Deer Herd Health and Production Profiling

A thesis presented in partial fulfilment of the requirements for the

degree of Doctor of Philosophy

in Veterinary Science at

Massey University

Laurent Jean Marie Audigé

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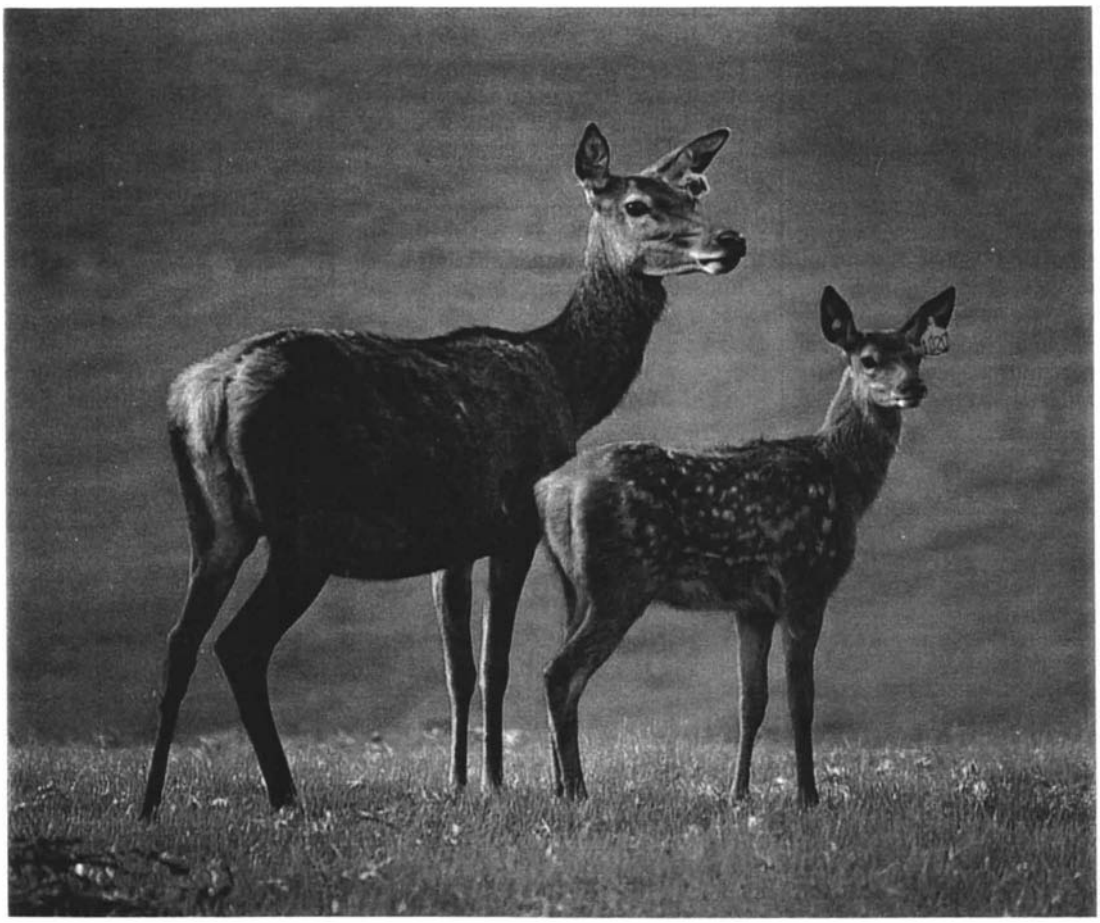
This work is dedicated to my parents, my brothers and sisters-in-law, my grand-mother, the rest of my family and all my friends, especially Kathy, who encouraged and supported me in my efforts until completion and acceptance for the PhD degree.



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ABSTRACT

Deer farming in New Zealand has been developed for about 25 years, with about 1.3 million deer being currently farmed. Knowledge of deer health and production has been acquired from experimentation in research stations and from field experience, but until now there has been limited research data from commercial farms. Little was known about the relative importance of a range of management practices, farm or animal characteristics, and how they related to deer health and production.

