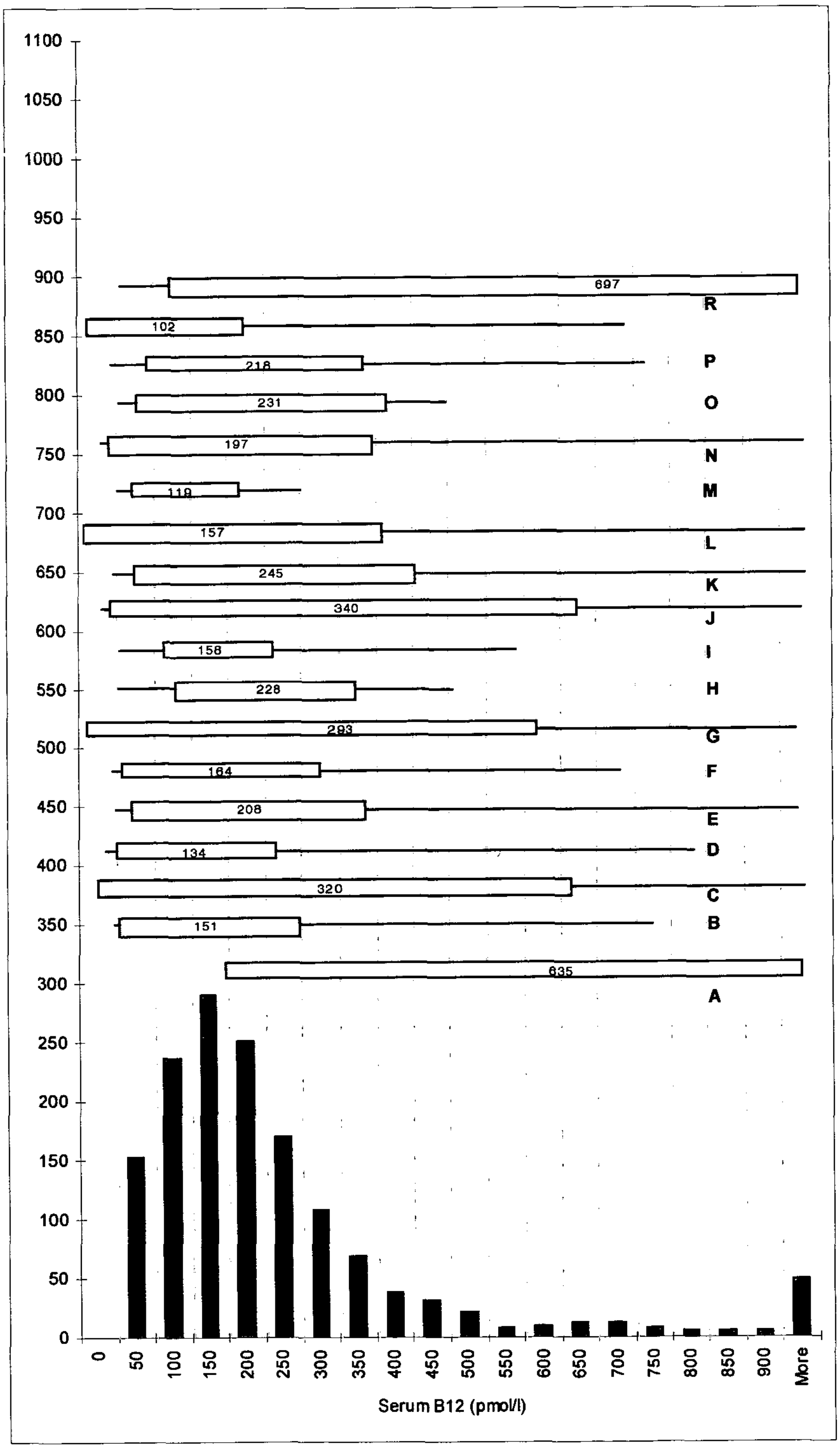


Figure 4.2. *An example of Deer Master Data – a frequency distribution of serum vitamin B12 concentration of sentinel hinds within all herds (histogram) and each property denoted by the letter code a-r. Box and whisker plots represent the sentinel hinds from individual herds where the box represents one standard deviation either side of the mean and the whiskers the total range in values*



