DEER HERD HEALTH AND PRODUCTION PROFILING : PRELIMINARY RESULTS

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The background to this paper and the methods used for this Deer Herd Health and Production Profiling study are presented in the previous paper in this proceedings (Audigé et al., 1993). The amount of data that was collected at the time of writing was substantial and most required validation before statistical analysis. Thus, the results presented in this paper are preliminary. More detailed analysis and results will be published in due course. The following tables and figures are from different areas of investigation to illustrate the type of results this project can produce.

1. Deer population characteristics

1.1 Age distributions

The age distribution of all hinds and stags recorded (excluding weaners) are presented in figure 1. Older deer represented only a small proportion of total herd numbers but many hinds were of unknown age. The age of almost all monitored stags was known. Most of these hinds of unknown age were suspected by farmers to be over 4-5 years old. Between 1992 and 1993, culling occurred at all ages, with increasing rates as hinds got older. The reason for culling within each age category has not yet been examined.

1.2 Blood lines

For each deer, the estimated percentage of New Zealand red, english red, european red and wapiti blood was recorded and deer categorised as described in table 1.

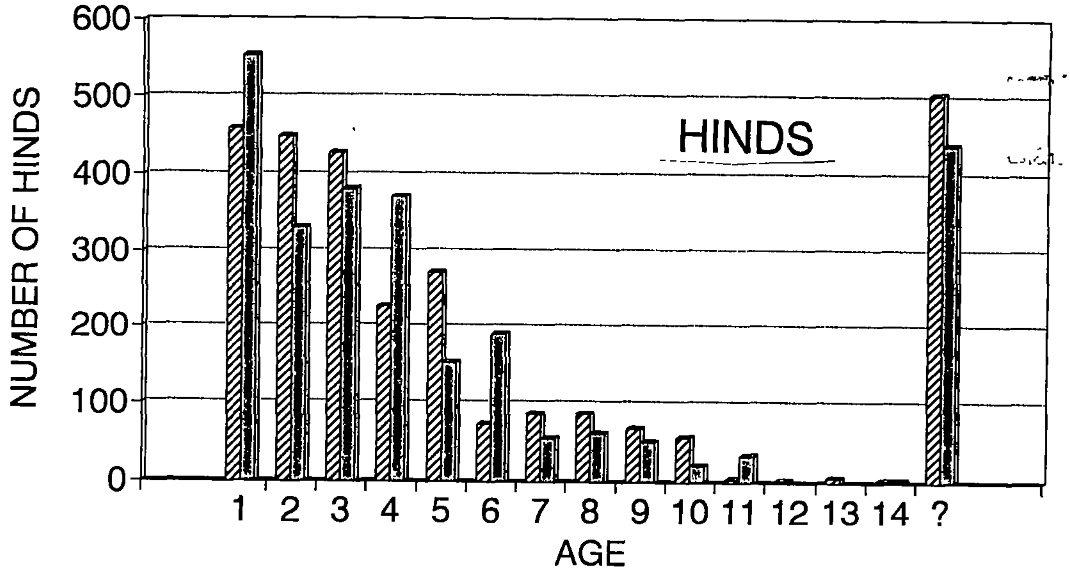
Table 1 : Blood line categories

New Zealand	=	100% New Zealand
English	=	100% english or english-NZ cross-breds
European	=	some european blood other than english
Wapiti	=	100% wapiti or wapiti-red hybrids

From individual data, the mean percentage of each blood line was calculated for each herd. Results are presented for hinds in 1992 and weaners in 1992 and 1993 [Figure 2].

The blood line percentages of each herd of hinds shows that there was almost no wapiti types within the study group. Despite the intensive use of foreign blood lines on some farms, the actual percentage of New Zealand blood remained over 70%. A very large

Figure 1 : Number of deer of each age group used in the survey for 1992 [hatched] and 1993 [shaded], excluding weaner deer.