"Herd health and production profiling" is a tool for studying complex systems such as pastoral farming. This is the first time this technique has been used for the study of deer farming. It is a longitudinal observational study with an holistic epidemiological approach. It involves gathering a variety of relevant information about the whole farm which is analysed by advanced multivariable statistical techniques at farm, herd or mob, or individual animal levels.

The present study aimed to explore the health and production results from selected red deer farms; to investigate risk factors associated with the most important performance outcomes, and to identify the most relevant fields for further research.

This study involved observations from commercial red deer farms in the lower part of the North island of New Zealand, and was conducted over two years beginning in March 1992.

Potential participating farmers were solicited by mail questionnaire. Fifteen with the appropriate stock and facilities were selected after farm visits. Farm characteristics were recorded by direct measurements or by questionnaires. Farm layout was mapped. Each deer paddock was described with characteristics such as area, topography, water supply, type of fence, shelter, exposure to wind, pasture type and weeds recorded. Deer were identified by sex (hinds or stags) and age (weaners, yearlings or adults). About 2700 hinds, 2400 weaner deer and 1500 stags were individually monitored each year.

Farmers recorded daily farm management practices such as grazing management, mating and calving management, handling and disease control; individual deer data such as rearing performance of hinds, bodyweight, velvet antler grade and weight; health problems and weather data. Post-mortem investigations were conducted by researchers, local veterinarians or farmers themselves.

Farm visits were scheduled in March, June, September and November to record information and collect samples with additional visits as required. Body measurements were recorded, and blood and faeces samples were collected from 30 selected deer of both sex and three age categories per farm. Pasture and soil samples were collected and measurements were taken for each paddock. A body condition scoring (BCS) system was devised, and hinds scored in March before mating, September before calving and in March of the next year at weaning. All hinds mated were pregnancy tested by rectal ultrasound during the June visit and pregnant hinds were classified as having conceived before or after May 1.

Blood on EDTA was analysed for standard haematology. Sera were analysed for total protein, albumin, phosphorus, gamma glutamyl transferase, blood urea nitrogen, glutathione peroxidase,

pepsinogen, copper, vitamin B12, and serological evidence of yersiniosis and leptospirosis. Faeces were analysed for egg and larval counts. Pasture mineral profiles (Cu, Co, Se, Mn, Mo, Zn, Fe, and S) and soil fertility (Olsen P, K, S and pH) were investigated.

Data were entered into a relational database. Databases were corrected for erroneous and missing information by reference back to farmers, and calculations were performed for mob and farm characteristics. Data on farm and deer characteristics, management practices, deer health and productivity parameters, and biological markers were tabulated and graphed at the individual and farm level.

Some of the key health and production outcome were: 84.7% and 96.8% of yearling and adult hinds conceived at mating, respectively, and 17.0 and 9.1% of them lost their progeny by weaning; mean bodyweights of weaner standardised on April 1within farms ranged 42-59 kg and 39-51 kg in stags and hinds, respectively; the percentage of stags reaching 92 kg bodyweight by one year of age within farms ranged 0-48%; the mean yearling hinds bodyweight at mating was 81.3 (SD=8.5) and 82.8 kg (SD=9.4) in 1992 and 1993, respectively; 2-year-old stags produced on average 1.16 and 1.19 kg of velvet antler in 1992 and 1993, respectively; annual mortality rates of weaners (3-15 months), hinds and stags were 5.87, 1.77 and 2.60 per 100 deer-years, respectively; deer blood characteristics and feacal parasite egg and larval counts varied significantly between farms.

Specific production outcomes chosen for risk factors analysis were: hind early conception (ie before May 1) and conception *per se*; hind lactational status at weaning and weaning rates (as a result of progeny losses from conception to weaning); bodyweights of weaners standardised to April 1; seasonal weaner growth rates; velvet antler grade and weight (summarised as the velvet monetary value), and the most important specific health problems, ie yersiniosis, malignant catarrhal fever and dystocia.

