How To Interpret A Forage Mineral Profile Correctly

August 2012 Bulletin

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Autumn Feed Prices – Is This A Perfect Storm?

With escalating global feed prices, there are many factors out of our control having an impact, such as

- The weather in USA
  - Rain v drought (currently)
- Pod filling stage of USA soya bean crop in August,
  - How much rain will we receive to help pod maturity & yield?
- How big will the USA soya harvest in October?
- How big will the USA maize harvest be in September?
- Floods in Europe, impact on grain harvest?
- How big will the world wheat crop be?
  - In southern Russia (by far the country’s largest production area for wheat), yields are 25 – 30% lower than in 2011, after 80% of the harvest has been completed so far this summer.

British dairy farmers are considering options, one of which must be “How can I utilise my forage more efficiently this winter helping to reduce bought in concentrates cost?” A fair and obvious question which is good news for powdered mineral supplement sales on to farm. Forage is going to be a challenge for many as current maize crops are looking poor in many areas of the UK. How many farmers have considered what impact to their winter rations this may have?

There is always room for improvement on many dairy units. Some simple areas for consideration showing potential cost benefit are highlighted below –

<table>
<thead>
<tr>
<th>Area For Review</th>
<th>Potential Financial Benefit/Cow</th>
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</thead>
<tbody>
<tr>
<td>Increase milk yield</td>
<td>£25.00</td>
</tr>
<tr>
<td>Increase milk fat content</td>
<td>£15.00</td>
</tr>
<tr>
<td>Increase milk protein content</td>
<td>£30.00</td>
</tr>
<tr>
<td>Review diet protein cost</td>
<td>£15.00</td>
</tr>
<tr>
<td>Dry cow focus</td>
<td>£80.00</td>
</tr>
<tr>
<td>Fertility improvement focus</td>
<td>£20.00</td>
</tr>
<tr>
<td>Forage management</td>
<td>£50.00</td>
</tr>
<tr>
<td>Target feeding concs</td>
<td>£80.00</td>
</tr>
<tr>
<td>Blend v straights</td>
<td>£10.00</td>
</tr>
</tbody>
</table>

A grass silage forage mineral profile is the starter for all mineral profile reviews in ruminant lactating diets and already this season is proving very popular with farmers, so get them analysed before someone else does.

Bespoke powdered mineral supplements has become the norm for many UK dairy herds, but quite often, we see many incorrectly balanced mineral supplements, sometimes due to a lack of information given to the mineral specialist when asked to formulate.
How To Interpret A Forage Mineral Profile Report

**Calcium - the most abundant element in a ruminant**
Generally a high level is target for lactating dairy cows. Grass silage contains a higher level of calcium (0.55% typical average) than maize silage (0.15% typical average), straw or whole crop. Excess calcium when supplied via forage is bad for dry cows (except animals on correctly formulated partial DCAB diets).

A low calcium status in lactating diets may require the need for extra limestone flour to be added to the diet in order to meet daily requirements and help balance the calcium; phosphorus target of 1.7:1 ratio. Pay close attention to calcium values on high maize silage rations especially. 50g Ca CO3 may produce a milk yield response where calcium is limiting in high maize inclusion/wholecrop based diets.

During calving, calcium is required for muscle contraction, the rumen and uterus being two key muscles. Partial DCAB feeding systems are recommended for UK based dry cow feeding systems.

**Phosphorus - important role in energy metabolism**
The relationship between phosphorus and fertility is related to energy metabolism. Requirements in UK diets have lowered substantially since a recent study in the US by NRC, although low levels of phosphorus plus high aluminium can contribute to a higher demand for phosphorus from the mineral fed. When certain protein rich straights are fed such as soya/rape/DDG, &/or dairy cake, a lower phosphorus mineral is always required.

**Over Feeding Of Phosphorus Is Wasted By Dairy Cows**

![Graph showing the relationship between P intake and faecal P excretion](graph)

When phosphorus is over fed to dairy cows, excess P is excreted via the urine and faeces - waste of money! Remember every 1% of P costs £23.50 (August 2012). As a rule of thumb, when formulating minerals, most UK nutritionists now work to 0.4% P/kilo DMI on most dairy herds, e.g. 20 kilo DMI cow requires 80g P. Check dairy rations to ascertain correct level this coming winter.
**Magnesium** - *involved in maintaining a healthy nervous system*
Generally OK on forage reports unless reported in the low zone. Caution should be raised when excess potassium is reported as being in the medium/high zone. Ruminant livestock may need additional magnesium supplementation to prevent grass staggers at certain times of the year, especially in the spring & autumn danger periods.