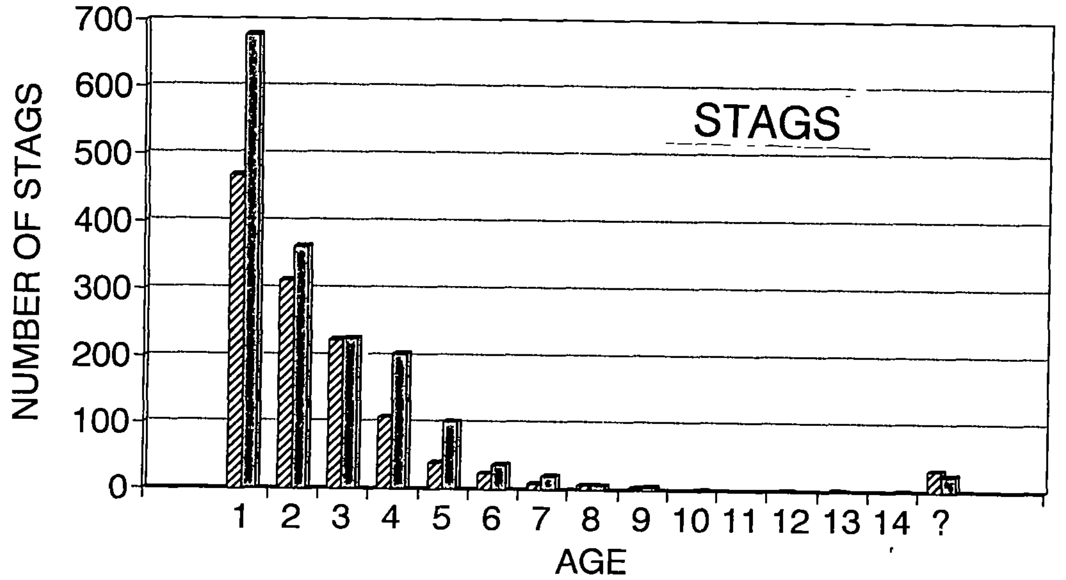
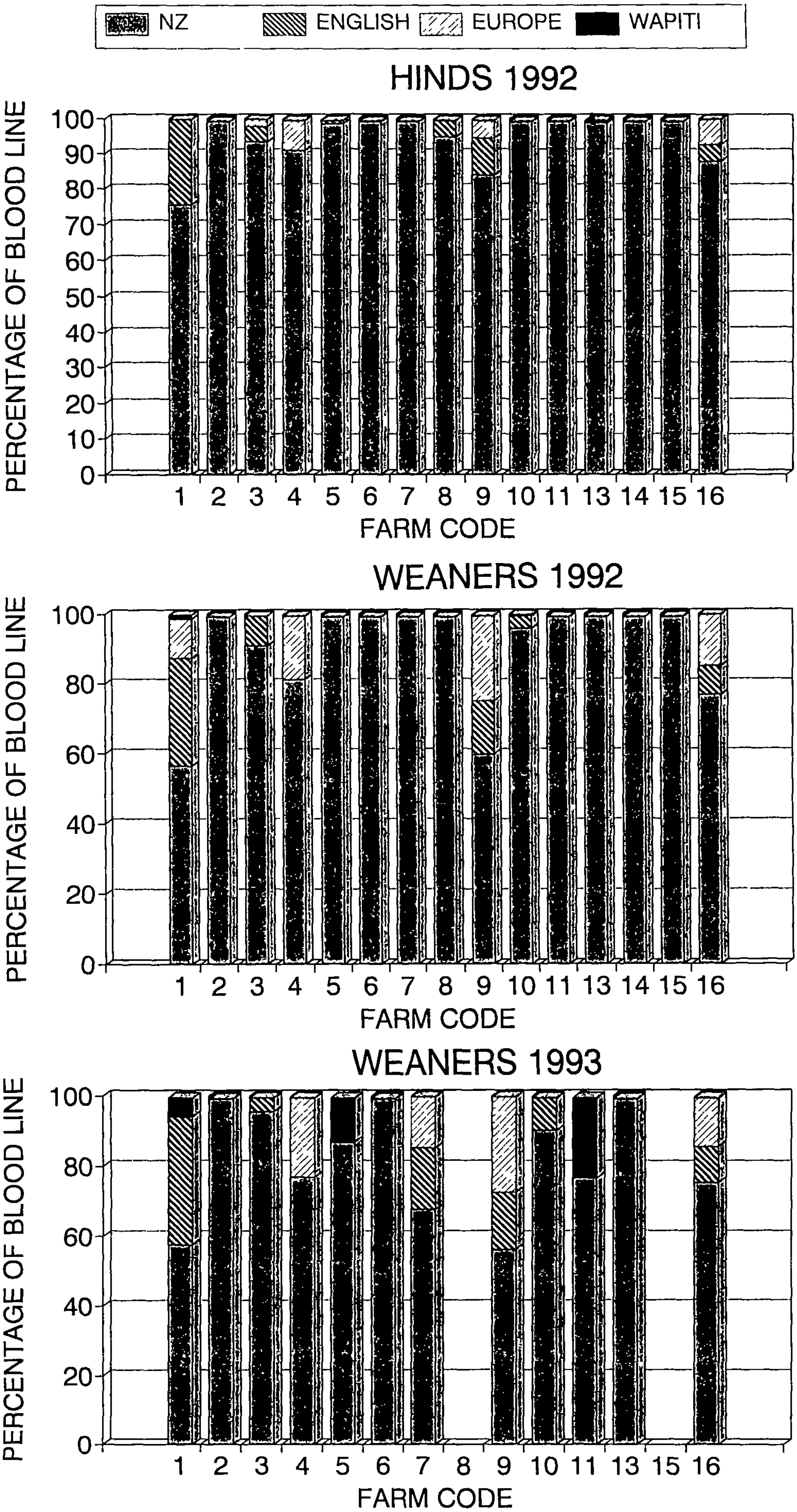


Figure 2 Average percentage of various blood lines within study herds 1992 and 1993



proportion of hinds were 100% New Zealand. The blood line percentages of weaner herds changed from 1992 to 1993. Whereas wapiti blood lines were very limited in 1992 due to the selection of farms, two farmers were using wapiti hybrids as sires introducing wapiti blood in their weaner herds. The amount of english and european blood also increased.

2. Weaner growth

Bodyweights and growth rates of young stags and hinds from weaning 1992 to March 1993 are presented in table 2.