Path analysis was the main analytical technique used in this study. Preliminary univariate analyses were carried out to identify associations between single descriptive variables and the outcome variable under investigation. Variables which showed sufficient evidence of an association in these analyses ($p<0.20$) were included in multivariable analyses such as multiple linear or logistic regression. A forward stepwise selection procedure was used for identification of risk factors associated with the outcome under investigation ($p<0.05$). Null hypothesis and final path diagrams were formulated.

Final path diagrams were consistent in most respects with the current understanding of deer health and production, and allowed a more thorough investigation of causal webs within the deer production system. This study confirmed some already identified or suspected relationships, such as the positive influence of yearling hind bodyweight on conception, that of imported blood lines, wapiti blood lines and grazing swards over 5-10 cm for weaner growth, and that of stag age on velvet production. Many other relationships between risk factors and outcomes were novel, thus identifying areas for further research to identify whether they were causal. The most striking of these findings were the significant positive relationships between hind body condition scores and reproductive performance, the apparent negative effect of sunshine on hind early conception, weaner bodyweight and weaner growth, and the overall apparent beneficial effect of the presence of trees in deer paddocks on these outcomes. The other most important observation is the lack of significant risk factors predicting the probability of yearling hinds rearing a calf up to weaning, suggesting an underlying limiting physiological process for yearling hind lactation.

A putative epidemiological model was proposed from risk factors analyses for management options that are likely to increase the performance. Potentially the most practical management tool defined in this study was the body condition score chart, and it is proposed that it should be used industry-wide. It is also believed a farm faecal lungworm larvae index, serum albumin, copper, phosphorus and vitamin B12 concentrations, and blood packed cell volume, haemoglobin and glutathione peroxidase activities may be useful for whole-farm investigation of health and productivity.

It is proposed that final models and putative management proposals should be targeted for future research.

This thesis provides the most comprehensive reference data available of farm characteristics, management practices, and health and production parameters of commercial deer farms. Data has shown a large range of productivity levels and, for the first time, potential productivity levels in a commercial farming environment have been demonstrated. These data can be used at the farm level for evaluation of performance and identification of production targets, and at the industry level for strategic planning of farm output. This study shows that there is considerable potential to improve the production efficiency and productivity on many deer farms and has identified the key factors likely to achieve that potential.

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TABLE OF ABBREVIATIONS AND UNITS

Codes	Descriptions	Units
%	Percentage	
% DM	Percentage of dry matter	
°C	Degrees Celsius	
µmol/l	Micromole per litre	
*	Statistical significance level p<0.05	
**	Statistical significance level p<0.01	
/g	Number per gram	
95% CI	95% confidence interval	
Alb	Serum albumin	g/l
ANOVA	Analysis of variance	
B12	Serum Vitamin B12	pmol/l
BCS	Body condition score	
BUN	Blood urea nitrogen	mmol/l
cm	Centimetre	
Co	Cobalt	
Cu	Serum copper	µmol/l
DSP	Deer slaughter premise	
Exch.K	Exchangeable potassium	ppm
Fe	Iron	ppm
FEC	Faecal egg count	/g
FLC	Faecal lungworm larval count	/g
g/d	Gram per day	
g/dl	Gram per decilitre	
g/l	Gram per litre	
GGT	Gamma glutamyl transferase activity	IU
GIB	Game industry board	
GSHPx	Glutathione peroxidase	kIU/l
ha	Hectare	
Hb	Haemoglobin	g/dl
IU	International unit	
kg	Kilogram	
kg DM/ha	Kilogram of dry matter per hectare	
kIU/l	Kilo international unit per litre	
l/l	Litre per litre	
MAF	Ministry of agriculture and fisheries	
Max	Maximum	
Min	Minimum	
MJME/kgDM	Mega joules of metabolizable energy per kilogram of dry matter	
mm	Millimetre	
mmol/l	Millimole per litre	
Mn	Manganese	ppm
Mo	Molybdenum	ppm
mU Tyrosine/l	Milliunit Tyrosine per litre	
NS	Not statistically significant at p<0.05	
Olsen P	Olsen phosphate measurement of soil	ppm
OR	Odds ratio	
P	Serum phosphorus	mmol/l
PCV	Packed cell volume	l/l
Peps	Serum pepsinogen	mU Tyrosine/l