4.2 Vitamin B12 trial

One hundred and thirty four deer were selected at slaughter from six herds which contained a range of vitamin B12 levels recorded by routine sentinel sampling. Serum samples analysed for vitamin B12 were collected in the field. A further paired serum and liver sample was collected at time of slaughter. Serum and liver samples were stored frozen while awaiting analysis.

Figure 4.3 indicates that a mathematical relationship could be calculated between serum vitamin B12 taken as a field sample and serum vitamin B12 taken at the DSP at time of slaughter.

The broken line represents a one to one relationship and therefore the two data sets are not perfectly identical. It appears that serum vitamin B12 is elevated when collected at Deer Slaughter Premises (DSP).

However, this variation does not seem to prevent accurate prediction of vitamin B12 status by collecting serum at the DSP as long as this mathematical relationship is applied to the result.

Figure 4.3. *Relationship between vitamin B12 concentration in serum collected in the field and at the Deer Slaughter Premise. The broken line represents a one to one relationship.*

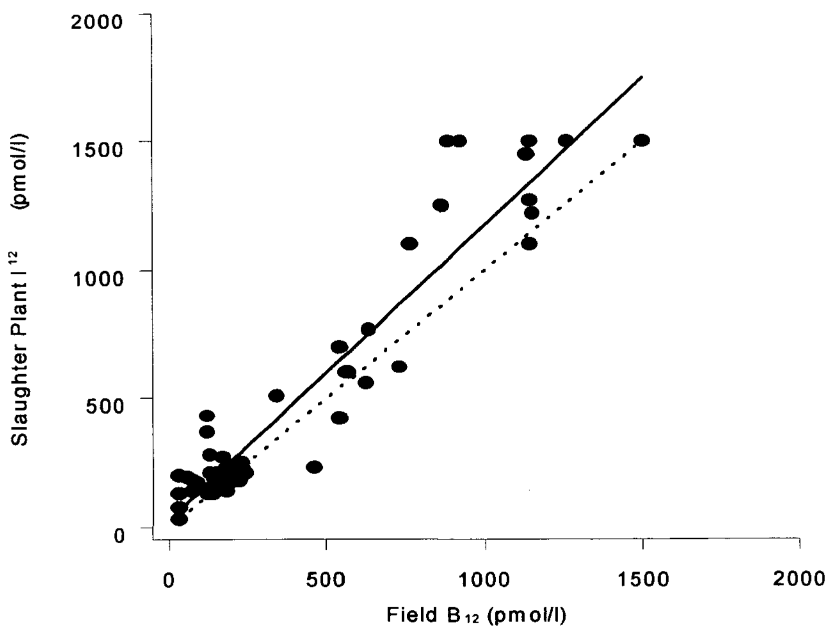


Figure 4.4 *Relationship between field serum vitamin B12 concentration and liver vitamin B12 concentration.*