Table 2 : Mean bodyweights (kg) and growth rates (g/d) of weaner stags and hinds, 1992-93

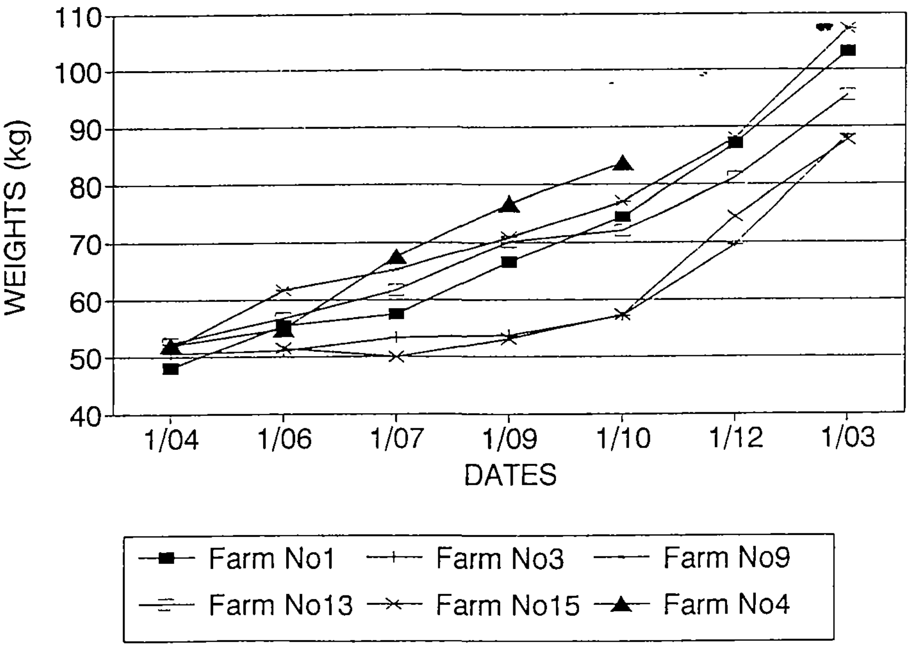
Date	Number of deer	Mean	Minimum	Maximum	SD
WEANER STAGS					
	Weights				
April 1 1992	614	51.2	22.8	67.0	7.0
June 1	661	57.2	32.0	82.0	8.3
July 1	731	58.9	28.9	84.0	9.1
Sept 1	559	63.2	34.8	90.5	10.9
Oct 1	507	68.5	37.6	98.6	11.9
Dec 1	308	77.3	48.9	106.8	11.1
March 1 1993	222	95.8	66.0	131.0	12.5
	Growth rates				
April 1-June 1	501	121.0	-36.1	358.4	56.9
June 1-Sept 1	470	75.0	-87.8	231.7	51.4
Sept 1-Dec 1	298	192.6	78.5	344.4	47.8
Dec 1-March 1	220	178.7	36.8	293.8	40.4
WEANER HINDS					
	Weights				
April 1 1992	611	47.1	28.6	64.5	6.6
June 1	646	52.3	28.0	73.0	7.3
July 1	579	52.8	27.7	74.8	7.7
Sept 1	473	56.0	27.4	78.1	8.0
Oct 1	471	59.2	28.5	94.9	8.5
Dec 1	385	68.0	34.6	93.5	8.4
March 1 1993	389	80.2	42.9	113.0	9.4
	Growth rates				
April 1-June 1	474	95.7	-66.2	225.7	48.7
June 1-Sept 1	414	38.5	-92.7	180.1	35.5
Sept 1-Dec 1	380	133.1	48.2	227.1	33.0
Dec 1-March 1	375	136.9	36.9	241.3	32.9

Table 3 : Bodyweights of weaner stags of each blood line category (kg)

Dates	Blood line	Number of deer	Mean	Minimum	Maximum	SD
April 1	NZ	492	51.0	22 8	67 0	7.1
	EN	61	50 7	30 1	64 7	7.3
	EU	61	53.1	33 7	66 1	6 1
June 1	NZ	545	56 2	32 0	82 0	8.1
	EN	57	58 0	36 0	71.0	7.7
	EU	59	65.0	43 3	79 3	6.9
July 1	NZ	577	58 4	28.9	84 0	8.9
	EN	69	58 9	37.8	74.1	7 9
	EU	85	63.0	34 5	81 2	10.4
Sept 1	NZ	405	61 2	34.8	88 0	10.3
	EN	69	66 5	45.8	80 7	8.8
	EU	85	69 9	41.3	90.5	11.7
Oct 1	NZ	338	65 2	37.6	92.0	10 6
	EN	69	72.1	49.0	89.8	10.0
	EU	100	76 8	46 2	98 6	12.5
Dec 1	NZ	199	73.2	48.9	99.3	9.2
	EN	57	85.8	62.0	106.8	10.3
	EU	52	83.7	58.3	106.8	10 7
March 1	NZ	112	89 1	66.0	112.8	9 3
	EN	57	102.7	76.8	127.2	11 3
	EU	53	102.4	74 8	131.0	12 3

NZ = New Zealand, EN = English; EU = Europe

Figure 3 : Mean bodyweights (kg) of weaner stags from six representative properties within the study



Mean weights of stags grouped by blood line are presented in table 3. Variations were highly significant between the three categories after June 1st. Pure New Zealand weaners were on almost all farms, weaners having other blood lines came from a fewer number of farms. The apparent drop in bodyweights in the european group in July was due to the inclusion of farm No16 which started recording only in June.

The growth curves of weaner stags should be interpreted cautiously. As european or english blood lines were not present in all farms, the differences in bodyweights between weaner groups, although significant after June 1st, may be due to other factors not yet analysed (table 3). Multivariate statistical analysis will investigate the importance of blood lines along with other variables including grazing management variables.