Table of abbreviations and units (Cont'd)

Codes	Descriptions	Units
pmol/l	Picomole per litre	
ppm	Parts per million	
r or R	Correlation coefficient	
S	Sulphur	%
SD	Standard deviation	
Se	Selenium	ppm
TP	Serum total protein	g/l
WCC	White cell count	
Zn	Zinc	ppm

COMPUTER SOFTWARE USED

Usage	Name	Version	Company
Word processor	Word	6	Microsoft corporation, One Microsoft Way, Redmont, WA, USA
Spreadsheet	Excell	5	Microsoft corporation, One Microsoft Way, Redmont, WA , USA
Drawings	Wordperfect presentation	2	Wordperfect corporation, 1555 N. Technology Way, Orem, Utah, USA
Data management	Paradox DOS	4	Borland International Inc., Scotts Valley, CA, USA
	DBMS/COPY Plus	3	Conceptual Software Inc, Houston, Texas, USA, published by SPSS Inc, Chicago, IL, USA
Statistical software	Statistix	4	Analytical Software, StPaul, MN, USA
	NCSS	5	Jerry L. Hintze, Kaysville, Utah USA
	SAS	6.04	SAS Institute Inc., Cary, NC, USA
	Statistica	4.1	Statsoft Inc., Tulsa, OK USA
Reference manager	Procite	2.2	Personal Bibliographic Software Inc., Ann Arbor, Michigan, USA
Farm mapping	FarmTracker	3	Physical Farm Management Software, B.M. Butler Computing Ltd, Palmerston North, NZ

ANIMAL REMEDIES USED FOR DISEASE CONTROL

Drug company	Code	Drug name
Anthelmintics		
Ancare New Zealand Ltd	ARR	New Arrest
	ARH	New Arrest Hi-Mineral
	OCH	Oxfen C Hi-Mineral
	OHM	Oxfen Hi-Mineral
	OXC	Oxfen C
Cyanamid of New Zealand Ltd	CPO	Cydectin Pour On
	VES	Vetdectin Oral Sheep
Merck Sharp & Dohme New Zealand Ltd	IOC	Ivomec Oral Cattle
	IOS	Ivomec Oral Sheep
	IPO	Ivomec Pour On
Hawke's Bay Veterinary Services Ltd	RLC	Red Label Cattle
	RLS	Red Label Sheep
Pitman-Moore New Zealand Ltd†	SMD	Synanthic Mini Dose
	SMS	Synanthic Mini Dose + Selenium
	SYS	Systamex Sheep & Catle
	SYC	Systamex Low Dose Cattle
SmithKline Beecham Animal Health	VAL	Valbazen
	VMD	Valbazen Mini Dose
Copper supplements		
Pitman-Moore New Zealand Ltd†	CIN	Coprin
	CNE	Copper Needles (4 grams)
	CNL	Copper Needles Large (12 grams)
	CUP	Cuprax (10 grams)
Rhône Mérieux	C05	Copacaps (5, 10 or 20 grams)
Vaccines		
Pitman-Moore New Zealand Ltd†	LPC	Leptavoid 3
	VAC‡	5-in-1 clostridial vaccine
AgVax Developments Ltd	YER	Yersiniavax

Note : Source New Zealand Index of Veterinary Specialities Annual 1994 (IVS), Volume 9

† now Mallinckodt Veterinary New Zealand Ltd

‡ Farmers noted whether they used multi-strain clostridial vaccines without the vaccine name. There are a number of clostridial vaccines marketed in New Zealand and published in the IVS.

