Investigation of poor calving performance

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Abstract

A low weaning percentage, which had dropped from 85% in 1995 to 72% in 1996, was causing concern. In order to identify the problem, levels of copper, vitamin B_{12}, selenium, iodine, and vitamin E were investigated, and testing done for toxoplasmosis, neosporosis, and leptospirosis. A group of hinds which were pregnant after scanning in July 1996, was closely monitored.

There was no convincing evidence from these investigations that any one of these factors was a major contributor to the lowered weaning percentage. The tracking of performance, now that the Leptospirosis vaccination is in place, may in the future show the effects on hind fertility of manipulating these factors.

As well as continuing with the previous two years' management regime, additional recommendations for the following year were: appropriate hind selection for sires; stag removal by 10 May 1997; scanning for early and late calves; special nutrition for the later-calving hinds; further investigation of mob size, paddock size and pre-calving vitamin E supplementation of hinds.

Key words: Reproduction, calving, weaning, vitamin E, minerals, leptospirosis, environment.

Introduction

After weaning in March 1996 it was apparent that there was a poor calving performance, especially in the first and second calvers. Calving percentage overall was 72%.

By age group it was as follows:

Mixed-age older hinds calved	83%
4-year-old-hinds	79%
3-year-old hinds	65%
2-year-old hinds	70%

All hinds (except first calvers) had a fawn the previous year. All the dry hinds were culled.

No scanning was carried out in the 1995 pregnancy, but in 1994 the pregnancy rates were over 90% on mobs scanned, and the overall weaning rate was 85%. Management practices have changed little over the last 3 years. With the need to build numbers, culling on age has not been carried out. However, the numbers now allow an age-culling policy to be implemented.

In order to identify the problem, levels of copper, vitamin B_{12}, selenium, iodine, and vitamin E were investigated, and testing done for toxoplasmosis, neosporosis, and leptospirosis.

Investigation

The first visit was on 8 March 1996, when the deer were divided into groups and samples collected.

Group 1: 2 and 3-year-old hinds which weaned fawns
Group 2: 2 and 3-year-old hinds which were dry
Group 3: Older hinds which were dry
Group 4: Older hinds which weaned a fawn

Results are as follows:

Table 1. Liver chemistry - Optigrow results 8.3.96

Group 1			
Animal ID	**Copper (μmol/kg)**	**Vitamin B_{12} (pmol/L)**	**Selenium (nmol/kg)**
1	100	540	3250
2	190	540	4050
3	310	260	2250
Means	200	447	3180
Adequate	> 110	> 220	> 854

Table 2. Blood total T_4 and vitamin E (8.3.96)

Animal ID	Group				
	1		*2*	*3*	*4*
	T_4 (nmol/L	*Vit E (μmol/L)*	*Vitamin E (μmol/L)*		
1	112 5	3 0	4 2	3 4	4 7
2	113 5	3 3	3 0	3 0	3 7
3	131 9 H	3 5		3 3	5 5
4	160 5 H	1 9			
5	139 4 H	1 8			
Mean	131 6	2 7	3 5	3 2	4 6
Adequate	50-130	2 5-5			

Data in Tables 1 and 2 show copper, selenium, vitamin B_{12} and iodine are adequate. Vitamin E averaged 3.39. The marginal range supplied for vitamin E at this time was 2.5 - 5.0 μmol/L.

All hinds were given a 10 gm "Copacap" and 4 mls of "Prolject" B_{12} on 5 and 6 March 1996. The pastures regularly received selenium prills.

Table 3. Neospora, leptospiral and toxoplasma titres, March 1996

Animal ID	Neospora IFAT	L. copenhageni MAT	L. pomona MAT	L. hardjo MAT	Toxo titre
Group 1					
1/1180		Negative	Negative	100	
2/25993		Negative	Negative	Negative	
3/276		Negative	Negative	100	
4 269		Negative	Negative	50	
5 255		Negative	Negative	200	
6/911		Negative	Negative	100	
7/234		Negative	Negative	Negative	
8/956		Negative	Negative	Negative	
9/737		Negative	Negative	50	
10/933		Negative	Negative	100	
Group 2					
1/1421	Negative	Negative	Negative	200	1 16
2/14067	Negative	50	Negative	Negative	-
3/241	Negative	50	Negative	800	1 16
4 468	Negative	Negative	Negative	100	-
5/Y53	Negative	Negative	Negative	100	-
6/Y44	Negative	Negative	Negative	100	-
7/715	Negative	Negative	Negative	200	-
8/1037	Negative	Negative	Negative	100	-
9/Y133	Negative	Negative	Negative	Negative	-
10/645	Negative	Negative	Negative	Negative	

