Trace element observations from commercial deer farms: Richmond Wrightson Deer Performance Project data

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One of the objectives of The Richmond Wrightson Deer Performance Project (RWDPP) (Walker *et al. 1999)* was to examine trace element and other biochemical parameters to examine the role they may have in deer farm productivity

Blood samples were collected on two occasions per year from 10 deer on each farm In the autumn (Feb-Mar), blood samples were taken from rising two-year-old (R2) hinds, and in the spring (Sept), samples were taken from mixed age (MA) hinds.

From the initial blood samples, the following parameters were examined

> Pepsinogen, gamma glutamyl transferase (GGT), albumin,
> Total protein and serum vitamin B12, selenium and
> Copper (Cu).

A comprehensive range of liver biopsies was also obtained in Sept 98 concurrent with some of the serum samples taken

Faecal egg counting from various classes of stock was also part of the testing program, but it proved difficult to get participants to regularly collect and submit faecal samples

After the initial 12 months testing period, the range of samples collected and analysed was assessed to determine the value of the information gained. As a result, further samples have been taken and stored for future reference if the need arises

Selenium, Vitamin B12, GGT and Albumin

Table 1 presents farm mean serum selenium, vitamin B12, GGT and albumin concentrations

Table 1. Mean serum selenium and vitamin B12 (Feb 98 and Apr 99) concentrations of R2 hinds, and serum GGT and albumin from MA hinds

Farm	R2 Hinds			MA Hinds	
	Selenium µmol/l	Serum B12 pmol/l		GGT	Albumin
Date	Feb 98	Feb 98	Apr 99	Sept 98	Sept 98
1	309	286	290	23.4	29 51
2	845	280	403	22 2	30.81
3	1081	174	186	39.7	32.22
4	809	433		24 1	30 15
5	327	324	409	20.9	27 76
6	587	162	309	20.5	30 5
7	272	273	264	21.8	30 86
8	548	199	307	25.7	30 36
9	283	219		19 3	30 39
10	429	340	381	23 7	31 67
11				24 3	30.49
12				36.6	30 85
ADEQUATE	140+	150 - 1000		18 - 56	22 - 33

Means of all parameters measured are within adequate levels as designated by the diagnostic laboratory. Within our group of farms we have not seen any clinical signs associated with deficiencies of any of these parameters, and productivity on most farms is increasing. No further monitoring was justified for these parameters in the interim.

Copper

Copper in deer is quite a controversial topic (Wilson and Audigé, 1998) and we have continued monitoring copper over a longer period It is difficult to get good evidence of productivity gains from giving copper (Wilson and Grace, 2000, and these Proceedings).

Until recently there have been no clinical signs of copper deficiency on the RWDPP farms, despite some low Cu levels

Table 2 Farm mean serum and liver copper concentrations recorded from farms in the RWDPP.

	Serum Copper µmol/L				Liver Copper µmol/kg	
Farm/date	Mar 99	Sept 98	Feb 98	Sept 97	Sept 98	July 98
1	13.6	5.61	14.17	8.3	49.75	172.5
2	11.1	5.93	10.69	5.2	53.25	111.75
3	7.2	8.02	11.75	3.5	48.5	68
4		8.24	12.14	3.49	44.75	53.5
5	12.9	9.3	10.45	7.42	57	81
6	14.1	6.03	11.28	11.0	55.5	112
7	16.1	8.3	11.21	9.71	57.75	
8	10.5	4.99	11.55	12.09	42.5	
9		11.89	11.07	8.7	178	107.75
10	12.8	13.74	9.74	12.98	72	120.67
11		13.5		12.32	202.5	41
12		10.02				
ADEQUATE		8.0 – 18.0 µmol/L			> 95 µmol/kg	

There is a clear seasonality with serum copper, with levels in the spring the lowest consistent with other observations (Wilson and Audigé, 1998). Based on observations of these authors, a number of deer on some of the RWDPP farms could be "at risk" of clinical copper deficiency disease

None of the RWDPP farms have a regular copper supplementation policy, but farm 11 has used copper oxide wire particles ("Coppercaps") in the winter on some occasions.