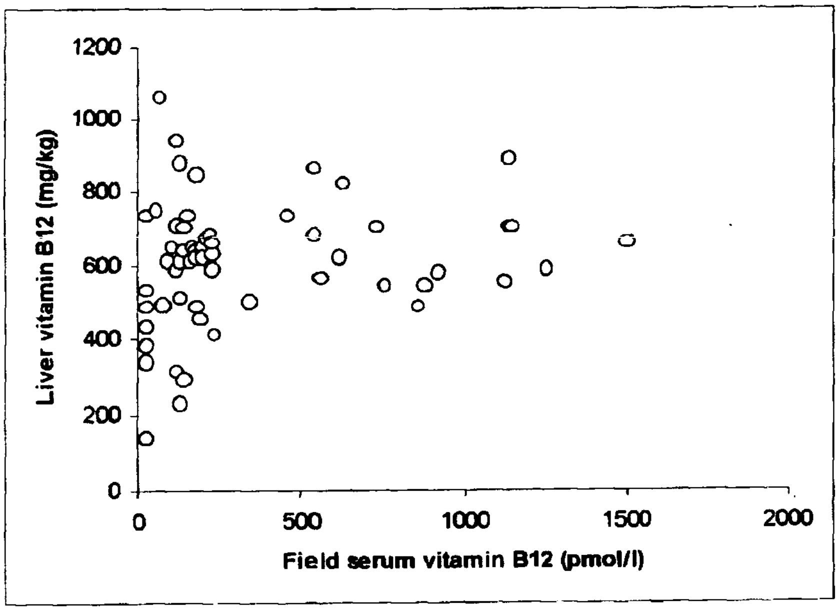
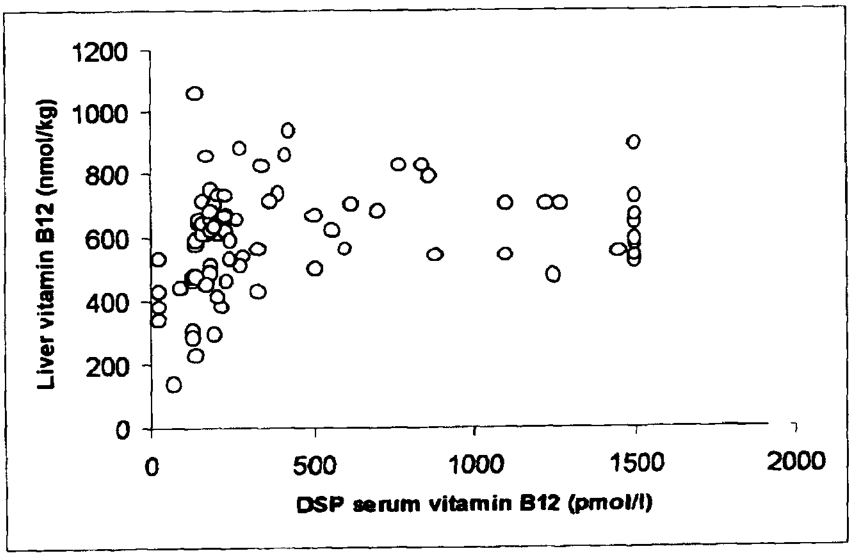


Figure 4.5 *Relationship between Deer Slaughter Premise serum vitamin B12 concentration and liver vitamin B12 concentration.*



Deer Master recommends that at best this relationship between liver and serum vitamin B12 is taken as a base indicator for further trial work before this relationship becomes an industry normal.