Mean bodyweights of weaner stags from 6 farms are presented in figure 3. Weaner stags from farm No4 were sold in November 92, so data were not available afterwards. Note the considerable variation in growth rates between farms. It is interesting to note that farm No 15 experienced an outbreak of weaner deaths in June and August, and that farm No 3 was severely copper deficient.

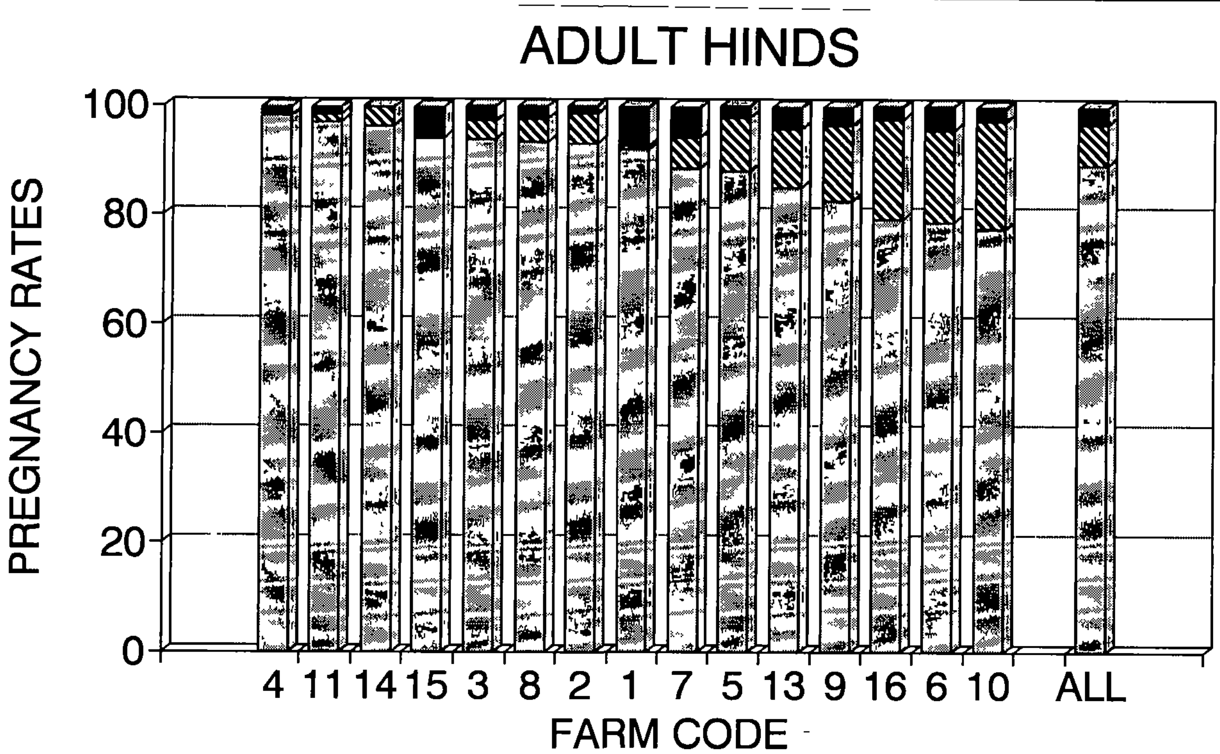
3. Reproductive performance

In June, almost all hinds mated were pregnancy tested by ultrasound scanning using a rectal probe (Audigé et al., 1993). According to foetal or placentome measurements, hinds were categorised as having conceived before May 1st, on or after May 1st or as being not pregnant. The number of adult and yearling hinds tested in 1992 and 1993 and the percentages of each category are presented for each farm in figures 4 and 5 and table 4. Farms were ranked in order of reproductive success measured as the percentage of hinds conceiving before May 1st.

Table 4 : Pregnancy rates of yearling and adult hinds 1992 and 1993

	Number of deer	% conceiving < May 1st	% conceiving ≥ May 1st	% not pregnant
June 1992				
Adults	1759	89.3	7.7	3.1
Yearlings	370	55.1	27.3	17.6
June 1993				
Adults	1728	92.8	3.5	3.6
Yearlings	417	72.9	12.2	14.9
1992 & 1993 combined				
Adults	3487	91.0	5.6	3.4
Yearlings	787	64.5	19.3	16.1

Figure 4: Pregnancy rate at June 1992 designating the percentage of deer conceiving before May 1st [legend], on or after May 1st [legend] and those not pregnant [legend].