**Potassium** - *a danger for dry cows and magnesium absorption*
Excess potassium is commonly supplied onto the pasture from rich background sources such as fertilizer compounds and slurry/manure which although contributes to grass growth, impacts on magnesium availability to cattle. Low levels of magnesium may contribute toward milk fever cases in pre calving dry cows also. Magnesium supplementation is critical. Ruminants are unable to store magnesium efficiently, so a daily supply required.

Important mineral ratio in complete diet of dairy rations - Potassium: Magnesium, 4:1 minimum.

**Aluminium** - *indicative of soil contamination - wet grass*
If high, may interfere with phosphorus uptake in diets. High aluminium in forage reports may be indicative of soil contamination. Check iron levels also to identify contamination dangers.

**Sulphur** - *often on a knife edge in grass*
Sulphur is required for grass growth, but at high levels may interfere with copper availability and combine with molybdenum to “lockup” copper. Sulphur plays a key role in the rumen to bind copper and molybdenum as “thiomolybdate” complexes - bad news for copper availability potentially.

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**Understanding Partial DCAB Forage Mineral Reports**

**CAB** - *The Cation+ (Na & K) Anion- (Cl & S) Balance*

High CAB levels are good for lactating animals whereas very low levels are needed for dry cows. A high CAB may cause milk fever in dry cows and careful rationing is required to identify the correct balance. This DCAB ratio will help identify the electrolyte balance in the ration fed.

The CAB value is reported using the following typical base equation.

\[
(K^+ + Na^+) - (Cl^- + S^{2-})
\]

(alkali) - (acid)

A high pH alkaline diet can suppress calcium mobilisation, and along with high potassium forages reduces the effectiveness of the parathyroid hormone (pTH). Typical DCAB diets for dry cows are restricted grass silage plus straw/maize silage and straights. Total mixed rations are typically 15-20kg of non-mineralised TMR plus straw - avoid TMR with caustic wheat or sodium bicarbonate added as high sodium causes problems in relationship to potassium. Care needs to be taken when formulating DCAB diets for dry cows and advice should be sought at all times before recommendations are made to the farmer from a mineral specialist. Accuracy is essential; please contact myself for further advice if required.
**Iron** - *in grass silage based forages, well above the cow’s daily requirement*

High amounts of ferrous iron are indicative of soil contamination - a titanium analysis is required to identify accurately. Iron can interfere with copper availability at high levels. Soluble forms of copper should be supplied via the mineral supplement when excess iron has been identified. Soil naturally contains approx 5% iron.

**Manganese & Cobalt** - *rarely deficient in UK grass based systems*

These two trace elements are nearly always typical to high in grass based forages but can be very low in cereal based forages such as maize silage or whole crop. A low level will need addressing through the minerals supplement formulated. Levels of cobalt in ruminant mineral supplements have been limited due to recent EU legislation.

**Zinc** - *precursor for keratin production - key trace element*

Low forage levels, in conjunction with identified high mastitis, SCC, skin problems or lameness, may need supplementation with chelated organic zinc in the mineral supplement. A typical level of chelated zinc would be 2000mg/kg on a 150g/day mineral feeding rate as part of total zinc supplied.

**Molybdenum** - *becomes more soluble under alkaline conditions in the soil*

High levels may reduce copper availability and may interact with other antagonists to “lockup” copper in certain situations. A meeting with the farmer’s vet &/or consultant should be arranged to discuss any copper challenges in agreement with the farmer. Care should be taken to not just “feed more copper” as
this may cause more damage than good. The diet may need to be reformulated in order to improve the availability of copper. A mineral specialist’s advice should be sought as other forms of copper in the diet such as boluses and compound cake needs to be calculated.

**Copper - sensitive to soil pH**

If content low to typical and availability not high, consider using a range of copper sources to boost availability. Copper based mineral supplements should never be fed to sheep. Over supply of copper to dairy cows and beef systems can lead to toxicity in the liver at high levels. Ensure the farmer informs you of all sources of copper being fed from dairy cake, mineral supplements, bolus’s etc. Check iron, sulphur & molybdenum values in forage in relation to copper score.

**Selenium & Vitamin E - both play an important role in key anti-oxidants**

Low levels are commonly reported in UK forages especially maize silage and whole crop. High SCC, retained cleansings, health problems, weak young stock, may need to be supplemented with organic selenium plus additional vitamin E.

Increasing numbers of forage mineral profile reports have highlighted as a major concern in UK forages. Sel-Plex or Alkosel may be required as part of the total selenium content supplied in the mineral supplement as sodium selenite is a poor source of selenium.

