FACT SHEET
August 2014

Trace Element Deficiencies
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Trace element deficiencies can reduce performance of cattle and sheep. However you can get too much of a good thing and excess trace elements can be costly and sometimes counterproductive. Getting trace element supplementation right is a careful balancing act and a deficiency should always be confirmed by testing before supplements are given.

Trace element deficiencies are often blamed for poor production, however there are more common causes of ill thrift e.g. gut parasites, liver fluke or diets that are short of energy or protein. The clinical signs of trace element deficiencies can be slow to develop and the only sign may be lighter weights and slower growth.

The trace elements of most concern for cattle and sheep producers are copper (Cu), selenium (Se), cobalt (Co) and iodine (I). Other minerals can interfere with the utilisation of the essential trace elements, for example molybdenum (Mo) and sulphur (S) affect copper absorption and sulphur can interfere with selenium uptake in plants.

There is a huge variation in trace element content in grass and forage across Wales due to geology, soil type, pH, plant species, drainage and fertiliser use.
Copper deficiency can be due to the interference of iron, molybdenum and sulphur, which reduce the availability and absorption of copper from the rumen.

The classic copper deficiency in lambs is ‘swayback’ where deficiency results in poor development of the spinal cord. This occurs when dams have low copper status in mid pregnancy. Other copper deficiency symptoms include poor coat quality, poor liveweight gain, scouring, stillbirth, reduced lamb survival and anaemia.

In cattle, copper deficiency symptoms also include the classic ‘spectacling’ of dark coated cattle around the eyes due to loss of hair pigment, scouring, thickening of bones around the joints and infertility. There is a debate whether infertility may be the result of excess molybdenum in forages rather than a straight copper deficiency.

Excess copper is stored in the liver. Ruminants are susceptible to copper toxicity if a large amount of copper is ingested or injected, or if copper is accumulating in the liver over a long period of time. Toxicity is more common in sheep than cattle and sudden death is often the first noticeable symptom. Other symptoms include jaundice, diarrhoea, pain and anorexia. Sheep breeds vary in the efficiency with which they absorb copper. Continental and lowland breeds (especially Texels) are very efficient at absorbing copper and are at risk of toxicity. Hill breeds are less efficient at absorbing copper and more likely to suffer from deficiency. Different breeds within a flock may require different supplementation.

Compound feeds and minerals formulated specifically for sheep do not have added copper. Cattle feeds and minerals have added copper and should not be fed to sheep.
**Selenium**

Selenium acts with vitamin E to protect tissues against oxidation. Selenium is also important for immune function. Selenium requirements of stock are related to the vitamin E content of the diet. For example on diets low in vitamin E the requirements for selenium are increased and vice versa.

Selenium deficiency is widely recognised as white muscle disease. Selenium also impairs growth, affects fertility (oestrous, ovulation and embryo development) and can increase the incidence of mastitis and retained placenta. Selenium deficiency also affects fertility in males and if a deficiency is identified it is important that rams and bulls are also supplemented.

Selenium in excess is toxic to both cattle and sheep. The risk is considerably less than with copper and cases of selenium toxicity are rare.

**Cobalt**

Ruminants need a daily supply of cobalt as they do not store it in the body, unlike copper and selenium, which are stored. Rumen bacteria require cobalt to produce vitamin B12. Vitamin B12 is used to metabolise propionic acid and propionic acid is used by ruminants as an energy source. Without vitamin B12 and cobalt, ruminants cannot use their diet efficiently. Growing animals generally have a higher requirement for vitamin B12 than adults. However suckling animals have a lower requirement as most of their energy comes from milk.

In sheep cobalt deficiency symptoms include pine, ill-thrift, poor appetite, an open fleece, tear staining around the eyes, reduced immunity to worms and greater susceptibility to clostridial diseases and pasteurella. An extreme form of cobalt deficiency is ovine white liver disease.

In both cattle and sheep cobalt deficiency can affect fertility, milk production and maternal behaviour.
Iodine

Iodine is a component of the important hormone thyroxine, which controls energy metabolism and is essential for the growth and development of the foetus.

Iodine deficiency is typically associated with an enlarged thyroid gland commonly known as a goitre. Other symptoms include late abortions, still born or weak calves and lambs. Neonatal mortality is markedly increased with iodine deficiency. Cows also have a tendency to retain afterbirths.

