Trace elements data from the Deer Master Project

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Abstract

The trace element status of rising 1 (R1YO) and 2-year-olds, (R2YO) and mixed age (MA) hinds in spring and autumn over 3 years on 17 South Canterbury and North Otago deer farms was measured Blood concentration of copper, Vitamin B12, selenium, pepsinogen and albumin were measured by the Invermay Animal Health Lab

Results varied between age group, season and farm These results indicate there is case for changes to the reference range for albumin. Copper showed a seasonal pattern, being higher in autumn than in spring and this was more pronounced for older hinds compared with R1YO hinds Serum Vitamin B12 and selenium varied between and within farm

Results are discussed with reference to level of supplementation, current guidelines on adequate levels and incidence of clinical deficiency

Introduction

This paper covers information held by Deer Master (Campbell, 1998) on the use of trace element supplements and trace element status of commercially farmed hinds on a range of properties in South Canterbury and North Otago

The aim of the Deer Master project was to increase fawning and weaning percentage and venison and velvet production As part of this effort a wide variety of information has been collected to allow the identification of the critical factors which enable high production and reproduction performance

Reports to farmers include a graphical blood trace element summary of these results and an explanation of how the data was collected and summarised

Results are likely to reflect current practices for the deer industry since no trace element management was imposed as part of the project and farmers were able to do as they saw fit.

Data are presented to demonstrate the ranges observed on commercial deer farms Interpretation is difficult because of the uncertainty of reference ranges for many trace elements The establishment of trace element reference ranges has recently been reviewed by Wilson and Grace (2000), with current data summarised elsewhere in these proceedings (Wilson and Grace).

Summary of survey and measurements

The trace element information is based on biannual blood sampling in March and October. This began in 1996 and concluded in October 1998 At each sampling episode blood samples were collected from 10 "sentinel" animals per age group (R1YO, R2YO and Mixed Age) per farm Animals had been identified with a Deer Master tag that facilitated repeat sampling from the same deer Blood samples were analysed at Invermay Animal Health Lab, Mosgiel using standard AOAC methods.

Samples were analysed for albumin, serum selenium, glutathione peroxidase, serum copper, Vitamin B12 and pepsinogen Due to cost and analytical sensitivities not all samples from each farm were tested for each parameter but each farm had some samples analysed for all parameters The numbers analysed from each property was based on statistical requirements

At each blood sampling episode the dose rate of oral or injectable trace elements and or the application rate for pasture broadcast of trace element products, for the previous 6 months were noted on each property.

Herbage samples from each property were taken on an annual basis in October-November

Copper

Supplementation practices

The quantity of copper given to hinds, the route of administration and the timing of supplementation have been summarised in Table 1

Table 1. Summary of copper supplementation in Deer Master herds between 1996 and 1998

Farm	Spring 96	Autumn 97	Spring 97	Autumn 98	Spring 98
A			Adult inj. 2ml		
B	Adult 10g bullet R2 5g bullet	R1· 4g bullet	Adult 10g bullet R2 5g bullet		Adult· 10g bullet R2 5g bullet
C	Adult 12g bullet R2 12g bullet R1:4g bullet	R2 Drench R1 Drench	Adult 12g bullet R2 4g + drench R1 Drench		Adult 12g + 12mg d R2 12g + 12mg dr R1 4g + 12mg drenc
D	Fert 7kg/ha $CuSO_4$	R1· 29mg Drench			
E	R2 8g bullet	R1 4g bullet	R2· 5g bullet	Adult. 5g bullet R2 5g bullet	Adult. 10g bullet
F	Nil	Nil	Nil	Nil	Nil
G					
H	Nil	Nil	Nil	Nil	Nil
I	Nil	Nil	Nil	Nil	Nil
J		Adult 4g bullet R2 4g bullet R1 4g bullet	Fert 2 5kg/ha $CuSO_4$ Adult: inj. 2ml		
K	Nil	Nil	Nil	Nil	Nil
L	Adult 10g bullet R2 10g bullet	Adult 10g bullet R2. 10g bullet R1· 4g bullet	Adult. Cu in suppl R2. 10g bullet R1. 4 g bullet	Adult 8g bullet R2: 8g bullet R1· 4g bullet (all on Cu in suppl.)	
N		R3 10g bullet			
O	Nil	Nil	Nil	Nil	Nil
Q					
R	Adult 12g bullet R2 12g bullet	R2 12g bullet R1 5g bullet + drench	Adult 12g bullet R2 12g bullet	R2. 12g bullet plus drench	Fert·4 5kg/ha $CuSO_4$

Where bullets = copper needle containing capsules
Drench = Oxfen C high mineral drench
Inj = injectable copper as Coppernate
Adult = hinds more than 2 years old
R2 = hinds between 1 and 2 years of age
R1 = hinds weaned but less than 1 year of age Cu in suppl = copper in processed feed fed to hinds

These results showed:

- Within the group, copper supplementation was significant in terms of numbers of deer supplemented and frequency.
- Supplementation policies ranged from a zero input system to both direct animal supplementation and fertiliser based supplementation.
- Orally dosed copper capsules were the most commonly used supplement although additions of copper to fertiliser increased in popularity

There was variation between years within some farms while others had a consistent copper supplementation programme These data and observations are similar to those reported in a survey of deer farms by Audige (1995) and Wilson and Audige (1998)

Seasonal and age variation in copper level

Group mean serum copper concentrations of hinds stratified by age are presented in Figure 1. These data are from all deer and all farms combined These results showed·

- A seasonal pattern of serum copper concentrations was recorded, with autumn levels higher than spring.
- An apparently greater amplitude in the seasonal differences of serum copper for mixed age hinds had greater variation than for younger hinds.
- Copper levels in weaners were generally higher than those in older deer.
- Mean serum copper values for all properties were within the 'normal" limits