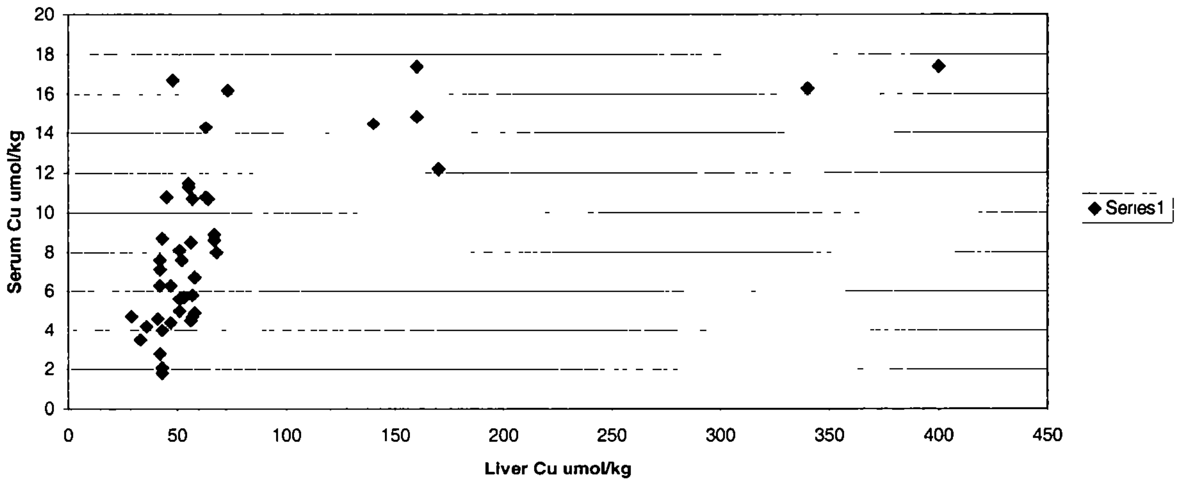
In September 1998, 4 hinds from each property were blood sampled and a liver biopsy performed on the same hinds. Paired data are presented in Table 3, with a scatter plot (Figure 1).

Table 3 presents the blood and liver copper concentrations which are summarized in Figure 1.

Table 3 Paired liver and serum copper from 11 Farms (4/farm)

Hind No	Liver Cu	Serum Cu	Hind No	Liver Cu	Serum Cu	Hind No	Liver Cu	Serum Cu
Y420	64	10 7	93/22	67	8.6	3061	58	6.7
G84	41	4 6	92/16	400	17.4	4107	51	5
Y423	57	5 8	102/94	67	8 9	189	57	4 7
Y592	51	8 1	A40	43	2 1	8154	56	4 5
206	36	4 2	90/3	43	4	4185	68	8
344	52	7 6	507	58	4 9	4457	42	7.1
88	48	16 7	521	55	11 5	4191	63	10 8
84	43	8 7	437	160	17.4	4200	55	11 3
91/92	56	8 5	4095	57	10 7	938/89	170	12 2
315/93	51	5 6	YB	42	6 3	42/90	160	14 9
183/93	45	10 8	489	29	4 7	19/88	340	16 3
555/91	42	2 8	958W	33	3 5	45/95	140	14 5
Y137	42	7 6	33W	47	6 3			
B147	73	16 2	14W	43	1 8			
B31	63	14 3	14B	47	4 4			
Y27	53	5 7						

Figure 1. Relationship between Serum Cu & Liver Cu from data in Table 3



What does this mean in terms of recommending to a farmer whether they should supplement copper or not?

Are the recommended "adequate" levels from the laboratory appropriate in our area or not?

In late 1999, we had one report of a pregnant R2 hind with slight hind limb ataxia on Farm 4

The body weights of other R2 hinds and stags on this property were equal to the means of all farms in the group There is no difference in reproductive performance on this property compared to others in the group either

Blood samples and liver biopsies were taken on this property from MA hinds, and blood samples from R2 hinds Results are presented in Table 4

Table 4. Serum and liver concentrations of clinically unaffected hinds from Farm 4 which experienced a clinical case of enzootic ataxia

MA Hind		R2 Hind
Serum Copper µ mol/L	Liver Copper µ mol/kg	Serum Copper µ mol/L
2 4		3.4
2 1		1 5
1 4		0.9
1 6		2.6
1 5		1 8
1 7	12	1 5
2 2	18	0 7
5 9		
1 3	9	
3 7		
Mean 2.4	**13**	**1.8**

In early 2000, farm 3 had 2 fawns of approx 600 calves with signs of hind limb ataxia or hoppy gait, and osteochondrosis just prior to weaning Serum copper levels from a sample of those fawns had a mean of 6 4 µmol/L (range 1 6—12 9)

This property is where a previous trial was performed looking for response to copper supplementation from velveting stags and growth in young deer (Walker *et al*, 1997). No significant response to treatmentwas found.

There has been very good improvement in weaning weights and growth rates over the last 2 years from this herd

Conclusions

The main variation from accepted normal levels of the parameters we have analysed in this project is related to serum and liver copper. Effects on productivity in terms of growth have not been demonstrated. However, the occurrence of clinical signs of enzootic ataxia and osteochondrosis indicate that where herd mean copper concentrations are low (serum Cu 3.5 µmol/L and below, and liver Cu 68 µmol/kg and below) some animals are at risk of disease These data are consistent with those of Wilson and Grace (2000 and these Proceedings). The results obtained for serum and liver copper levels leave many unanswered questions with respect to appropriate minimum levels which may trigger suitable supplementation, but suggest that the levels recommended by Mackintosh *et al* (1986) provide a significant margin for safety Data from this project also supports the suggestion of Wilson and Grace (2000) that reference values for growth in young deer, and prevention of clinical disease in older deer may be different, with the latter group requiring higher levels

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