Iodine in excess has been shown to reduce colostrum absorption in lambs.

Common causes of trace element deficiency:

• Grassland improvement
• Poor soil structure
• Increasing dependence on forages
• Reduced dependence on formulated feed
• Unusual forages/ration ingredients
• Incorrect or no use of supplements
Establishing trace element status

Soil samples can give an indication of the trace element levels that might be in grass but are not a reliable measure of what the animal is actually eating. For instance, soil is often high in cobalt but deficient in animals grazing there. There are many trace element and major mineral interactions that affect availability of trace elements and soil samples are generally not a good indicator of sufficiency in the animal.

Forage/grass analysis from a representative number of fields gives an indication of levels of trace elements and the variation across the farm. Samples should be taken when grass is growing in the spring and autumn and samples should be clean and free from soil and muck contamination. The trace element content of plants varies and in general, herbs and weeds and older leys have higher levels of trace elements than perennial grasses and newer leys. Clover has a good level of trace elements, generally higher than in grass. Care must be taken when grazing forage crops as the dietary requirement for iodine increases four fold and there is a higher risk of copper deficiency.

Forage analysis should be supported by blood sampling as this shows what is actually happening in the animal. Forage analysis may show satisfactory levels and blood tests show deficiencies and vice versa so skilled interpretation of results is vital. Blood tests should be taken when animals are at grass, preferably when they are not receiving any supplementation.

Liver samples give the most accurate picture of what is going on in the animal especially for copper and selenium as these elements are stored in the liver. In cases of copper toxicity the blood levels may be normal, whilst the liver is overloaded with copper.

The table below gives a suggested sampling protocol. The numbers to be tested depend on the size of the flock and the number of different groups.

<table>
<thead>
<tr>
<th>Trace Element</th>
<th>Clinical signs</th>
<th>When to sample</th>
<th>Numbers to sample</th>
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</table>
| Copper        | Swayback III thrift  | • Ewes pre-tupping  
               |                        | • Lambs at weaning  
               |                        | • Cases of ill thrift  
               |                        | Blood – 7 to 10 clotted or  
               |                        | preferably heparinized samples  
               |                        | Liver – minimum of three  |
| Cobalt        | III thrift  
               | Poor fertility  
               | Neonatal losses  | • Ewes pre-tupping and  
               |                        | pre-lambing  
               |                        | • Lambs at weaning  
               |                        | • Cases of ill thrift  
               |                        | Blood – 10 clotted samples  
               |                        | Liver – minimum of three  |
| Selenium      | III thrift          | • Tups and ewes pre-tupping  
               |                        | • Ewes pre-lambing  
               |                        | • Lambs at weaning  
               |                        | • Cases of ill thrift  
               |                        | Blood – 3 to 5 heparinized samples  
               |                        | Liver – minimum of three  |
The need for supplements

There are various types of supplements available and careful consideration is needed to choose the most appropriate. Often the most cost effective supplement is one that is given directly into an animal e.g. a bolus or an injection.

Oral drenching with cobalt raises the blood vitamin B12 level for only around seven days so has to be repeated regularly. Drenching with cobalt every three to four weeks may be sufficient for animals close to slaughter rather than using a product that lasts over three months or more. Oral supplementation with selenium can provide adequate supplementation for up to three months.

Applying trace elements to grass is another option but often considered expensive. Free choice minerals can be offered but there can be considerable variation in intake between animals with some taking none at all while others take considerably more than they require.

If supplementation is required, it is always worth comparing treatments and leaving a few animals untreated to see what works best for your farm and animals. Try to supplement with the trace element that is deficient and monitor the response to a treatment. Animals should only be supplemented with copper when blood and liver tests confirm that extra copper is needed because of the high risk of toxicity.

It must be remembered that trace element requirements vary with age and production level. Young, pregnant and lactating animals have the greatest need. A deficiency identified in sheep does not mean that cattle will be deficient and vice versa. For example sheep are more likely to be cobalt deficient and cattle more likely to be copper deficient.
Case studies

Great House Farm, Llansoy, Usk, Monmouthshire

Great House Demonstration Farm is run by Peter Williams and family. Great House is a traditional upland beef and sheep farm running 400 ewes, mostly Mules put to Texel and Charolais rams and 30 Aberdeen Angus, Limousin and Hereford cross suckler cows put to a Charolais bull.

