MICRONUTRIENTS AND ANIMAL NUTRITION AND THE LINK BETWEEN THE APPLICATION OF MICRONUTRIENTS TO CROPS AND ANIMAL HEALTH

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SCHEME

• The need for micronutrients (what do they do in animals?)
• Micronutrients of interest
• Importance of micronutrients (case study with cobalt)
• Animal requirements
• The link between application and animal health
• Future work
• Conclusions
THE NEED – WHAT DO MICRONUTRIENTS DO?

• Enzymes and co-enzymes – THEY ARE INVOLVED IN EVERYTHING!

• Metabolic disorders in livestock affecting fertility, growth and welfare

• Deficiency – Clinical and sub-clinical forms

• Toxicity – in certain cases

MICRONUTRIENTS OF INTEREST

• Copper (Cu)
• Selenium (Se)
• Cobalt (Co)
• Iodine (I)
• Zinc (Zn)
• Manganese (Mn)
• Boron (B)
MICRONUTRIENTS ARE IMPORTANT
A CASE STUDY WITH COBALT

Lack of Co leads to
Lack of vit B₁₂ leads to
Lack of energy leads to
Reduced growth, immunity, fertility and vigour, etc, etc.

Cobalt deficiency and immunity to disease

(Fisher and MacPherson, 1988)
Cobalt deficiency and lamb vigour

<table>
<thead>
<tr>
<th>Time from birth to (average in minutes):</th>
<th>Clinical</th>
<th>Sub-clinical</th>
<th>OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing</td>
<td>22</td>
<td>29</td>
<td>15</td>
</tr>
<tr>
<td>Finding udder</td>
<td>41</td>
<td>44</td>
<td>24</td>
</tr>
<tr>
<td>Suckling</td>
<td>76</td>
<td>61</td>
<td>31</td>
</tr>
</tbody>
</table>

(Fisher and MacPherson, 1988)

Cobalt deficiency and immunity to disease

<table>
<thead>
<tr>
<th>Lamb blood immunoglobulins (as % of OK)</th>
<th>Clinical</th>
<th>Sub-clinical</th>
<th>OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 weeks after lambing</td>
<td>69</td>
<td>61</td>
<td>100</td>
</tr>
<tr>
<td>4 weeks after lambing</td>
<td>62</td>
<td>52</td>
<td>100</td>
</tr>
</tbody>
</table>

(Fisher and MacPherson, 1988)
### Cobalt deficiency and lamb survival

<table>
<thead>
<tr>
<th></th>
<th>Clinical</th>
<th>Sub-clinical</th>
<th>OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>% neonatal mortality</td>
<td>47</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>% treated for ill-health and survived</td>
<td>5</td>
<td>24</td>
<td>0</td>
</tr>
</tbody>
</table>

*(Fisher and MacPherson, 1988)*

### ANIMAL REQUIREMENTS

**e.g. copper:**

<table>
<thead>
<tr>
<th></th>
<th>Cattle</th>
<th>Sheep</th>
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<tbody>
<tr>
<td></td>
<td>Maintenance 0.7 mg Cu per 100 kg live weight</td>
<td>Maintenance 0.04 mg Cu per 10 kg live weight</td>
</tr>
<tr>
<td></td>
<td>Growth 1.1 mg Cu per 1 kg live weight gain</td>
<td>Growth 0.11 mg Cu per 0.1 kg live weight gain</td>
</tr>
<tr>
<td></td>
<td>Milk 0.1 mg Cu per litre</td>
<td>Milk 0.4 mg Cu per litre in early lactation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2 mg Cu per litre in late lactation</td>
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APPLICATION
AND ANIMAL RESPONSE

Options for diagnosis:
- Soil
- Herbage
- Animals

Soil and herbage levels of micronutrients are poor indicators of deficiency.

Animal tissue (usually blood) provides more accurate diagnosis, but account for the ‘liver-effect’

DON’T sample happy cows!
(mid lactation, early pregnancy)

DO sample stressed cows!
(last third pregnancy, early lactation)

- Sample 10% of stock
- Get a full metabolic Profile
- Re-sample after treatment
DON'T sample suckling young!

DO sample rapidly growing, weaned stock

- Sample 10% of stock
- Get a full metabolic Profile
- Re-sample after treatment

Treat the soil
- Fertilisers

Treat the herbage
- Sprays

Treat the animal
- Metered water
- Feeding blocks and licks
- Feed supplements
- Injecting
- Dosing (with boluses)
- Drenching

OPTIONS FOR SUPPLEMENTATION
Example with Se from a fertiliser for dairy cows

Average of 7 assessments, May - November

Example with mixed nutrients from a fertiliser for lambs

Fertiliser applied start of June
Growth rates through to September

(Phosyn, 1990)
### Micronutrient content of different species

<table>
<thead>
<tr>
<th>Species</th>
<th>Fe (mg/kg DM)</th>
<th>Cu (mg/kg DM)</th>
</tr>
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<tbody>
<tr>
<td><em>Achillea millefolium</em></td>
<td>123 - 284</td>
<td>10.5 – 18.4</td>
</tr>
<tr>
<td><em>Daucus carota</em></td>
<td>164 - 298</td>
<td>7.3 – 17.6</td>
</tr>
<tr>
<td><em>Sanguisorba officinalis</em></td>
<td>278 - 356</td>
<td>7.6 – 25.0</td>
</tr>
</tbody>
</table>

(Lyduch and Trzaskos, 1992)
**FURTHER WORK**

- Micronutrients in manures
- Concentrations in different forage plant species
- Selection by animals
- Gaps in the knowledge of farmers

**CONCLUSIONS**

- Micronutrients are important
- Ask the animal
- Treat all deficiencies in a manner that fits the system best
- Benefits in fertility, production, welfare