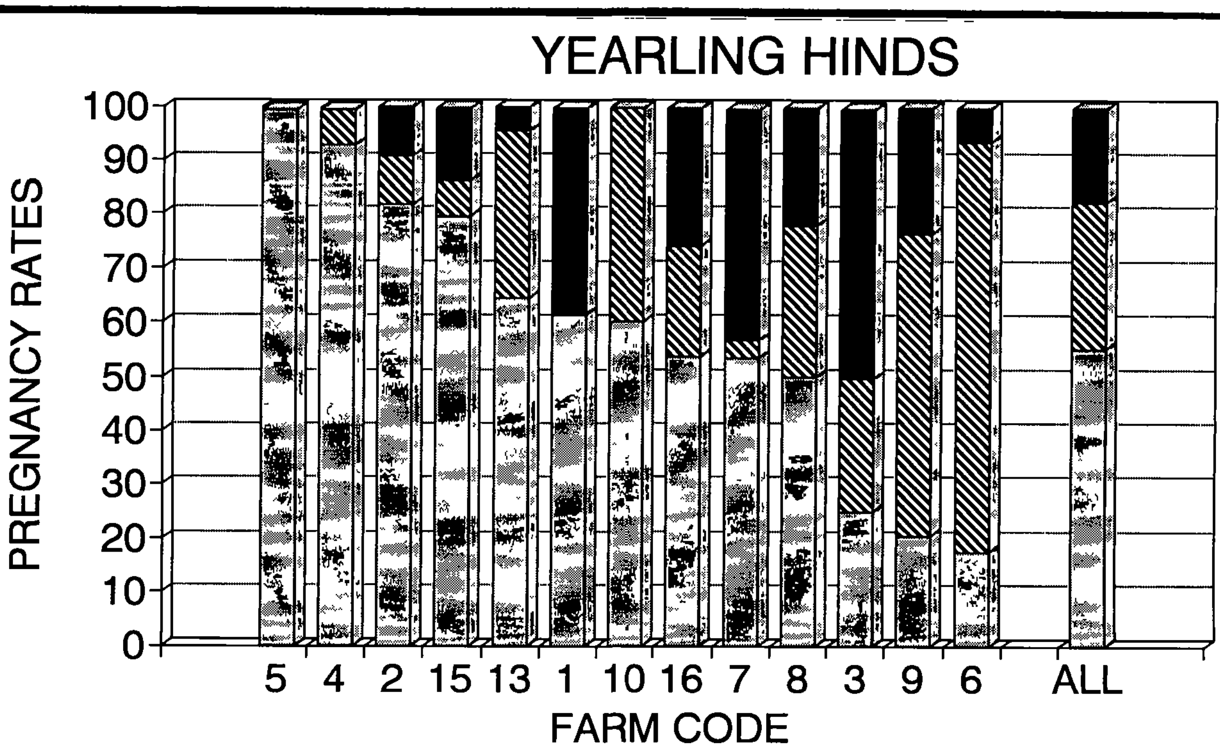
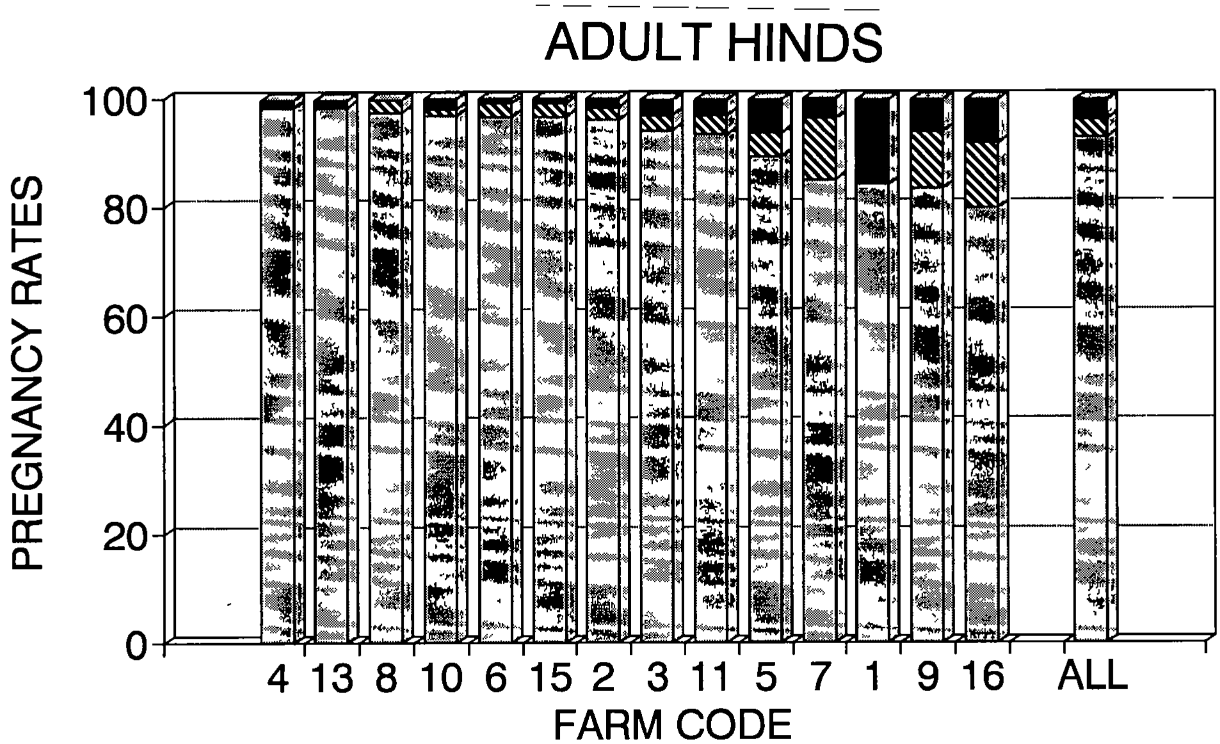
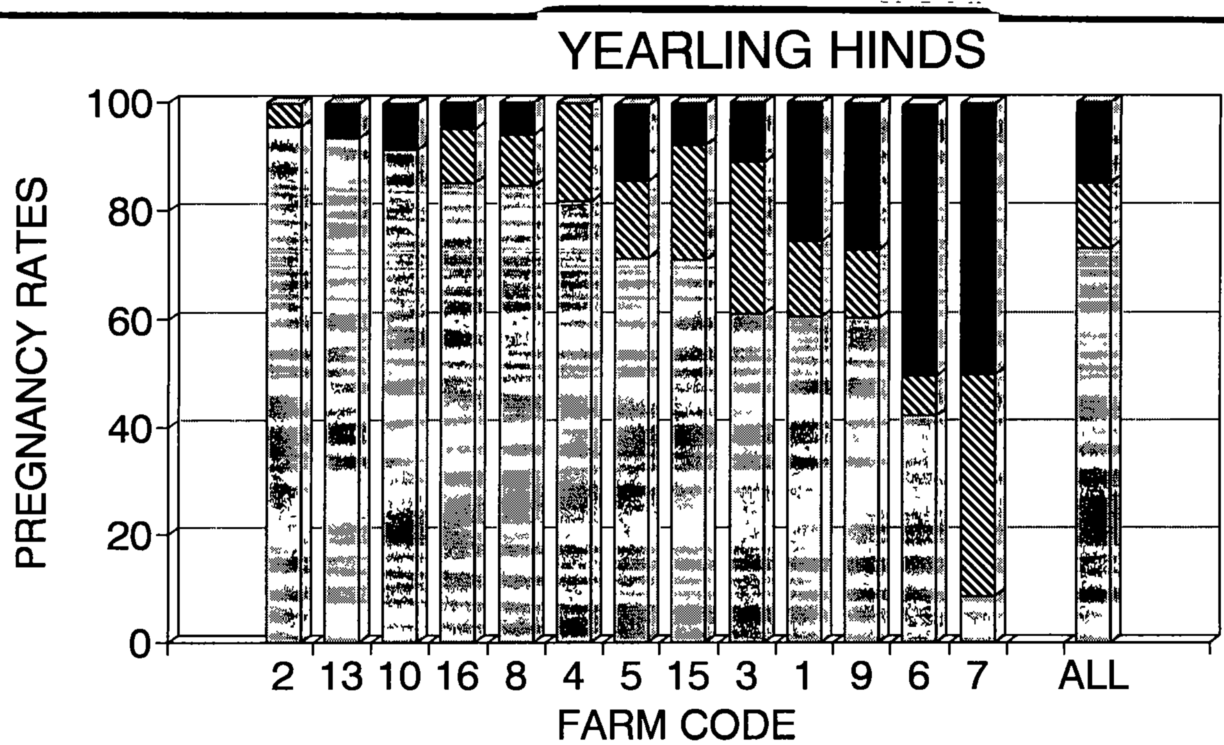