Bloods taken from Group 2 showed no evidence of antibody to *Neospora*. Both *L. ictero-haemorrhagica* and *Toxoplasma* showed 20% with low titres. *L. hardjo* showed 70% seroprevalence in Groups 1 and 2.

On 23 April 1996, Optigrow samples were taken from a line of hinds sent to the works (Table 4). Selenium, copper and vitamin B_{12} levels were all adequate which is what we would expect after the treatment in March when the hinds received copper and vitamin B_{12}.

Table 4. Liver selenium, copper and vitamin B_{12}, 23.4.96

Animal ID	Se (nmol/kg)	Cu (μmol/kg)	B_{12} (pmol/kg)
1	8500	740	580
2	7800	900	610
3	8920	920	470
4		1990	
Means	8470	1138	553
Adequate	>854	>110	>220

On 28 May 1996, the rising 2-year-old hinds showed 80% positive for *L hardjo* (Table 5).

Table 5. *L. hardjo* serology, from rising 2-year-old hinds 28.5.96

Animal ID	*L. hardjo* MAT
394	400
209	200
210	200
167	100
257	400
321	Negative
178	Negative
387	400
401	200
212	200

On June 19 1996, 32 weaner hinds were blood-tested for Leptospirosis, with 19% positive to *L hardjo* (Table 6).

Table 6. Leptospiral titres of weaner hinds 19.6.96

No. deer sampled	No. titre positive				
	L copenhageni	*L hardjo*			*L pomona*
		200	400	800	
32	0	1	4	1	0

Scanning of the hinds was carried out during the first week of July 1996.

Table 7. Ultrasound scanning results July 1996

Hinds scanned	No. tested	No. dry	% pregnant
3-year-olds	70	2	97 1
Old hinds	167	19	89 2
Dry last year - mixed age	50	1	98 0
Rising 2-year-olds	30	2	93 3
	73	0	100 0
Total	390	24	97 4

The conception rates averaged 92.4% for the hinds three years and older, and 100% for the rising two-year-olds (Table 7).

Comments

Low calving percentages are often due to several factors. The investigations so far had shown that Leptospirosis was present in the herd and that the vitamin E levels may have been low.

The scanning results showed that conception rates were very good. Even though only representative groups of hinds were scanned we could expect the conception rates to be similar throughout the herd. We now had a group of 366 pregnant hinds to calve. The group was closely monitored through to weaning.

Vitamin E investigation

In order to investigate the need for, and the potential benefits of, vitamin E supplementation we treated 183 of the 366 pregnant hinds in the monitor group with vitamin E at the beginning of September, and again at the end of October. The vitamin E was given to half the hinds by injection and the remainder by the oral route. The remaining 183 hinds were untreated controls.

Close monitoring was really essential as we needed to find the cause of death of the calves. It has been shown that up to 17% of calves are lost between calving and weaning, and generally very few are ever found. I suggested that someone was available to closely watch this mob through the calving time until the calves were about three weeks old. All dead calves were to be postmortemed as soon as possible after being found.

Leptospirosis

Relatively little is known about leptospirosis in deer. It would appear that the deer become infected after weaning and most become positive by the time they are two years old. Winter is the important time for infection. Water is considered important for the spread of the organism. Leptospirosis is also a severe human disease, and care should always be taken when working with a positive herd. The organism is shed in the urine and enters usually through cuts or abrasions in the skin. It is an obligation for employers to take reasonable steps to protect their employees from known hazards.

There is a vaccine for leptospirosis available and I suggested that we commenced a vaccination programme. We therefore vaccinated all deer 4-6 weeks apart in an attempt to protect all the deer that had not already had contact with leptospirosis.