5. Parasitism trial and Results

5.1 Parasite trial Protocol 1

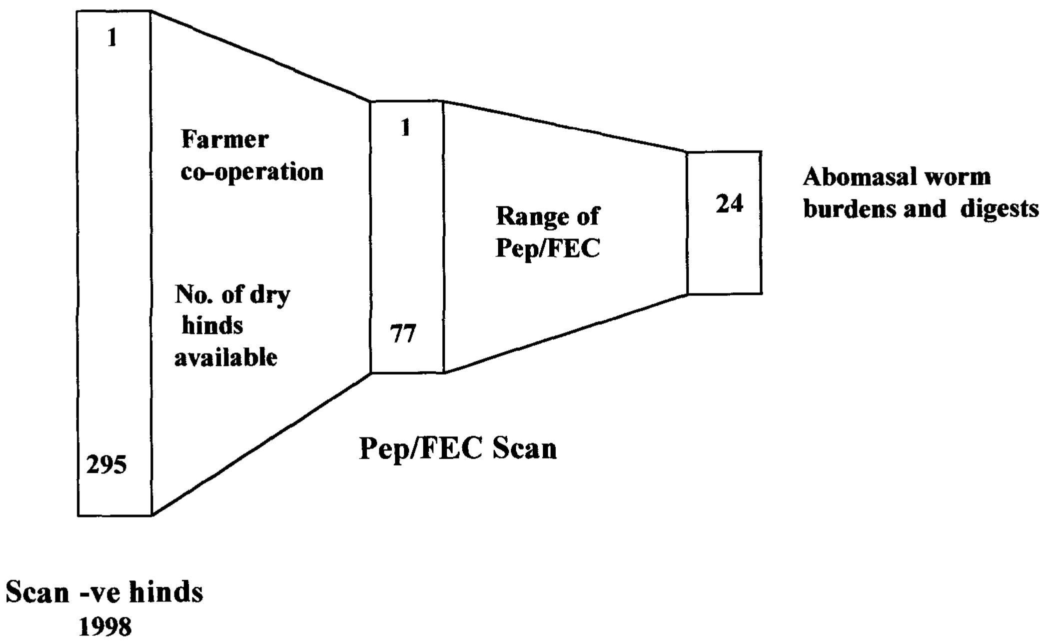
Introduction

Deer Master has received anecdotal reports and evidence of enteric parasitism occurring mid-winter in red hinds. To gauge the presence and level of any enteric parasites the following protocol was adopted.

Materials and Methods

The selection procedure for animals for this trial was at two levels (Figure 5.1). Initially hinds were selected from those identified as scan negative from the current pregnancy scanning programme with a minimum of 7 and a maximum of 20 hinds per property. The study aimed to include as many properties as possible. Where more than 20 scan negative hinds occurred on a property; animals were selected on a random basis.

Figure 5.1. *Selection procedure for hinds on which abomasal counts were recorded.*



Within the constraints of farmer co-operation and availability of dry hinds 77 were selected.

At this stage a blood and faecal sample were taken from all selected animals. A subset of 24 deer on which abomasal worm counts were carried out was selected based on the outcome of the pepsinogen and faecal egg counts (FEC) of individuals. Deer in this subset were selected to give a range of pepsinogen levels and FEC which would most likely enable a good estimation of the relationship between worm burdens, FEC and pepsinogen levels.

Information collected - field

Blood samples for pepsinogen analysis and faecal samples for faecal egg counts were collected in the field and submitted to Invermay Animal Health Lab.

Information collected - DSP

The 24 deer selected for abomasal counts were slaughtered. At slaughter, faecal samples were taken for larval culture and FEC and blood samples were collected for a second pepsinogen analysis. The abomasum was removed and sent to Invermay Animal Health Lab for determination of adult and 5th stage larval infestations and for pepsin digest to establish the number of 4th stage larvae.

Table 5.1 Individual hinds, age and adult abomasal parasites

Age	Abomasum (adult)		
	Ost	Trich	Total
R2	0	0	0
R2	700	0	700
R2	3600	5400	9000
MA	0	0	0
MA	0	0	0
R2	0	0	0
R2	600	0	600
R2	200	100	300
R2	4000	500	4500
MA	300	100	400
R2	400	600	1000
R2	400	300	700
R2	400	2100	2500
R3	0	200	200
R2	300	0	300
MA	0	0	0
MA	800	200	1000
R2	400	500	900
R2	300	0	300
R2	700	0	700
R2	600	300	900
MA	700	300	1000
R2	0	0	0
R2	0	400	400