Figure 5 : Pregnancy rate at June 1993 designating the percentage of deer conceiving before May 1st , on or after May 1st and those not pregnant .





Hind bodyweights pre-mating and hind growth rates during Autumn are presented in tables 5 and 6.

Table 5 : Pre-mating bodyweights (kg) and growth rates (g/d) of Hinds (1992)

	Class of deer	Number of deer	Weight		
			Mean	Minimum	Maximum
Pre-mating weight April 1	AH	1285	99.8	68.0	136.4
	YH	227	83.7	56.0	106.8
Growth rate from April 1 to June 1	AH	892	-11.6	-229.9	216.9
	YH	162	28.8	-114.0	226.2
Growth rate from June 1 to Sept 1	AH	332	-2.4	-160.4	222.8
	YH	68	7.7	-93.3	168.5

AH = Hinds 2 y.o. and older
YH = Yearling hinds

Table 6 : Pre-mating bodyweights (kg) and growth rates (g/d) during the bree season of hinds according to pregnancy results (conception and time of conception) (1992)

	Time of conception	Number of deer	Weight		
			Mean	Minimum	Maximum
Hinds 2 y.o. and older					
Pre-mating weight April 1	< May 1	1151	99.8	68.1	136.4
	> May 1	91	98.2	70.1	124.0
	Empty	38	102.6	68.0	124.0
Growth rate from April 1 to June 1	< May 1	802	-8.4	-229.9	216.9
	> May 1	59	-42.3	-212.6	96.4
	Empty	26	-35.0	-195.4	95.2
Yearling hinds					
Pre-mating weight April 1	< May 1	113	84.5	65.2	105.4
	> May 1	83	82.7	56.0	106.8
	Empty	30	83.9	67.2	106.3
Growth rate from April 1 to June 1	< May 1	90	26.9	-114.0	226.2
	> May 1	46	43.0	-86.2	134.4
	Empty	25	13.4	-104.2	115.4

There was a wide range of pre-mating bodyweights for both yearling and adult hinds. Almost all hinds were over the threshold weight of 65 kg under which they were reported to be at risk of not conceiving (Hamilton and Blaxter, 1980). However, mean weights were similar between pregnancy status groups.
Hinds lost weight during the mating season; adult hinds that conceived late or were not pregnant appeared to have lost more weight than other hinds. More analyses will be carried out to look at weight loss as a risk factor for late pregnancy or failure to conceive.

The overall pregnancy rates of adult hinds is satisfactory, although improvement is possible for herds having less than 90% of hinds conceiving before May 1st. The data suggest also that 2-3% of empty adult hinds is very common. The higher percentage of empty hinds in 1993 is due to farm No1 that had 15.6% of hinds not pregnant. On this farm, the failure of a newly introduced young stag has been identified as the cause of this poor result, combined with a very restricted mating interval. As pregnancy test results were available, most farmers culled empty or late conceived hinds in winter. Whether this practice had a positive effect on pregnancy rates in 1993 needs to be answered and will be analysed.