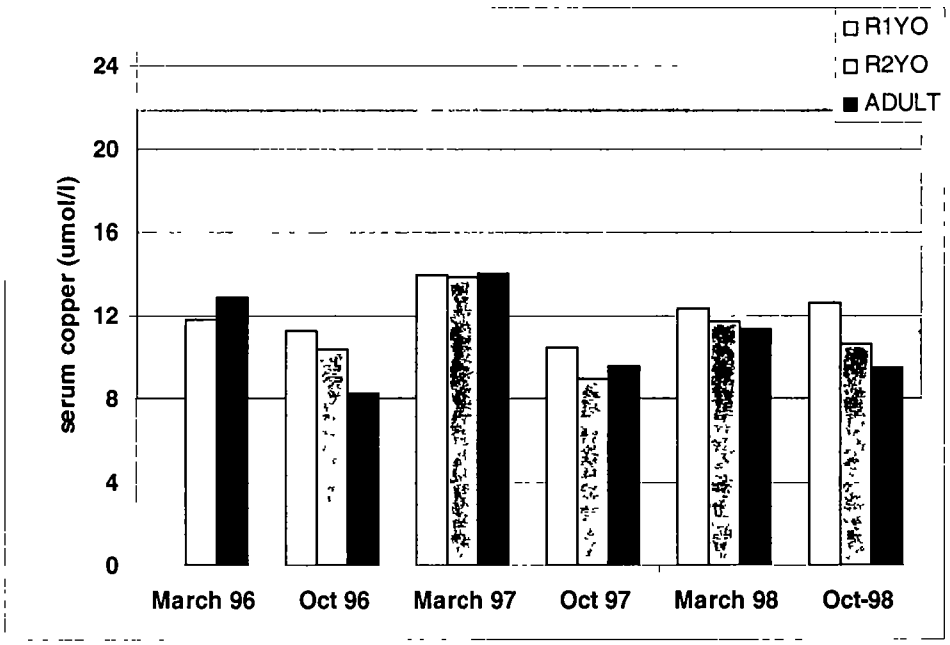

Figure 1 *Mean serum copper concentration (μmol/l) of sentinel R1YO, R2YO and adult hinds on all properties over 3 years The shaded area represents the recommended "normal" range as specified by the Animal Health Lab*

These results show a pattern consistent with that reported by Wilson and Audige (1998) who proposed that the seasonal and age patterns of blood copper concentrations were related to feeding levels. Generally older hinds are on maintenance or below maintenance during winter whereas R2YO are generally fed to achieve some growth. Weaners are generally fed an allowance well above maintenance to achieve optimum growth

It is notable that blood levels on many farms supplementing with copper (Table 1) still fall in the range where some deer may be at risk of clinical disease Further some herds not supplementing have some deer with low copper A similar range of blood copper in relation to supplementation practices was observed by Wilson and Audige (1998)

Range and Distribution of copper levels between farms

The distribution of serum copper concentration on each farm for all hinds and all sampling episodes is presented in Figure 2

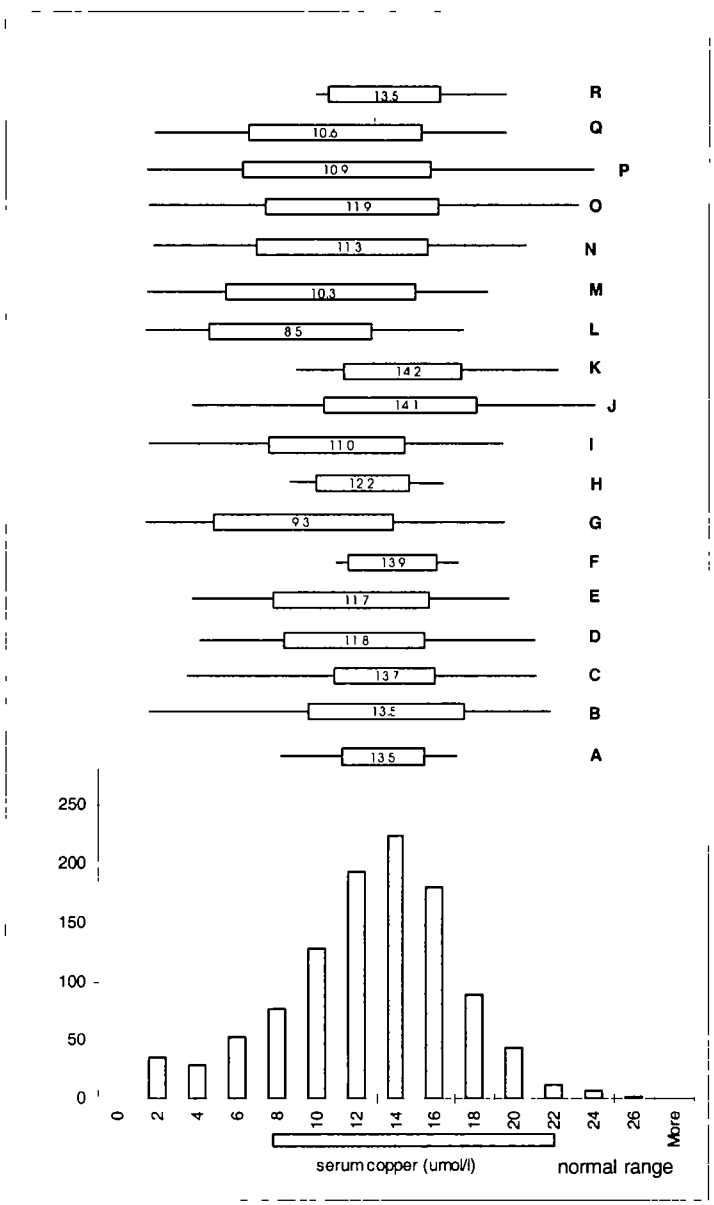

Figure 2. *A histogram of serum copper concentrations on all farms and at all sampling periods, with box (± 1 SD, 66% of values) and whisker (range) plots representing each property. Figures in the box are the mean and the grey bar below the x axis indicates the recommended 'normal' range*

Selenium

The quantity of selenium, the route of administration and the timing of supplementation has been summarised in Table 2 No substantial reference range exists for selenium or glutathione peroxidase in deer (Wilson and Grace, 2000). There were no signs of clinical deficiency on any farms.