Further analyses

On 3 September 1996 liver biopsies and blood samples were taken.

Table 8. Liver trace elements and blood vitamin E, 3.9.96

Animal ID	Liver Cu (μmol/kg)	Liver Se (nmol/kg)	Liver B_{12} (pmol/kg	Vit # (μmol/kg)
WB 824	190		710	
WB 263	130		610	
WB 253	400		620	
RW 632	320		Insufficient	
WB 1320	400		690	
YB 961	400		450	
WB 824		5180		
WB 253		5260		
632/90				19
253/93				24
961/92				28
Means	307	5220	616	24
Adequate	>110	>854	>220	

Copper, selenium and vitamin B_{12} were adequate and vitamin E seemed to be low (Table 8).

During the September visit samples were taken for routine mineral and vitamin analysis. At those treatment times we weighed all the hinds. Pregnant hinds should have gained between 15-18 kg while dry hinds would be expected to gain only about 3 kg.

On 4 September 1996, all the hinds were weighed and the vitamin E given to the treatment groups (half by the oral route using 7.5 mls of "Solar-Vit", and half by injection of 4 mls of "Vetade". All the hinds were given a "Copcap" 5 g.

On 24 October bloods were collected to measure vitamin E levels. The vitamin E concentrations rose in all three hinds, despite no treatment in the control deer (Table 9).

Table 9. Blood vitamin E levels (μmol/L) before and after treatment

Animal ID	Treatment	Vitamin E 24.10.96	Vitamin E 3/9/96 (previous test)
632/90	Injection 4/9/96	33	19
253/93	Oral 4/9/96	36	24
961/92	Control	42	28

On 25 October 1996, the hinds were all weighed and the vitamin E treatments as outlined above were repeated.

Results of vitamin E treatments - Weaning Time 1997

- Of the 183 untreated hinds, 17 (9.3%) were dry
- Of the 91 hinds receiving 4 ml of Vetade, 5 (5.5%) were dry
- Of the 92 hinds receiving 7.5 ml Solar-Vit, 5 (5.4% were dry
- Of the 183 treated hinds, 10 (5.5%) were dry

The vitamin E-treated groups appeared to have a higher weaning percentage. This difference was not significant at the 10% level when tested by the chi-square test.

Vitamin E concentration interpretation

To provide a benchmark for interpretation of vitamin E results, sera from ten clinically normal animals were tested in March 1997. Five sera were from a high-producing herd, and five sera from a low-producing herd. These were from a serum bank from hinds surveyed by Laurent Audigé (see data elsewhere in these Proceedings). The mean concentration of the animals in the low-producing group was no lower than that of the high-producing group. The range was 1.8 - 4.2 and the overall mean was 3.11.

Thus results from deer in the present investigation appear to be within the normal range. However, the requirement in late gestation warrants further investigation.

Perinatal mortality

During calving time close monitoring of the hinds to establish the cause of death of the calves was very difficult. Despite good stockmanship the hinds resented humans in the paddocks and became disturbed. After five days the monitoring was abandoned as it was felt it could cause unnecessary fawn losses.

Two dead calves were presented for necropsy (after being frozen). A larger male fawn (A) had breathed but not suckled. Its stomach contained a little fibrous plant material. Death was probably due to mismothering. A small male fawn (B) had breathed but not suckled. This animal had extensive bruising and oedema in the right cervical/shoulder region suggesting trauma.

Table 10. Trace element results from necropsied newborn calves

Animal ID	Liver Se (nmol/kg) 16.1.97	Liver Cu (μmol/kg) 16.1.97	Liver B_{12} (pmol/kg) 16.1.97
A	9160	7020	100
B	2620	1420	110
Adequate	854-10 000	110 - 2 000	
Excessive		2 000 - 10 000	

Marking

Marking was carried out in late January 1997. The hinds were classified as wet/dry (those that scanned pregnant in July but were not lactating at marking time). The weights plus the wet/dry status of the hinds, vitamin E treatments, weaning percentages, and sires are recorded below.