Table 5.2. Individual hinds, age, abomasal larval parasites and pH

Age	Abomasal digests (Ost)				Abomasal digests (Trich)				
	5th	*4th*	*3rd*	*Total*	*5th*	*4th*	*3rd*	*Total*	*pH*
R2	0	0	100	100	0	0	0	0	4.54
R2	0	0	2100	2100	0	0	0	0	2.99
R2	0	200	6600	6800	0	0	100	100	6.19
MA	0	0	0	0	0	0	0	0	4.89
MA	0	0	0	0	0	0	0	0	5.92
R2	0	0	7100	7100	0	0	0	0	4.3
R2	0	100	7000	7100	0	0	0	0	4.88
R2	0	600	600	1200	0	0	0	0	5.3
R2	200	900	26800	27700	100	0	0	0	5.25
MA	0	0	1500	1500	0	0	0	0	4.09
R2	0	100	7300	7400	0	0	0	0	4.13
R2	0	200	20	220	0	0	0	0	5.86
R2	0	200	4200	4400	0	200	0	200	6.1
R3	0	0	1300	1300	0	0	0	0	4.27
R2	0	200	5700	5900	0	0	0	0	5.49
MA	0	0	1200	1200	0	0	0	0	4.69
MA	0	100	200	300	0	100	0	100	4.72
R2	0	100	7100	7200	0	0	0	0	5.69
R2	0	0	1400	1400	0	0	0	0	5.44
R2	0	100	7200	7300	0	0	0	0	4.04
R2	100	200	8300	8500	0	0	0	0	5.24
MA	0	200	700	900	0	0	100	100	
R2	0	0	0	0	0	0	0	0	4.69
R2			9100	9100	0	0	0	0	6.24

Results and Discussion

Adult abomasal and larval stages of parasites

Abomasal worm counts ranged from 0 to 900 (Table 5.1) and total worm number and arrested stages from 0 to nearly 28 000 (Table 5.2). Of the 24 deer surveyed 25% did not contain adult worms and 13 % contained no arrested stages. Without exception those hinds found to have adult worms also had arrested stage larvae, but there were three hinds which did not have adults but were found to have arrested stage larvae. The average worm burden of those individuals with adult worms was 1411 and for arrested Ostertagia, 5177.

This investigation shows that both adult and arrested larval stages of parasites can be found mid-winter in the abomasum of scan negative mixed age and rising 2-year-red hinds.

While the numbers of both adult and immature parasites seem high, the significance is unknown and therefore the value of anthelmintic treatment to clear this infestation is also undetermined.

The pH values (at post mortem) are included as reference data for any other research projects.

Pepsinogen

The two pepsinogen values listed pre-slaughter, collected on farm and at slaughter, were separated by approximately three weeks on average.

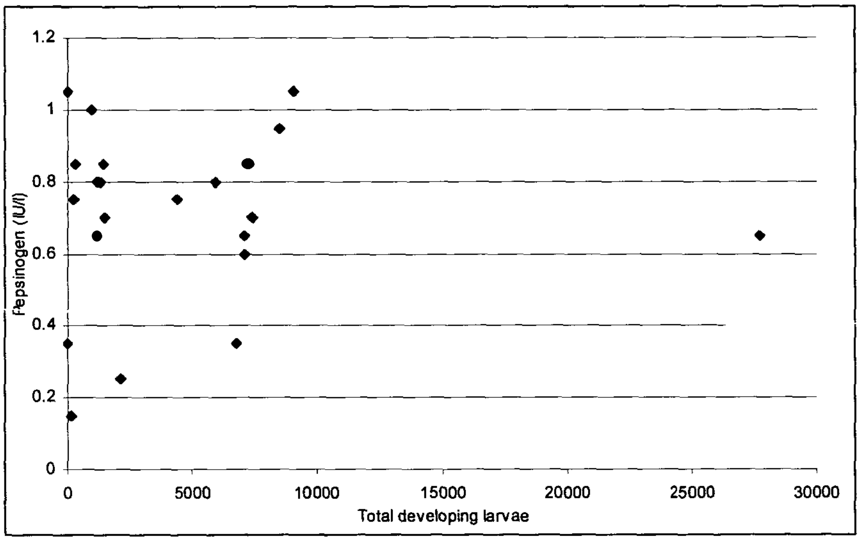
Table 5.3 and Figure 5.2 do not indicate a clear relationship between the pepsinogen and parasite levels for individual hinds.