GLOSSARY

Risk factor codes used for analytical investigations and their descriptions

Codes	Tables	Descriptions
%AHCM	2.11	Percentage of adult hind (hinds at least 3 years old) in the calving mob
ADULT	2.18	Deer at least 2 years old in March (hind at least 3 years old at calving)
ADVC	2.18	Hind (or dam) conceived before May 1 (early conception)
AGE	2.18	Deer age at the beginning of the survey year, ie in March
AGE3	2.18	Deer over 3 years old in March (hind over 3 years old at mating or at calving)
AGE4	2.18	Deer over 4 years old in March
AH	2.10	Number of adult hinds in the mating mob
AH2	2.10	Number of adult hinds in the back-up mob at mating
ALB	2.23	Serum albumin concentration
AVMAT	2.27	Average of daily maximum temperatures during the grazing period
AVMIT	2.27	Average of daily minimum temperatures during the grazing period
AVMMT	2.27	Average of daily temperature ranges (maximum-minimum) during the grazing period
AVWIND	2.31	Paddock average wind exposure index = average of wind strength over potential wind protection scores from trees, hill, gully and shelter belt.
B12	2.23	Serum vitamin B12 concentration
B12185	2.36	Serum vitamin B12 concentration >= 185 pmol/l
BACK	2.10	Use of at least one back-up stag before May 1 at mating
BACKD	2.10	Number of days between April 1 and the first back-up sire used before May 1
BACKM	2.10	Use of at least one back-up stag after May 1 at mating
BCS	2.18	Body condition score
BCSD	2.18	Body condition score difference between March (pre-mating) and September (post-winter)
BCSL	2.18	Body condition score change during late pregnancy and lactation (between September and weaning)
BCSM	2.18	Pre-mating body condition score (recorded in March)
BCSM25	2.18	Pre-mating body condition score below 3
BCSM4	2.18	Pre-mating body condition score over 3.5
BCSS	2.18	Post-winter body condition score (recorded in September)
BCSS2	2.18	Post-winter body condition score below 2.5
BCSS4	2.18	Post-winter body condition score over 3.5
BIRTH	2.18	Number of days between November 1 and the date of birth (BIRTHD)
BSHEEP	2.31	Time spent in paddocks on deer farm boundary adjacent to paddocks where sheep could be found all year round
BULLR	2.31	Mean paddock bull rushes score during the grazing period
BUN	2.23	Blood urea nitrogen concentration
CHD	2.10	Number of days between April 1 and the use of the first back-up sire
CHS	2.10	Use of at least one back-up stag at mating
CHS2	2.10	Use of at least one more back-up stag a second time during mating
CHW9C	2.18	Bodyweight change between September and calving (late October-November)
CHWJV	2.18	Percentage of stag bodyweight change between June and the time of velvet antler harvesting
CLAH	2.10	Presence of adult hinds in the mating group
CLAHC	2.11	Paddocks shared with adult hind(s)(hind at least 3 years old at calving) at least one day during calving and early lactation
CLOVER	2.29	Mean pasture clover score during the grazing period
COATD	2.21	Coat density of sentinel deer
COATL	2.21	Length of the upper coat of sentinel deer
COPPER	2.33	Copper supplementation prior or during winter (before early July)

Glossary (Cont'd)