Table 11. Mean (range) of weights (kg) and status at weaning of vitamin E treated and control old hinds, 1996

Group	N	4.9.96 weight		25.10.96		Difference		Status at weaning
		Mean	*(range)*	*Mean*	*(range)*	*Mean*	*(range)*	
Control	31	105 3	(86-127)	114	(80-139 5)	9 6	([-]34-[+] 22)	3 dry
Vit E injection	18	103 6	(92-126)	110 2	(96-134)	6 9	([-]14-[+] 11)	2 dry
Vit E oral	21	102 9	(85-121)	109 3	(92-127)	67 4	(1 5-12)	4 dry

Table 12. Mean (range) of weights (kg) and status at weaning of vitamin E treated and control mixed age hinds (different mob to data in Table 11), 1996

Group	N	4.9.96 weight		25.10.96		Difference		Status at weaning
		Mean	*(range)*	*Mean*	*(range)*	*Mean*	*(range)*	
Control	59	98 73	(86-122)	105 1	(87-120)	6 4	([-]4-[+] 20)	6 dry
Vit E injection	37	95 8	(70-111)	113 5	(85-119)	7 7	([-]7-[+] 31)	2 dry
Vit E oral	33	99 8	(85-128)	106 6	(87-134)	7 7	([-]5-[+] 21)	1 dry

We expected to see a 15-18 kg increase in weight for pregnant hinds and only a 3 kg increase in weight for the dry hinds. The weights reported showed some hinds that weaned a calf only put on a small amount of weight, or lost weight from September to late October. Thus, deciding if hinds were dry on weights taken early in September and late October was rejected.

Sire effects

Following are the fawns marked to various sires (Table 13).

Table 13. Calves marked from various sire groups

Hinds in calf to	No.	No. fawns	%
Hybrid stags	544	422	77 6
English stag	28	23	81 2
Yugo	71	52	73 2
Hungarian stag	32	28	87 5
Red stags	297	278	93 6
3/4 -bred stags	420	359	85 5
½-bred stags	178	144	80 1

Comments and recommendations

The hybrids and Yugo returned the lowest percentage of fawns marked. Yugo, who is getting old, should serve fewer hinds in 1997. The hybrids should serve the larger good-conditions hinds and not the old hinds as happened in 1996. The old hinds which are not culled were to be served by red stags.

Weaning percentages

Table 14. Weaning percentages

Age	1996	1997
Mixed-age	83%	88%
Old hinds (10 yrs and older)	79%	80 5%
4-year-old	65%	91%
3-year-old	70%	84%
2-year-old		
Overall	72%	83%

Improvements are obvious across all age groups, but especially in the two- and three-year-old hinds.

Age, breed, condition, weight and fertility history are all important in the overall marking percentage. We know that dry hinds which calve late should be culled. Also poor condition hinds should not be kept. Selection pressure on the hinds needs to be increased. The effect of leptospirosis in the herd is unknown.

It is believed by some that the weaning percentage on most larger farms has dropped from 95% to 85% over the last few years. The reasons for this are not clear, but we can be sure that many factors are involved. Also, there have been some reports that smaller mobs of hinds wean higher percentages of fawns than do the larger mobs on some properties. We now had some good data on which to work for 1997.

The improvements were obvious across all age groups. Nutrition had improved over the last year. However, it still needed attention as some hinds appeared to have lost weight or put on only a small amount in late gestation.

Recommendations and actions implemented in 1997

Weaning time

Dry, old and poor condition hinds were culled. The number of hinds for Yugo was reduced and the larger and good condition hinds were selected for the hybrid stags. The hinds for the hybrid stags were not first calvers. The hinds prior to mating received their booster leptospirosis vaccination, 10 g Copacap, and a Vetdectin pour-on drench.

Mating

The mating protocol remained the same as last year with the above changes noted.

At scanning

We tried to identify the later-calving hinds so that they could be fed differentially, especially in late gestation, to try and avoid dystocia. From the remaining pregnant hinds we took 402 mixed-age hinds and divided them into five groups. They went into the five paddocks listed below, all of which performed well the previous year with respect to the percentage marked. Within each group some hinds received vitamin E in the form of vitamin E 500 powder, by the oral route. Each hind received the equivalent of 300 iu of vitamin E. This was given once orally at hind-sorting time (late October). Results are presented in Table 16.