Table 2. Summary of selenium supplementation in Deer Master herds between 1996 and 1998

Farm	Spring 96	Autumn 97	Spring 97	Autumn 98	Spring 98
A		Fert 1kg Se/ha		Fert 10g Se/ha R1 inj 10mg Se	
B		Adult Deposel 2ml Inj.			
C		R1 8mg Se drench	R2 drench 10mg Se	R1.drench 6mg Se	Fert· 1kg Se/ha R2 10mg Se drench R1 6mg Se drench
D		R1 6mg Se drench			

Farm	Spring 96	Autumn 97	Spring 97	Autumn 98	Spring 98
E		Fert. 2yr Se Prills			
F		R1 6mg Se drench		Fert 1kg Se/ha	
G					
H					
I	Fert 1kg Se/ha	R1 6mg Se drench	Fert 1kg Se/ha		Fert 500g Se/ha
J	Fert 1kg Se/ha		Fert 1kg Se/ha		Fert 1kg Se/ha
K	Fert. 1kg Se/ha		Fert. 1kg Se/ha	Fert 1kg Se/ha	
L	Fert 1kg Se/ha		Fert 800g Se/ha		Fert 800g Se/ha
N		Fert 300g/ha		Fert 500g Se/kg	
O			Fert 1kg Se/ha		
Q					
R		Fert 1kg/ha	Fert 1kg Se/ha	R2 15mg Se drench	Fert 1kg Se/ha

Where Adult = hinds more than 2 years old
R2 = hinds between 1 and 2 years of age
R1 = hinds weaned but less than 1 year of age

Seasonal variation in selenium level

Mean serum selenium concentrations (Fig 3) and mean glutathione peroxidase concentration (Fig 4) of hinds stratified by age are presented These data are from all deer and all farms combined

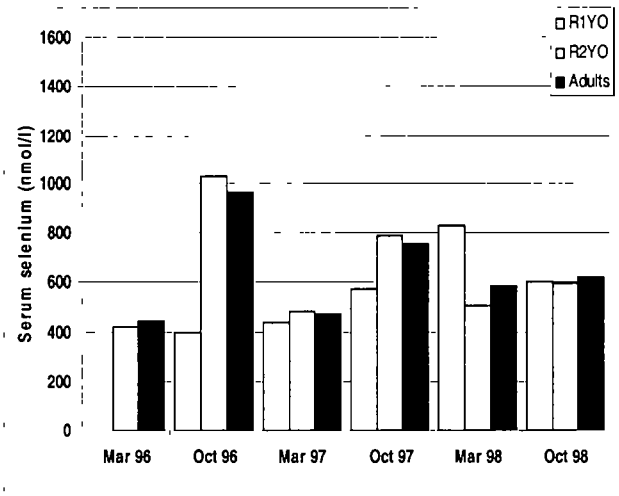

Figure 3 Mean serum selenium concentration (nmol/l) of sentinel R1YO, R2YO and adult hinds on all properties over 3 years

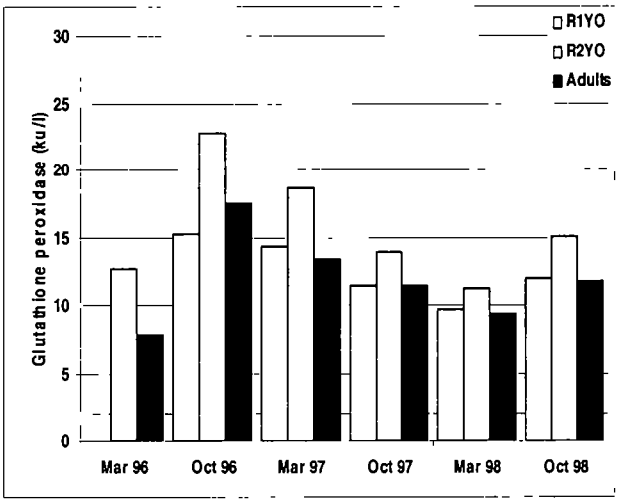

Figure 4 Mean glutathione peroxidase concentration (ku/l) of sentinel R1YO, R2YO and adult hinds on all properties over 3 years The shaded area represents the recommended "normal " range as specified by the Animal Health Lab

Range and Distribution of selenium levels

The distribution of serum selenium concentration on each farm for all hinds and all sampling episodes is presented in Figure 5 The reference range for Selenium is currently unknown but appears to be below the recommended level of 250 nmol/L used for sheep (Grace *et al* 2000).