Requirements for vitamin E have increased dramatically in recent years and benefits have been independently published in both dry cow and lactating diets.

It is now generally accepted that all forages are an unreliable source of vitamin E & selenium with cereal based forages and feeds being the worst. Vitamins & organic selenium sources though need to be fed accurately as both are expensive raw materials.

**Changes in Vitamin E Plasma Values During Dry Period and Early Lactation**

![Graph showing changes in Vitamin E Plasma Values during dry period and early lactation](image)
Antioxidants
Antioxidants are found in cellular membranes, herd health and immunity status is potentially critical to lactation performance. Traditionally vitamin E (minimum 1,000mg/hd/day supplemental during the dry period) and selenium have been two sources of micro nutrients to consider in relation to immunity status benefits and dietary antioxidants. But quite often, we are unable to meet the true technical levels of these nutrients during the dry period and lactation due to changing feeding policies on farm or commercial limitations.

Interestingly, plasma concentrations of a-tocopherol (vitamin E) decrease through the transitional dry cow period (Weiss et al, 1990). It is also well known that inorganic sodium selenite has a limited availability to the ruminant.

Vitamin E supplementation and neutrophil function
Requirements Based On Scientific Research

<table>
<thead>
<tr>
<th>Type Of Cow</th>
<th>Supplementation</th>
<th>Response</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactating cow, 30 days in milk</td>
<td>Dry period: 1000iu/day of supplemental vitamin E. First 500 days lactation 500iu/day</td>
<td>Ability to kill S.aureus &amp; E.coli was improved</td>
<td>Hogan et al 1990</td>
</tr>
<tr>
<td>Fresh cow (&lt;3 days in milk)</td>
<td>3000iu vitamin E injected at 10 &amp; 5 days before anticipated calving</td>
<td>Ability to kill E.coli was improved</td>
<td>Hogan et al 1992</td>
</tr>
<tr>
<td>Dairy cows from 4 weeks pre to 5 weeks post calving</td>
<td>3000iu/day of dietary vitamin E from 4 weeks pre to 8 weeks post calving + 3000iu of vitamin E injected 1 week precalving.</td>
<td>Neutrophil chemotaxis (movement into infection site) was improved</td>
<td>Politis et al 1996</td>
</tr>
<tr>
<td>Fresh cows (&lt;7 days in milk)</td>
<td>3000iu/day vitamin E from 4 weeks pre to 8 weeks post calving + 3000iu vitamin E injected 1 week pre calving</td>
<td>Overall neutrophil function was improved</td>
<td>Politis et al 1995</td>
</tr>
</tbody>
</table>

Understanding Straights/Co-Products & Supply Of Minerals
It is important that total dietary information is obtained to include any trace element bolus administration regime. As detailed below, alternative sources of energy & protein based raw materials supply a total range of background minerals and trace elements.

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Phosphorus</th>
<th>Calcium</th>
<th>Copper</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Distillers Grains</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Rape Meal</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Sugar Beet</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Soya</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Wheat</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Bolus</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
Understanding Boluses
For example if the farmer supplies 2 “well known” cattle boluses to the cows at calving, this will provide 93.8mg/day of copper, 3.5mg/day of cobalt and 2.1mg/day of selenium (high).

A powdered mineral containing 25mg/kg of selenium fed at 100g/hd/day will supply 2mg/day! So as you can see, some boluses are high in some specific trace elements, BUT lacking in all the other trace elements, vitamins and macro elements required.

Common Culling Reasons In UK Dairy Herds

Key summary points for consideration to discuss with customers

1. Review feeding program/management plans
2. Discuss the potential cost of a “poor health status” dairy herd
3. Check vitamin E and selenium status within diets fed for dry cow group and early lactation group
4. Analyse forage for a complete mineral profile if required, to ascertain & balance forage correctly
5. Check sources of selenium used in mineral supplements and compound feeds/blends as inorganic sources are known to be poorer quality versus organic sources
6. Discuss with farmer/herdsman and if possible vet to identify potential areas for improvement in relation to herd health and immunity status within the unit
7. Consider & calculate nutritional supply from all feed inputs – minerals, compound/blends, bolus’s, drenches, injections etc. If unsure, please feel free to contact myself for assistance around formulation work.
8. Agree a nutritional feed plan for early/mid lactation groups of autumn lactating cows incorporating a targeted nutritional plan where appropriate
9. In discussion, try to get farmer to record/benchmark no. of cases of mastitis, SCC readings, and metritis going forward.
10. Last but not least, ensure you review performance of the mineral supplement fed regularly with customer.

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