Pregnancy rates of yearling hinds were low and represent a considerable waste factor for the industry. Despite an overall increased percentage of hinds conceiving before May 1st in 1993, there was still a wide range of results between farms. Pregnancy rates will be calculated for each mating mob to look at their association with mating management practices.

IV. Deer Mortality

Deer deaths and diagnoses are presented in table 7. Data includes all deer that died or were killed because of health problems such as lameness, ataxia or very poor condition. Perinatal mortalities were reported from only 9 farms and post-mortems of those deer could be performed only on properties that closely observed calving paddocks.

The monthly distribution of deaths of weaners, hinds and stags are presented in figure 6.

A large proportion of dead deer unfortunately could not be autopsied in time to confirm the cause of death, or post-mortems were inconclusive. These cases were designated "unconfirmed".

The most common features of hind death were fading [14.8%], dystocia [11.5%] and malignant catarrhal fever [MCF][8.2%]. MCF was the most common cause of stag death [21.6%] followed by injuries, either self-inflicted or caused by other stags [13.5%]. Confirmed losses of weaners were mainly associated with broken bones [13.8%] or osteochondrosis lesions [7.8%]. Calf losses resulted mainly from dystocia [22.8%] and stillbirth [12.3%]. There was a large variation in disease occurence and mortality rates between farms.

The monthly distributions of deer losses shows seasonal

Table 7 · Summary of mortalities and diagnoses on survey farms during 1992

WEANERS (male and female) (< 15 months)	Number	% of deaths
Unconfirmed	81	69.8
Broken neck	11	9.5
Osteochondrosis	9	7.8
Broken leg	5	4.3
Yersiniosis	3	2.6
Lameness	3	2.6
Misadventure	3	2.6
Hepatitis	1	0.9
TOTAL	116	100.0

MA HINDS (> 15 months)	Number	% of deaths
Unconfirmed	22	36.1
Fading	9	14.8
Drowned	7	11.5
Dystocia	7	11.5
Malignant Catarrhal Fever	5	8.2
Broken leg	3	4.9
Pneumonia	2	3.3
Broken neck	2	3.3
Enteritis	2	3.3
Misadventure	1	1.6
Ataxia	1	1.6
TOTAL	61	100.0

PERINATAL	Number	% of deaths
Dystocia	13	22.8
Unconfirmed	9	15.8
Stillbirth	7	12.3
Through fence	6	10.5
Victimised	5	8.8
Mismothering	5	8.8
Ruptured stomach	3	5.3
Misadventure	3	5.3
Small weak	2	3.5
Left alone	1	1.8
Overmothered	1	1.8
Malformation	1	1.8
Cryptosporidiosis	1	1.8
Total	57	100

MA STAGS (> 15 months)	Number	% of deaths
Unconfirmed	17	45.9
Malignant Catarrhal Fever	8	21.6
Misadventure	3	8.1
Broken neck	3	8.1
Enteritis	1	2.7
Gun shot	1	2.7
Nephritis	1	2.7
Injuries	1	5.4
Fading	1	2.7
TOTAL	36	100.0

Figure 6. Monthly distribution of deer deaths on survey farms from March 1992 to March 1993

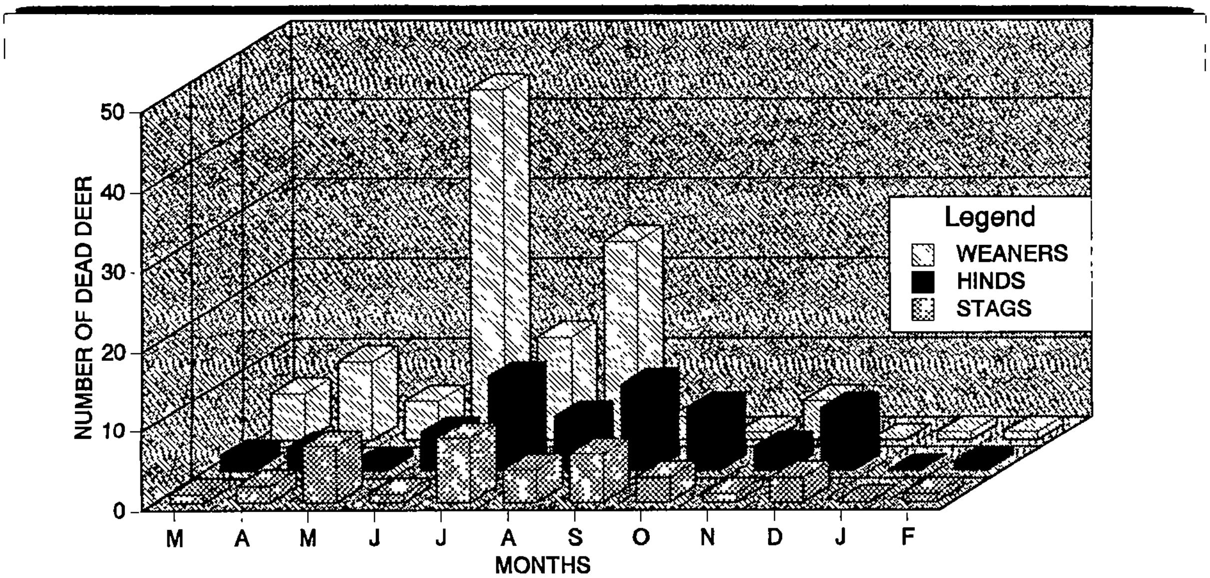


Table 8 : Individual blood haematological and biochemical characteristics of mature hinds for two sampling periods, pooled over all farms.