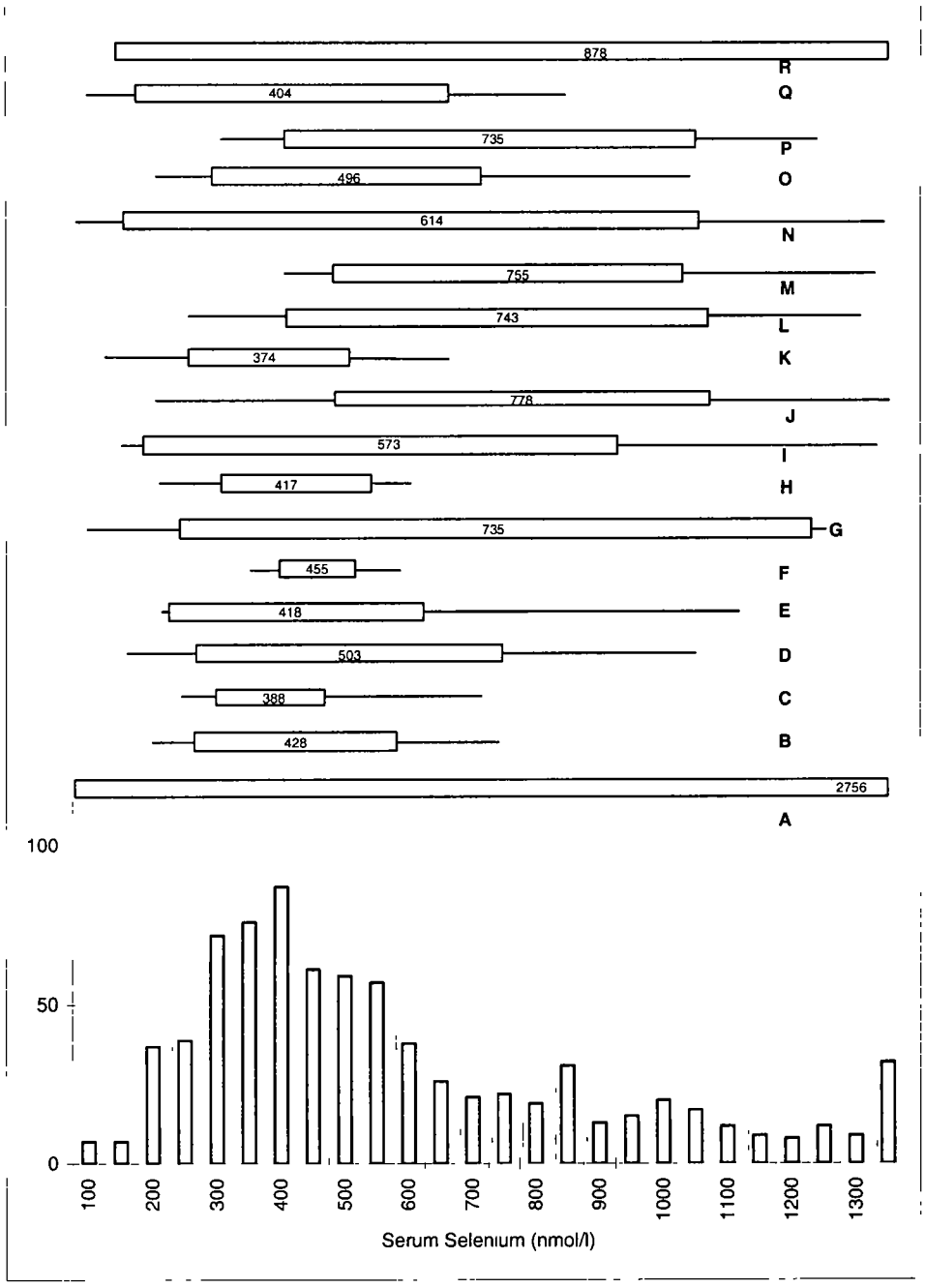

Figure 5. *A histogram of serum selenium concentrations (nmol/l) on all farms and at all sampling periods, with box (± 1 SD, 66% of values) and whisker (range) plots representing each property Figures in the box are the mean for each property*

The distribution of glutathione peroxidase concentration on each farm for all hinds and all sampling episodes is presented in Figure 6.