Codes	Tables	Descriptions
CU	2.23	Serum copper concentration
CU8	2.36	Serum copper concentration >= 8 μmol/l
CUT	2.18	Number of days between October 1 and the date of velvet antler harvesting
DAM	2.31	Percentage of time spent in paddocks with a dam, pond or swamp
DEATH1	2.36	Mob experienced natural death other than that caused by misadventure before June 1
DEATH2	2.36	Mob experienced natural death other than that caused by misadventure after June 1
DEER	2.29	Average number of deer in the mob during the grazing period
DEER/Ha	2.29	Average number of deer per deer-fenced hectare (grazing density)
DOSEOK	2.33	Weaner receiving at any drench the recommended dosage of anthelmintic
DRENCH1	2.33	Mean time interval between two anthelmintic treatments
DRUG	2.33	Use of only ivermectin/albemycin or benzimidazole-based anthelmintics
EASES	2.21	Deer blood sampled without firm physical restraint
ENTERP	2.11	Frequency of entering calving paddocks during visits
EOP	2.23	Eosinophil percentage
EXP	2.10	Use of at least one experienced sire stag for mating
EXP2	2.10	Use of at least one experienced sire stag for back-up at mating
FAREA	2.31	Mean paddock size (deer-fenced area)
FEC	2.23	Faecal egg count
FEC>0	2.36	Positive faecal egg count
FLC	2.23	Faecal lungworm larval count
FLC>0	2.36	Positive faecal larval count
FLCI	2.36	Farm calf faecal lungworm larvae index = geometric mean lungworm larval count multiplied by the number of calves with positive count (over 10 calves)
FSUP	2.32	Food supplementation of deer during the grazing period
GGT	2.23	Serum gamma glutamyl transferase activity
GIRTH	2.21	Thoracic girth of sentinel deer
GR46	2.18	Growth rate between April 1 and June 1
GR46<0	2.18	Weaner losing bodyweight between April 1 and June 1
GR69	2.18	Growth rate between June 1 and September 1
GR912	2.18	Growth rate between September 1 and December 1
GRADE	2.18	Highest grade of the left and right velvet antler
GRJS	2.18	Bodyweight gain between June and September
GSHPx	2.23	Serum glutathione peroxidase activity
GSHPx3	2.36	Serum glutathione peroxidase activity >= 3 kIU/l
GULLY	2.31	Mean paddock gully score during the grazing period
HB	2.23	Haemoglobin concentration
HIND	2.18	Weaner hind (ie sex = female)
HIND/Ha	2.11	Number of hinds per deer-fenced hectare at calving
HINDCM	2.11	Number of hinds in the calving mob
ISWH	2.29	Mean pre-grazing pasture sward height during the grazing period
IVE	2.33	Use of ivermectin/albemycin anthelmintics only
JOIN	2.10	Number of days between February 15 and joining with stag(s)
JULYD	2.33	Anthelmintic treatment in July (mid winter drench)
JUNED	2.33	Anthelmintic treatment in June (early winter drench)
JUNEW	2.18	Pre-winter bodyweight recorded in June (same variable as WD6)
KALE	2.29	Deer grazing on a kale crop at least one day
LAME	2.36	Mob with observed lameness (including clinical osteochondrosis)
LAUGD	2.33	Anthelmintic treatment in the last 15 days of August
LP	2.23	Lymphocyte percentage
LYING	2.21	Deer lying on the floor of the pen during handling (sampling)
M%AH	2.29	Mean percentage of adult hinds in the hind mob during the grazing period
M%WS	2.29	Mean percentage of weaner stags in the weaner mob
MACRO	2.31	Hinds grazing in at least one paddock with macrocarpa tree
MALB	2.36	Mean serum albumin concentration within farms

Glossary (Cont'd)