Taken on a property basis there does seem to be some predictive value from mean pepsinogen values to indicate an overall parasite status of the hinds as a group. This relationship requires further evaluation.

Table 5.3. Individual hinds, age and pepsinogen.

	Pepsinogen		
	Field	DSP	Mean
R2	0.1	0.2	0.15
R2	0.3	0.2	0.25
R2	0.5	0.2	0.35
MA	0.4	0.3	0.35
MA	0.1	0.6	0.35
R2	0.6	0.6	0.6
R2	0.7	0.6	0.65
R2	0.6	0.7	0.65
R2	0.9	0.4	0.65
MA	0.9	0.5	0.7
R2	0.6	0.8	0.7
R2	1.1	0.4	0.75
R2	0.7	0.8	0.75
R3	1.2	0.4	0.8
R2	1.1	0.5	0.8
MA	1.1	0.5	0.8
MA	1.2	0.5	0.85
R2	1.2	0.5	0.85
R2	1.1	0.6	0.85
R2	0.8	0.9	0.85
R2	1.0	0.9	0.95
MA	1.2	0.8	1
R2	1.4	0.7	1.05
R2	1.3	0.8	1.05

Figure 5.2. *Plasma pepsinogen concentration of individual hinds with varying larval worm counts.*

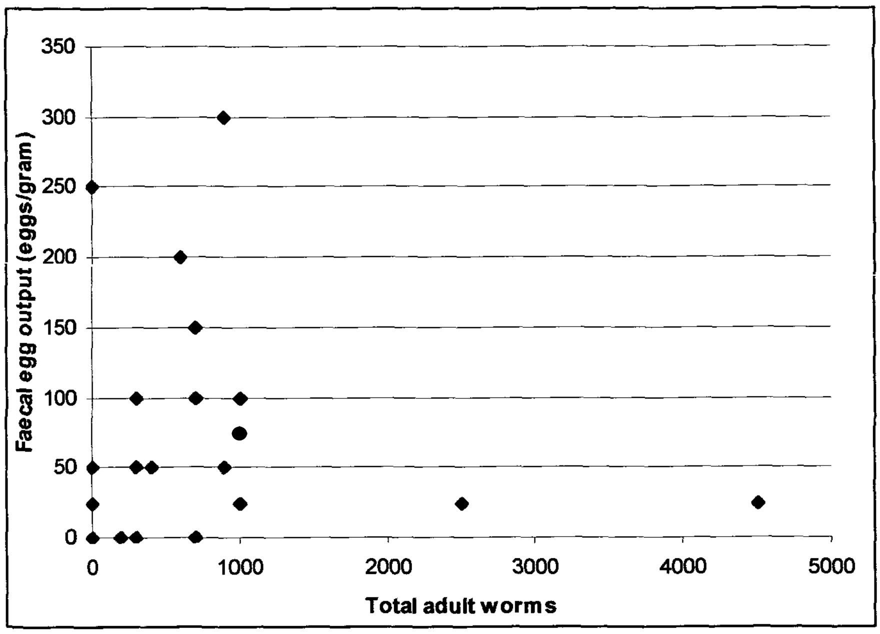


Faecal egg count

Table 5.4. Individual hinds, age, faecal egg count (pre- and at slaughter).

Age	Eggs/gram	
	Field	*DSP*
R2	0	0
R2	100	100
R2	200	1800
MA	0	0
MA	0	50
R2	200	300
R2	100	300
R2	0	0
R2	0	50
MA	0	100
R2	100	100
R2	0	0
R2	0	50
R3	0	0
R2	100	0
MA	0	500
MA	0	50
R2	100	0
R2	0	200
R2	200	100
R2	300	300
MA	100	50
R2	100	0
R2	0	100

Figure 5.3. *Faecal egg output of individual hinds with varying total adult worm populations.*



All the data presented, and especially Figure 5.3, indicate that there is no clear relationship between the faecal egg count of individual hinds and total adult worms. However, taken on a property basis there does seem to be some predictive value from massed faecal egg counts as an indicator of overall parasite status of the hinds as a group. This relationship needs further study.