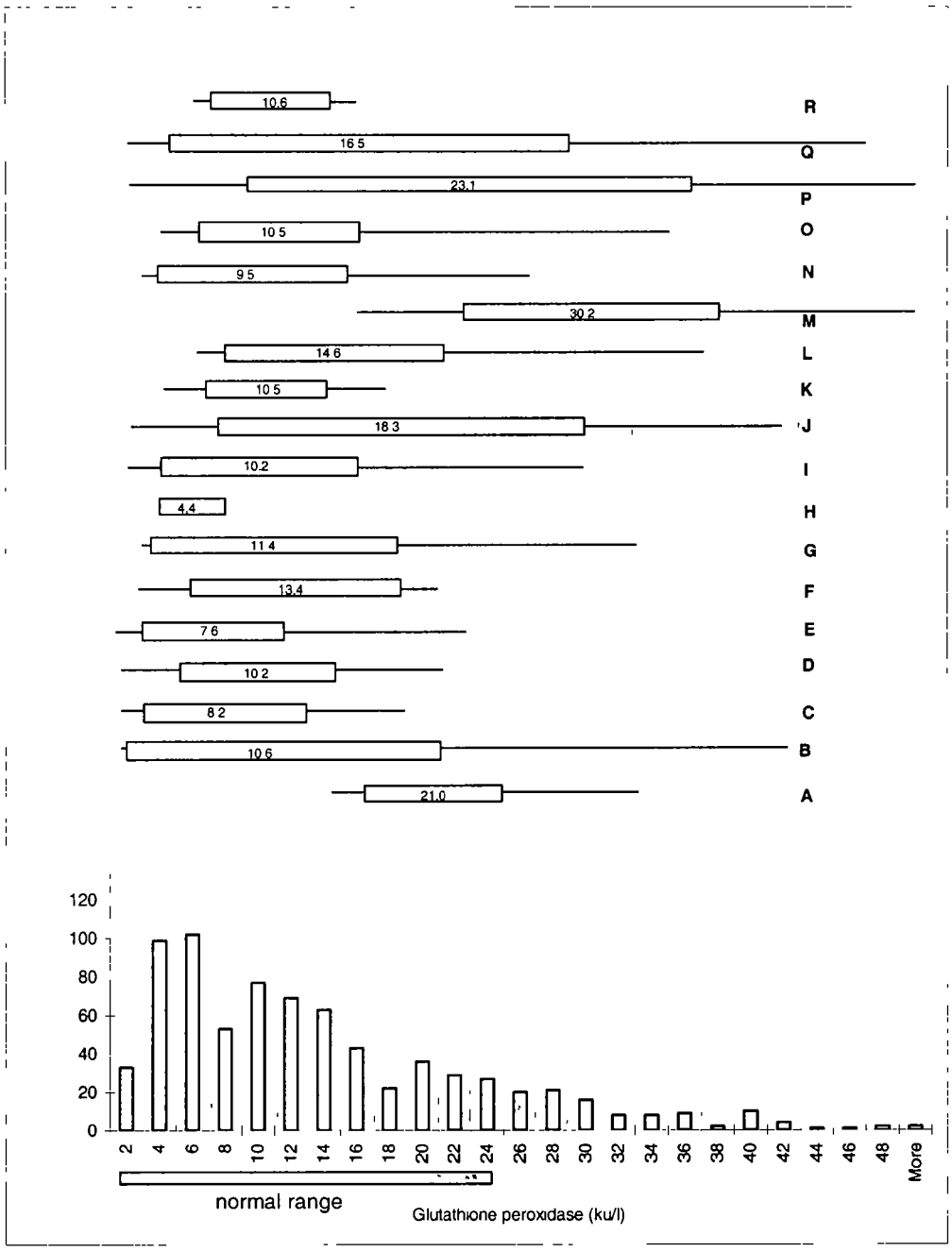

Figure 6. *A histogram of glutathione peroxidase concentrations (ku/l) on all farms and at all sampling periods, with box (± 1 SD, 66% of values) and whisker (range) plots representing each property. Figures in the box are the mean for each property and the grey bar below the x axis indicates the recommended 'normal' range*

Summary

- This survey confirmed a high proportion of farmers using selenium supplements
- Most farmers apply selenium as prills via annual fertiliser at a rate of 1kg/ha
- Serum selenium has shown no consistent seasonal pattern. In some years levels are higher in autumn compared with spring but the opposite in others There were differences in this pattern between age groups.
- There is big variation in individual hind serum selenium and glutathione peroxidase both within farm and between farms with some deer possibly at risk of clinical disease on some farms

Vitamin B12

No substantial reference range data is available for Vitamin B12 (Wilson and Grace, 2000 and this proceedings) Table 3 records the Vitamin B12/cobalt supplementation practices on farms

Table 3. Summary of Vitamin B12/Cobalt supplementation in Deer Master herds between 1996 and 1998

Farm	Spring 96	Autumn 97	Spring 97	Autumn 98	Spring 98
A		Fert 350g Co/ha		Fert 350g Co/ha	
B					
C					
D					
E	R2 2ml Inj Vit B12 R1 4g Co bullet	R1 4g Co bullet	R2: 4g Co bullet		
F					
G					
H					
I					
J				2ml Inj Prolavax	
K					
L					
N					
O				R2 Prolaject 2ml	
Q					
R		R2 Inj Prolavax 2ml		R2 Prolaject 2ml 15mg Co drench	Fert 375g Co/ha

Where Adult = hinds more than 2 years old
R2 = hinds between 1 and 2 years of age
R1 = hinds weaned but less than 1 year of age
"Prolavax" (Bomac Laboratories Ltd) contains 1mg of Vit B12/ml
"Prolaject" (Bomac Laboratories Ltd) contains 2mg of Vit B12/ml

Seasonal variation in vitamin B12

Mean serum Vitamin B12 concentration of hinds stratified by age is presented in Figure 7.

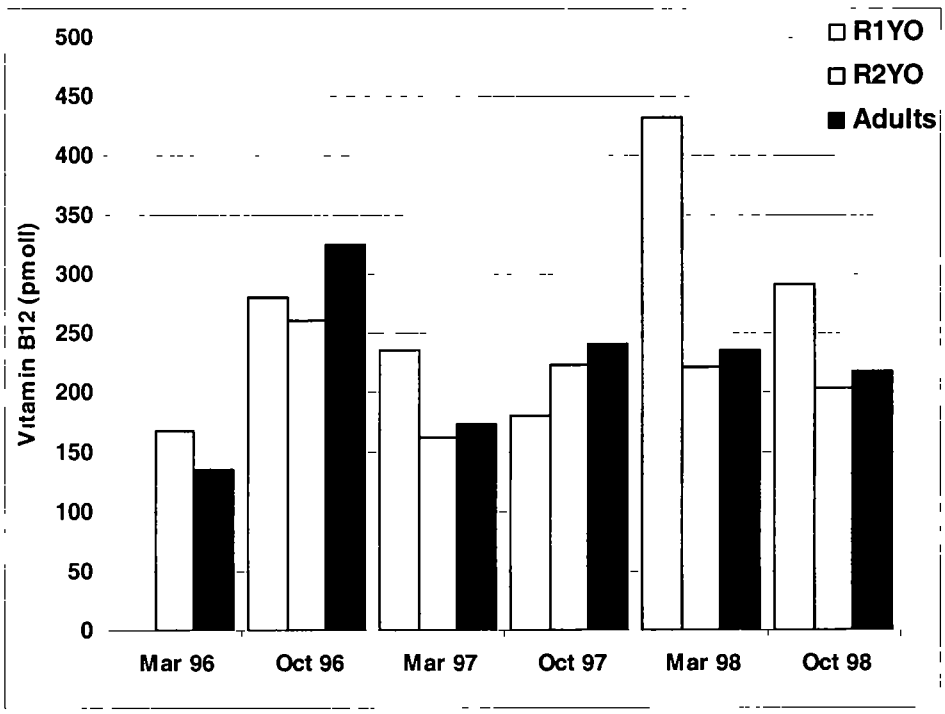

Figure 7 *Mean vitamin B12 concentration (pmol/l) of sentinel R1YO, R2YO and adult hinds on all properties over 3 years*