Codes	Tables	Descriptions
MARW	2.18	Pre-mating bodyweight (recorded in March)
MAXW4	2.18	Bodyweight differences between individual bodyweights (W4) and the highest bodyweights within mobs on April 1
MAXW6	2.18	Bodyweight differences between individual bodyweights (W6) and the highest bodyweights within mobs on June 1
MAXW9	2.18	Bodyweight differences between individual bodyweights (W9) and the highest bodyweights within mobs on September 1
MAXW12	2.18	Bodyweight differences between individual bodyweights (W12) and the highest bodyweights within mobs on December 1
MB12185	2.36	Geometric mean vitamin B 12 concentration >= 185 pmol/l
MBUN	2.36	Mean blood urea nitrogen concentration within farms
MCU	2.36	Mean serum copper concentration within farms
MCU8	2.36	Mean serum copper concentration >= 8 µmol/l
MEOP	2.36	Geometric mean eosinophil percentage within farms
MGGT	2.36	Geometric mean serum gamma glutamyl transferase activity within farms
MGSHPx	2.36	Mean glutathione peroxidase activity within farms
MGSHPx3	2.36	Mean glutathione peroxidase activity >= 3 kIU/l
MHB	2.36	Mean haemoglobin concentration within farms
MINSUP	2.33	Use of mineral supplemented anthelmintics
MJME/Ha	2.29	Mean mob daily energy requirements per grazed hectare (effective paddock area)
MLP	2.36	Mean lymphocyte percentage within farms
MNP	2.36	Mean neutrophil percentage within farms
MNZ	2.29	Mean weaner percentage of New Zealand blood lines within mobs
MP	2.36	Mean serum phosphorus concentration within farms
MPCV	2.36	Mean packed cell volume within farms
MPEPS	2.36	Geometric mean serum pepsinogen activity within farms
MTP	2.36	Mean serum total protein concentration within farms
MW4	2.29	Mean weaner bodyweight on April 1within mobs.
MWCC	2.36	Geometric mean white cell count within farms
NANTH	2.33	Number of anthelmintic treatments during the studied period
NFEC>0	2.36	Number of calves with positive faecal egg count (over 10 calves)
NOVD	2.33	Anthelmintic treatment in November
NP	2.23	Neutrophil percentage
NUMFS	2.32	Number of food supplementation episode during the grazing period
NZ	2.18	Percentage of New Zealand blood lines (estimated for many weaners)
NZ100	2.18	Pure New Zealand type deer
NZC	2.18	Estimated percentage of New Zealand blood lines in the calf
NZD	2.18	Percentage of New Zealand blood lines in the dam
NZS	2.10	Presence of only New Zealand red sire stag for mating
ODEER	2.29	Weaners grazing with deer over-15-month-old during the grazing period
OTHERST	2.29	Paddocks shared with stock other than deer at least one day during the grazing period
OSHEEP	2.29	Paddocks shared with sheep at least one day during the grazing period
P	2.23	Serum phosphorus concentration
PAREA	2.4	Paddock size, eg calving paddock area
PASTT	2.31	Mean pasture type score during the grazing period
PBULLR	2.4	Paddock bull rushes score
PCV	2.23	Packed cell volume
PDAM	2.4	Presence of a dam, pond or swamp in the paddock
PEPS	2.23	Serum pepsinogen activity
PERCW12	2.18	Percentile of deer bodyweight (12 = on December 1) within mobs on December 1
PERCW4	2.18	Percentile of deer bodyweight (4 = on April 1) within mobs on April 1
PERCW6	2.18	Percentile of deer bodyweight (6 = on June 1) within mobs on July 1
PERCW9	2.18	Percentile of deer bodyweight (9 = on September 1) within mobs on September 1
PFP	2.4	Paddock fence pacing score

Glossary (Cont'd)

Codes	Tables	Descriptions
PGULLY	2.4	Paddock gully score (visual estimate of its depth)
PRAG	2.4	Paddock ragwort score
PRIVER	2.4	Presence of a river or stream all year round in the paddock
PSTUMP	2.4	Presence of stump, branches, or objects (eg. drums, rubbish) in the paddock
PSUR	2.4	Paddock proximity to road, buildings or houses (ie signs of human presence)
PTHISTLE	2.4	Paddock thistle score
PTOPO	2.4	Paddock topography score
PTREES	2.4	Presence of trees (tree score)
PWIRE%	2.4	Percentage of paddock fence being wire-and-batten fences close to the ground.
RAG	2.31	Mean paddock ragwort score during the grazing period
RAIND	2.27	Average daily rainfall during the grazing period
RATIO	2.10	Hinds to sire stag ratio for mating
RATIO2	2.10	Hinds to sire stag ratio with back-up stags
REMD	2.10	Number of days between April 1 and sire stag removal
RIVER	2.31	Percentage of time spent in paddocks with a river or stream running all year round
RSWH10	2.29	Mean residual (ie post-grazing) pasture sward height over 10 cm during the grazing period
RSWH5	2.29	Mean residual (ie post-grazing) pasture sward height below 5 cm during the grazing period
SEPTD	2.33	Anthelmintic treatment in September
SEROYERJ	2.36	Maximum seroprevalence (increase of 20 Unit OD between March and June) against *Yersinia pseudotuberculosis* type I, II or III
SEROYERS	2.36	Maximum seroprevalence (increase of 20 Unit OD between March and September) against *Yersinia pseudotuberculosis* type I, II or III
SET	2.11	Number of days between October 1 and the date when hinds were set-stocked for calving
SHELT	2.4	Average paddock shelter score combining scores of trees, hill, gully and shelter belt
SHIFT	2.34	Number of times deer were shifted between paddocks
SIPC	2.33	Number of days between January 1 and the starting date of internal parasite control (first drench)
SIZE	2.21	Shoulder height of sentinel deer
SSIRE	2.10	Single sire mating
SSIRE2	2.10	Single sire mating with back-up sire
STAG	2.29	Paddocks shared with stag(s) over 15 months old at least one day during calving and early lactation
STARTD	2.33	Number of days between the start of the studied period (eg June 1 or September 1) and the next anthelmintic treatment (drench)
STOCK	2.34	Number of times the mob composition was changed
STRIP	2.29	Deer strip grazing at least in one paddock during the grazing period
SUMD	2.33	Anthelmintic treatment in summer (December 1 - March 1)
SUN	2.27	Average daily sunshine score during the grazing period
SUPEN	2.32	Estimated daily individual energy intake (MJME) through food supplementation during the grazing period
SUR	2.31	Percentage of time spent in paddocks close to road, buildings or houses (ie signs of human presence) during the grazing period
TAGB	2.11	Tagging of calves at birth
TEETH	2.21	Incisor teeth score of sentinel deer
THISTLE	2.31	Mean paddock thistle score during the grazing period
TINE	2.18	Velvet antler with a bez tine on at least one side
TOPO	2.31	Mean paddock topography score during the grazing period
TP	2.23	Serum total protein concentration
TREES	2.31	Mean paddock tree score during the grazing period
USED	2.10	Sire stag(s) already use in the first mating mob