After scanning

These mobs had the same management as the previous year.

Final update 1998

Marking

Marking was carried out in late January 1998. The hinds were classified as wet/dry (those scanned pregnant in June but were not lactation at marking time). The weights plus the wet/dry status of the hinds, vitamin E treatments, weaning percentages, and sire are recorded in Table 15.

Table 15. Mean (range) of weights (kg) and status at weaning for hinds given vitamin E, and controls. 1997 trial

Group	N	18.9.97 weight		28.10.97 weight		Difference		Status at weaning
		Mean	*(range)*	*Mean*	*(range)*	*Mean*	*(range)*	
Control	61	98 8	(86-116)	106 8	(85-134)	8 3	([-]9-[+] 27)	3 dry
Vit E oral	46	100 4	(85-123)	112 8	(95-137)	10 1	([-]4-[+] 19)	2 dry

There was a similar pattern to that observed the previous year (1997). Deciding if hinds are dry on weights taken early in September and late October is not advised on this property.

Results of vitamin E treatments - marking time 1998

Table 16. Data for vitamin E treated and control hinds at marking, 1998

Group No.	Paddock	Vitamin E treated	Dry	Untreated	Dry	Sire	Total
1	Comp Stop	20	1	20	3	Red (R)	40
2	Jims	41	0	56	6	Hybrid (H)	97
3	Woolshed	30	1	46	3	R	76
4	Winstons	30	0	20	0	E	59
5	Innes	30	1	100	7	H	130*

Total: 402 deer

* Please note: The difference in this mob is significant at the 1% level when tested by the chi-square test. There was no significant difference between Vit.E treatment on controls in the first four groups.

Overall:
- Of the 251 untreated hinds 19 (7.6%) hinds were dry (SE = 1.7%)
- Of the 151 hinds receiving oral vitamin E, 3 (2.0%) were dry (SE = 1.1%)

The difference was significant at the 5% level. Thus, the vitamin E-treated group had a significantly higher weaning percentage.

Sires

Following are the fawns marked (Table 17):

Table 17. Summary of marking from sire groups 1996-97

Hinds in calf to	1996			1997		
	No hinds	*No fawns*	*%*	*No hinds*	*No fawns*	*%*
Hybrid stags	544	422	77 6	708	569	80 4
English stag	28	23	82 1	39	27	69 2
Yugo	71	52	73 2	45	38	84 4
Hungarian stag	32	28	87 5	-	-	-
Red stags	297	278	93 6	348	318	91 4
3/4-bred stags	420	359	85 5			
½-bred stags	178	144	80 1			
European cross (includes ½ and 3/4 breds)				463	413	89 2

Comments

The English stag performed poorly this year. The hybrid stags also returned a lower percentage compared with the red stags. Yugo appeared to improve this year with serving fewer hinds.

The hybrid progeny realise more money at weaner sales and thus compensate for the poorer percentage.

Weaner percentages

Table 18. Weaning percentages

Age	1996	1997	1998
Mixed-age	83%	88%	85%
Older hinds (10 yrs & older)	80 5%		
4-year-old	79%		
3-year-old	65%	91%	83%
2-year-old	70%	84%	88%
Overall	72%	83%	85%

Comments

The overall percentage has increased. No obvious reason is seen for the three-year-olds' poor performance compared with the previous year. The majority of two-year-olds which calved in the Hill Paddock weaned 91%.

Environment

The hill paddock performed well for the two-year-olds, and the Tractor house paddock also performed well again. The Roadside paddock was down on last year's good result, and the Back paddock was up on last year's disappointing result. Future long-term record-keeping with respect

to the environment may help us identify paddocks where calving performance is reasonably consistent.

Comments after weaning 1998

General

A two percent increase was less than we had hoped for, but still represented 32 more fawns than the previous year. Although the data regarding vitamin E treatment has only been analysed for the past two years, my personal view is that the results have considerable significance for the reproductive performance of the deer on this property.

The future?

It is hoped that by adding to and updating data already collected and subjecting this to further analysis, the calving performance will continue to improve.

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