Summary

- Few farmers supplement with Vitamin B12 or cobalt
- Vitamin B12 levels have been relatively consistent in all age groups.
- Farms A,E J and R supplemented and these recorded some of the higher values.
- A large number of deer possess Vitamin B12 concentrations within the range expected to produce growth responses in sheep, but not in deer (Wilson and Grace, 2000)

Range and Distribution of vitamin B12 levels

The distribution of Vitamin B12 concentration on each farm for all hinds and all sampling episodes is presented in Figure 8

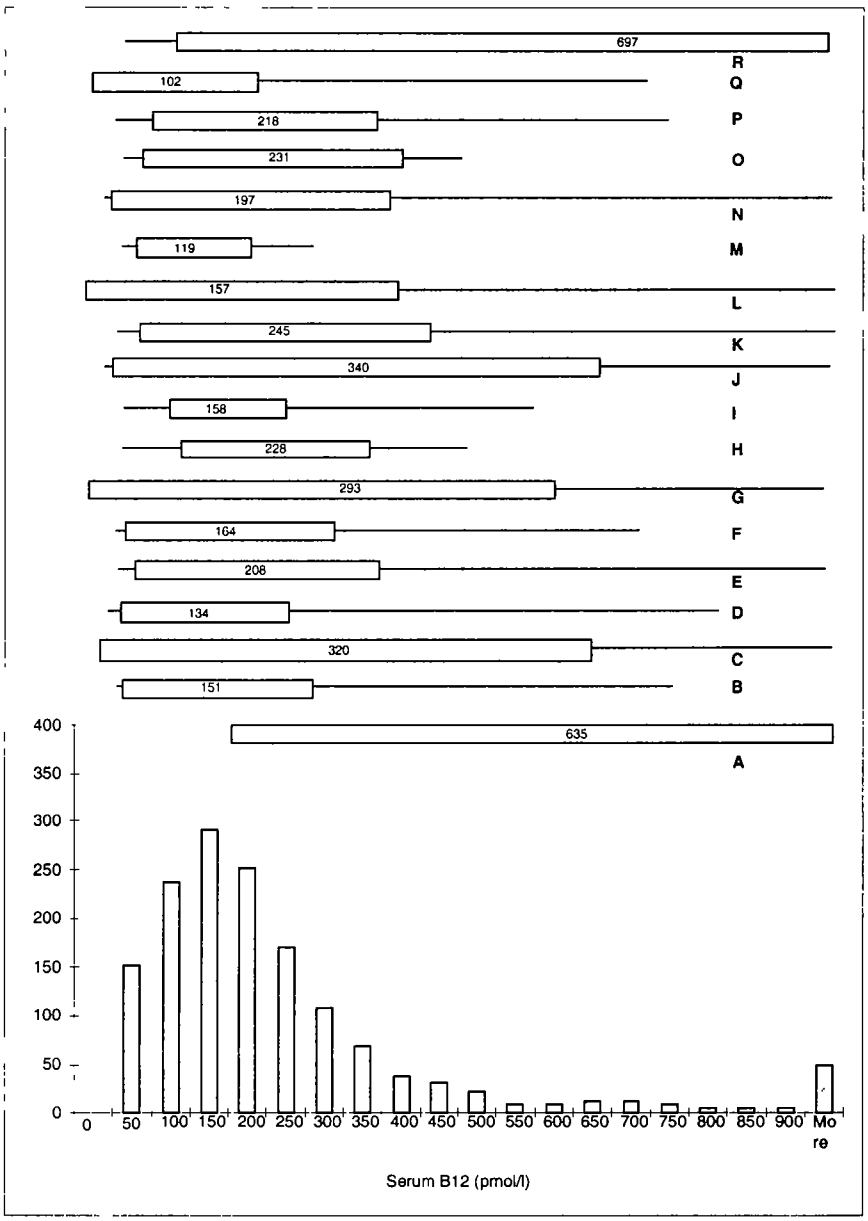

Figure 8. *A histogram of serum Vitamin B12 concentrations (pmol/l) on all farms and at all sampling periods, with box (± 1 SD, 66% of values) and whisker (range) plots representing each property Figures in the box are the mean for each property*

Pepsinogen

Seasonal variation in pepsinogen

There are few data published which allow interpretation of pepsinogen in deer. Audige (1995) showed a statistically significant negative relationship between growth rate and group mean pepsinogen concentration but no relationship between individual weaner deer pepsinogen and growth

Mean serum pepsinogen concentration of hinds stratified by age are presented in Figure 9

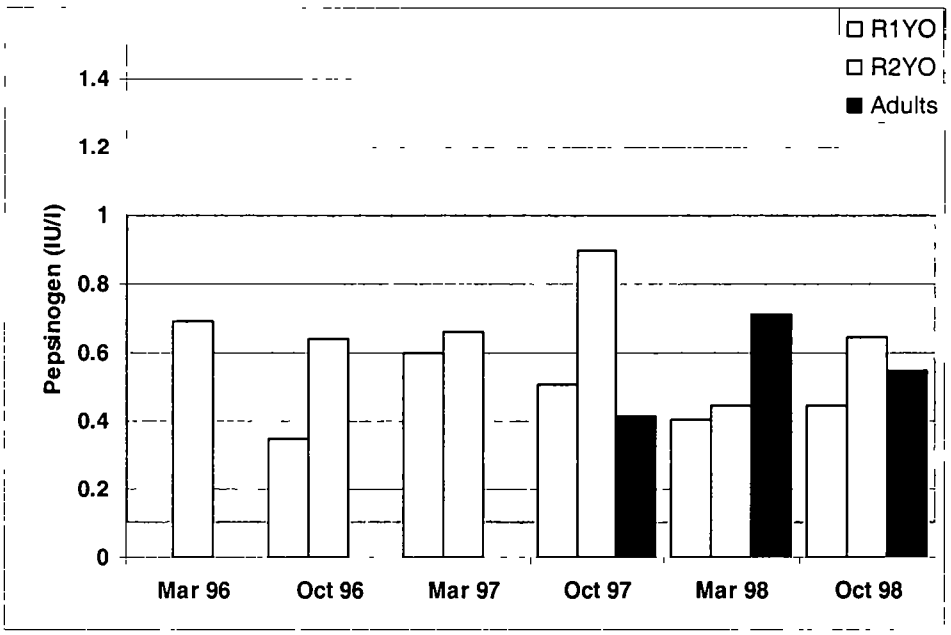

Figure 9. *Mean pepsinogen concentration (IU/l) of sentinel R1YO, R2YO and mixed age hinds on all properties over 3 years The shaded area represents the recommended "normal" range as specified by the Animal Health Lab for cattle*