Glossary (Cont'd)

Codes	Tables	Descriptions
VCLOST	2.33	Vaccination of young deer against clostridial diseases with two doses of vaccine 3 to 4 weeks appart (5-in-1)(injection of at least one dose before April 1 as risk factor for W4)
VICTIM	2.21	Visible hair loss (sign of victimisation) on the back of the deer
VISIT/W	2.11	Number of visits of calving hinds per week by the farmer
VISITCP	2.11	Close monitoring calving hinds by moving throughout the calving paddock
VYERS	2.33	Weaners vaccinated with the Yersiniavax vaccine
VYERS1	2.33	First dose of Yersiniavax vaccine injected into weaners before April 1
W12	2.18	Individual deer bodyweight standardised to December 1
W4	2.18	Individual deer bodyweight standardised to April 1
W40	2.18	Individual weaner bodyweight standardised to April 1 below 40 kg
W50	2.18	Individual weaner bodyweight standardised to April 1 between 40 and 50 kg
W6	2.18	Individual deer bodyweight standardised to June 1
W9	2.18	Individual deer bodyweight on September 1
WAP	2.18	Percentage of wapiti (or elk) blood lines in the deer
WAPC	2.18	Estimated percentage of wapiti (or elk) blood lines in the calf
WAPS	2.10	Presence of one or more wapiti-type sire stag
WCC	2.23	White cell count
WD6	2.18	Post-mating dam bodyweight calculated on June 1 (same variable as JUNEW)
WEAN	2.18	Date of weaning = number of days between January 1 (February 15 in the analysis of hind conception, see Table 2.10) and weaning
WEIGHT	2.18	Weight of velvet antler harvested
WET	2.18	Hind lactating at weaning
WET-1	2.18	Hind lactating at weaning the year before
WINCOP	2.33	Copper supplementation of stag in winter (June 1 - September 1)
WINTD	2.33	Anthelmintic treatment during winter (June 1 - September 1)
YARDBW	2.34	Calves handled in yards before weaning
YARDED	2.34	Number of times weaners were yarded by June 1
YERS	2.36	Mob experienced clinical yersiniosis
YERS1	2.36	Mob experienced clinical yersiniosis before June 1
YH	2.10	Number of yearling hinds in the mating mob
YH2	2.10	Number of yearling hinds in the back-up mob at mating
YS	2.10	Presence of exclusively one or more yearling sire at mating
YSMATE	2.10	Yearling hinds left with their yearling stag mates during the rut
YSPM	2.10	Yearling hinds grazing with yearling stags up to mating

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