5.2 Parasite Protocol 2

Introduction

Given the presence of both adult and immature enteric parasites in dry hinds slaughtered mid-winter, Deer Master investigated the timing of possible transmission to offspring. The period investigated was the time of perceived stress during late pregnancy and early lactation of the hind.

Materials and Methods

Deer well accustomed to human interference were used in the study. A faecal sample (>10g) was taken from each hind (n=13, 11 wet and 2 dry) at approximately 1-2 weekly intervals from October until late December (Figure 5.4). Samples were analysed for faecal eggs.

Faecal egg counts were carried out at a dilution rate of 1:100 with each egg counted representing 100 eggs per gram of faeces.

Figure 5.4. *Timing of faecal egg counts in this study in relation to the fawning period for 13 deer.*

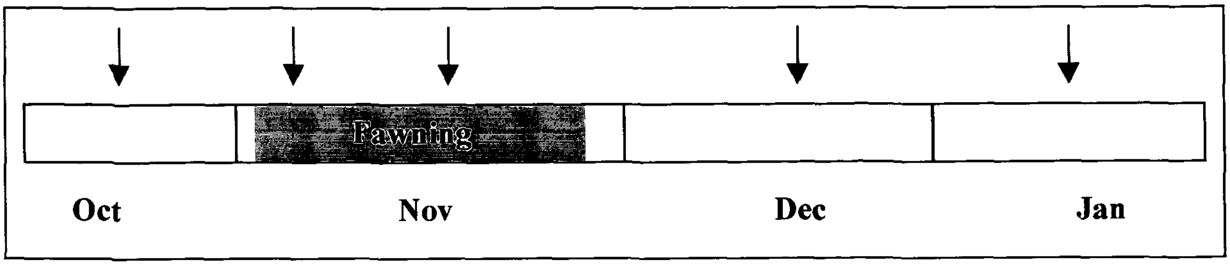


Table 5.5 Faecal egg counts (eggs per gram) of 11 pregnant and 2 non-pregnant deer before, during and after fawning. Animals shaded fawned on or before 5th November while the remaining hinds had all fawned by the 22nd November.

ID	Preg. status	Faecal eggs counts (eggs/gram)				
		23/10	*8/11*	*15/11*	*22/11*	*7/12*
35	Wet	0	0	0	100	0
37	Wet	0	0	0	0	0
79	Wet	0	0	0	0	0
81	Wet	0	0	100	0	0
82	Wet	0	100	0	0	0
84	Wet	0	0	0	0	0
86	Wet	0	0	200	0	0
5003	Dry	0	0	0	0	0
5004	Dry	0	0	0	0	0
5005	Wet	0	0	0	0	0
NT	Wet	0	0	0	0	0

Results and Discussion

There did not appear to be an elevated count above zero before calving, nor a consistent increase in faecal output through the early stages of lactation in mature red deer hinds. Although eggs were present in some samples they did not occur in consecutive samples. These counts are considerably below those found in periparturient sheep.

From the 11 wet hinds over five sampling periods only four samples contained faecal eggs and these were all from different hinds. Those positive counts were only 100-200. This could mean that a more sensitive dilution of 1:25 may be more appropriate for this low egg count data in any future work, although at such low levels, pasture contamination to pose a threat to the new calf would seem minimal.

While these results suggest a periparturient rise in egg count does not occur in deer, further work needs to be completed in late lactation which may be a more stressful time for the hind, allowing through immune suppression greater egg output.

References

Audigé WLM, Wilson PR, Morris, RS (1998). A body condition score system and its use for farmed red deer hinds. NZ J Agric Res **41**, 545-53.

Campbell. A. C. (1998) Deer Master-What is it? *Proceedings of a Deer Course for Veterinarians no15*. pp.49-52

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