- Pepsinogen levels for all hinds on all properties remained relatively constant throughout the 3 years
- There was large between animal variation in pepsinogen level.

Range and Distribution of pepsinogen levels

The distribution of pepsinogen concentration on each farm for all hinds and all sampling episodes is presented in Figure 10

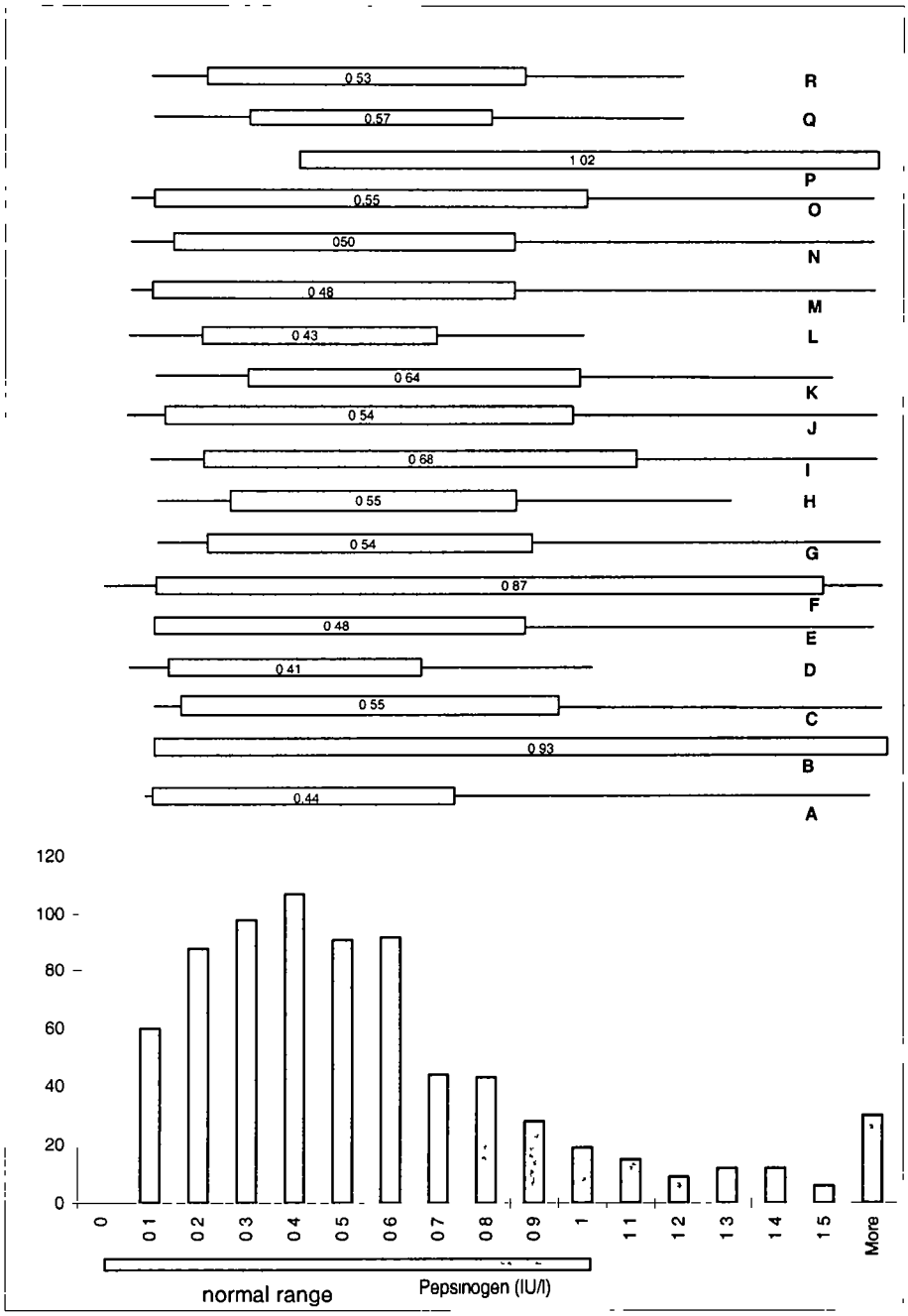

Figure 10. *A histogram of pepsinogen concentrations (IU/l) on all farms and at all sampling periods, with box (± 1 SD, 66% of values) and whisker (range) plots representing each property Figures in the box are the mean for each property and the grey bar below the x axis indicates the recommended 'normal' range for cattle*

Albumin

Seasonal variation in albumin

Mean serum albumin concentrations of hinds, stratified by age, are presented in Figure 11.