	Units	MARCH 1992 Number of deer	Mean	Minimum	Maximum	SD	SEPTEMBER 1992 Number of deer	Mean	Minimum	Maximum	SD
HAEMATOLOGICAL CHARACTERISTICS											
White Cell Count	10 /l	135	5.7	2.8	15.3	1.9	137	4.6	2.3	17.6	1.9
Neutrophils	%	134	40.9	16.0	75.0	14.8	137	39.1	15.0	66.0	11.2
Eosinophils	%	134	5.0*	0.0	17.0		137	6.0*	1.0	25.0	
Bands	%	134	0.0*	0.0	7.0		137	0.0*	0.0	7.0	
Lymphocytes	%	134	51.6	23.0	81.0	15.1	137	51.6	23.0	76.0	11.8
Monocytes	%	134	0.0*	0.0	5.0		137	0.0*	0.0	3.0	
Basophils	%	134	0.0*	0.0	4.0		137	1.0*	0.0	6.0	
Odd Lymphocytes	%						137	0.0*	0.0	4.0	
Haemoglobin	g/dl	135	16.5	8.8	28.1	3.5	137	17.8	13.1	25.3	2.6
Packed Cell Volume	%	135	40.5	23.0	52.0	4.6	137	45.3	35.0	55.0	4.3
MCHC	g/dl	135	40.7	29.2	74.3	7.6	132	39.4	30.6	57.0	5.2
BIOCHEMICAL CHARACTERISTICS											
Total Proteins	g/l	135	69.9	55.7	83.2	5.3	137	69.4	58.0	78.8	4.3
Albumin	g/l	135	35.3	29.9	42.9	2.9	137	34.1	25.6	39.1	2.7
Phosphorus	mmol/l	135	2.5	1.1	3.5	0.5	137	2.0	0.8	3.0	0.4
GGT	IU	135	34.1	16.0	98.0	12.4	137	24.7	10.0	83.0	9.4
Blood Urea Nitrogen	mmol/l	135	10.6	6.6	16.0	1.8	137	10.5	5.7	15.3	1.8
Copper	umol/l	135	13.3	1.5	24.0	4.0	137	10.2	0.9	23.0	5.5
Vitamin B12	pmol/l	135	160.5*	<70.0#	1500.0	135.5	137	230.0*	<70.0#	920.0	
G.S.H Px	kIU/l	42	7.4*	1.2	29.7	6.6	45	7.5*	1.7	24.9	
Pepsinogen	mU Tyrosine/l						133	337.0*	0.0	2368.0	

* Medians are reported instead of means because data was not normally distributed

6 values were <70 pmol/l in March, the lower level of analytical sensitivity (1 value was <70 pmol/l in Septenber)

MCHC = Mean Cell Haemoglobin Concentration

GGT = Gamma Glutamyl Transferase; G.S.H.Px = Glutathione Peroxidase variation. The highest death rate for weaners was between the ages of 3- and 6-months whereas the highest death rates for adults was between June and October. The large number of deer that could not be post-mortemed is unfortunate but highlights the reality of commercial deer farming. A number of deer were also missing but it was not possible to know whether they died or not, thus were not included in the list.

Although a number of weaner deaths were categorised as "unconfirmed", about 80% of them occurred during disease outbreaks between June and August. Circumstantial observations and results of some late post-mortems suggest a diagnosis of Yersiniosis, although it was not confirmed. Yersiniosis was identified from 3 weaners that died in June on two farms.

The total number of perinatal deaths is almost certainly higher than 57 since some farmers did not visit calving paddocks at all. From the number of hinds that were dry at weaning [data not presented here], we believe some dead calves were not found by farmers even under close monitoring. Thus, the factors associated with calf deaths reported in table 7 from 9 farms may be different than those from the other properties. It is not likely, however, that dystocia or stillbirth is associated with farmers'level of interference during calving.

5. Blood profiles

Blood samples from 20-30 deer were collected at each farm visit for a range of laboratory analyses (Audigé et al., 1993). Analyses of samples from the first four visits have been completed and data validated. At the time of writing, analyses had been carried out to investigate variations between class of deer, farm and period of sampling. Results will be presented elsewhere. However, to give an insight of the range of data under study, mean values and ranges of just one class of deer (hind) haematological and blood biochemical characteristics are presented for just two sample periods in table 8.

It is too early to give any definitive results on the variations of blood characteristics and their association with individual production outcomes. However, the raw data showed wide variations between farms at each sampling period for almost half of the characteristics. Data in table 7 suggests a wide range of values for many of these characteristics in hinds including white cell counts, neutrophil and lymphocyte percentages, haemoglobin concentrations, mean cell haemoglobin concentrations, total protein and albumin concentrations, and copper levels.

6. Conclusion

The data presented here are preliminary, but give an insight into what this research project can produce and the type of analyses under way. Data were presented on stock characteristics (age and blood lines), growth and bodyweights, reproductive performance of hinds, health problems and some blood characteristics.

Analysis of preliminary results showed that already numerous questions can be answered, thus meeting one of the objectives of this project. It is our expectation that other questions will not be answered, but the project will allow us to focus future research projects on what appeared the most important positive or negative factors influencing health and production in commercial deer farms.

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