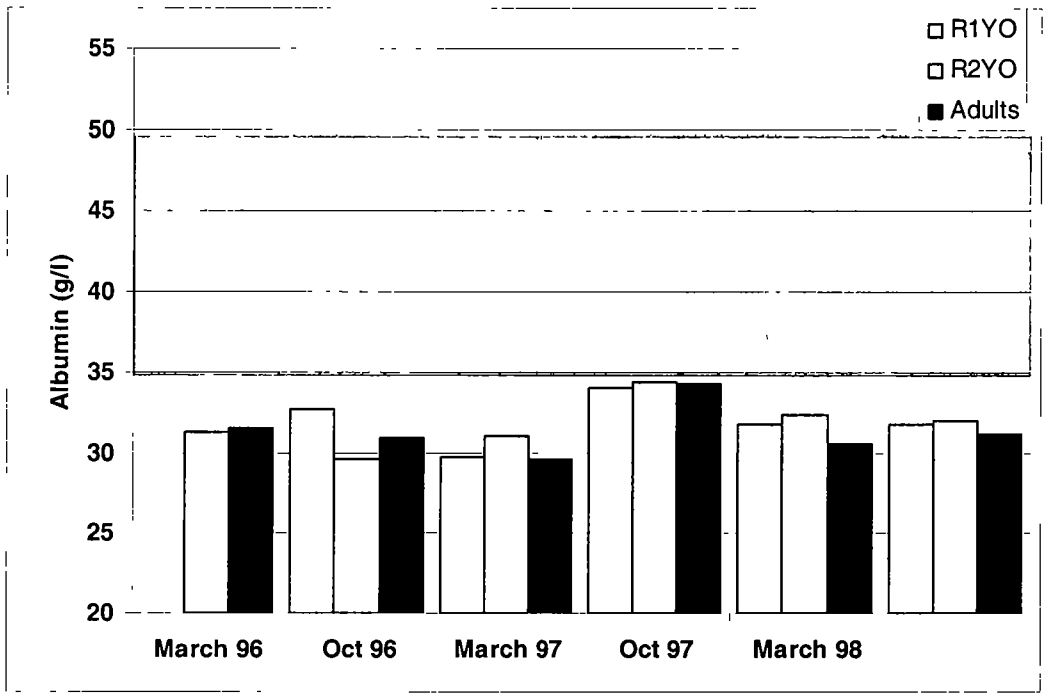

Figure 11 *Mean serum albumin concentration (g/l) of sentinel R1YO, R2YO and mixed age hinds on all properties over 3 years The shaded area represents the recommended "normal " range as specified by the Animal Health Lab*

Summary

- Little variation exists between age groups
- Little variation exists between sampling times
- Little variation exists between farms
- Distribution in healthy deer appears to be different to the reference range set for sheep and cattle and the 'normal' current recommended for deer.

Range and Distribution of albumin levels

The distribution of albumin concentration on each farm for all hinds and all sampling episodes is presented in Figure 12

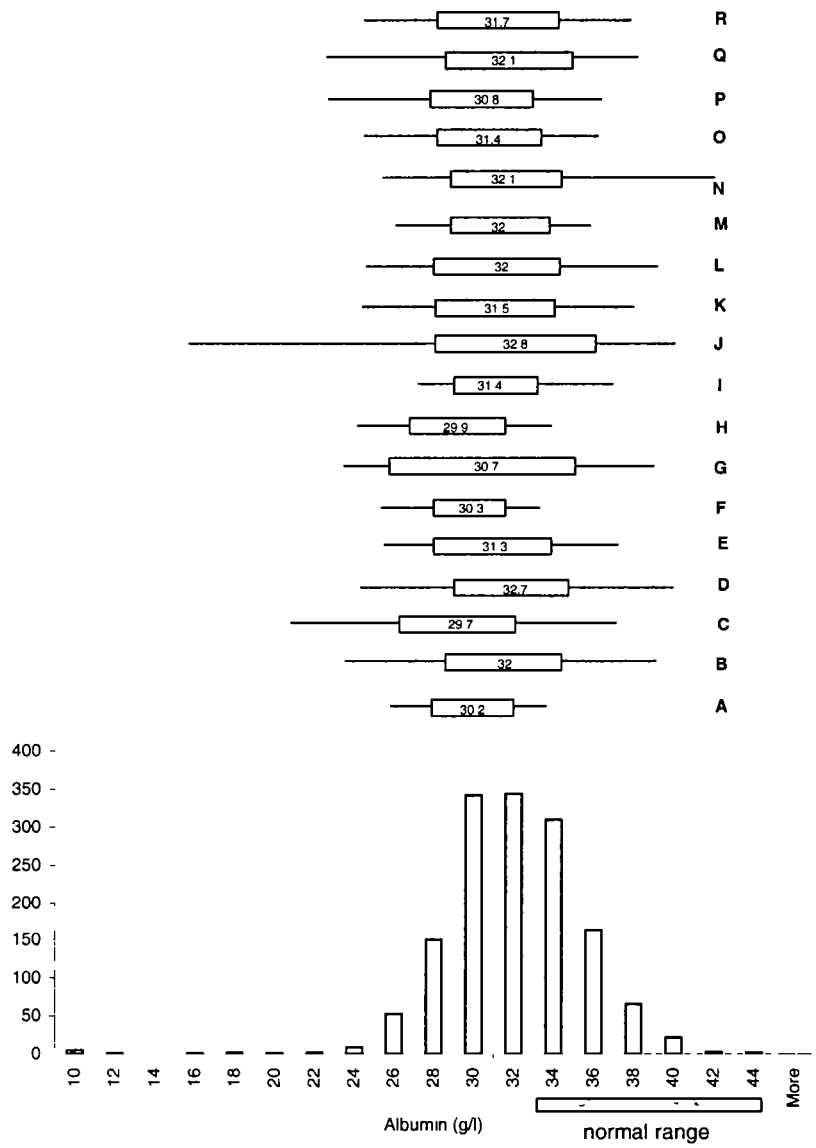

Figure 12. *A histogram of serum albumin concentrations (g/l) on all farms and at all sampling periods, with box (± 1 SD, 66% of values) and whisker (range) plots representing each property. Figures in the box are the mean for each property and the grey bar below the x axis indicates the recommended 'normal' range*

References

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