Forage analysis suggested possible copper deficiency in the animals as the level in the forage was slightly low. All other trace elements were satisfactory.

Initial blood sampling in September 2012 showed selenium deficiency in all six cows and all six calves tested. All cows and calves tested had satisfactory cobalt levels and only one cow was below the recommended range for copper.

Blood sampling in January 2013 showed a slightly different picture. Selenium levels in cows had increased with only three out of six cows slightly below the reference level. However all six calves showed selenium levels below the recommended level. Cobalt levels had decreased slightly with two calves below the reference level and a further three only just above it. Only one cow was within the reference range for copper; the rest were all below. Two calves were below the reference range for copper with the other four only just within the range.

This shows how trace element levels can change through the year. Selenium appears to be the most significant deficiency for the cattle on this farm. Copper appears to be more of a deficiency issue in the winter; with very few blood results suggesting deficiency in September. Cobalt was satisfactory in cows and calves in September and in cows in January. However the calves were marginal with some showing deficiency in January. Liver samples are required to confirm copper status.

It was decided to give all cows a trace element bolus to last up to nine months. Blood tests were carried out seven months later on six cows and six calves. Similar to the previous January, calves were low in selenium and only half the cows had an adequate level of selenium.

All calves have therefore received a trace element bolus.
Guddr Farm, Llanbedr, Crickhowell, Powys

Guddr Farm is an upland beef and sheep farm run by Richard Powell and family. The 1,000 Talybont Welsh ewes run on an open hill, which is part of the Black Mountains. The farm also runs 77 Limousin cross and Belgian Blue cross suckler cows.

Two of the four forage samples suggested a possibility of copper deficiency. Only one sample suggested cobalt deficiency and only the wholecrop silage suggested that selenium deficiency could be an issue. Despite the satisfactory levels in most of the forages, selenium deficiency has been a huge problem on the farm affecting survivability of calves at three to four months old.

Four calves and seven cows were tested. Low levels of selenium were seen in all of the calves and three of the cows tested and white muscle disease was diagnosed.

Selenium blood tests also showed three of four cows low in selenium and all calves. Copper blood tests showed one cow slightly high in copper.

Long acting selenium injections were given to cows and calves in May and the vet also advised to give a vitamin/selenium injection to new born calves.

Three calves born to supplemented cows were blood tested for selenium and copper and the results were satisfactory. The cattle were tested 11 months after the injection showed satisfactory selenium levels.
Gelli Farm, Cymmer, Port Talbot

Gelli is a hill farm run by Richard Howells and family. It extends from 900 to 1,800 feet. The ewes are mainly Glamorgan Welsh (2,000 ewes) with a small flock of 300 Texel cross Welsh ewes. There are also suckler cows and a pedigree Limousin herd on the farm.

Forage analysis suggested copper deficiency due to low copper and high molybdenum.

The first lot of blood samples were taken in July 2012 as a snapshot of what was happening on the farm. Ewes and lambs grazing permanent pasture showed low cobalt levels. Copper and selenium levels were normal. On the improved grazing only one lamb showed a low level of cobalt. Those on the reseeded land showed no abnormalities in copper, cobalt or selenium in blood. Bolus supplementation was given to those that needed it.

Blood samples carried out in February 2013 showed no deficiencies.

Blood samples carried out on ewes in October 2013 again showed low cobalt levels and cobalt supplementation was given.

Blood samples taken on a group of ewe lambs that were not thriving very well showed that two out of six were low in cobalt and one ewe was low in copper. Supplementation with cobalt was advised but further testing was needed prior to supplementation with copper as some ewes showed slightly high levels of copper. Blood tests for copper are not always reliable and liver biopsies could be considered for a more accurate diagnosis or samples of the liver taken at the abattoir.

The general picture suggests that cobalt is low across most of the farm. Trace element problems may vary year on year and sampling will continue.
Cost benefit of supplementation

The response to supplementation is the best way to calculate the cost effectiveness of any supplement. So with any group of animals, weigh them before supplementing to provide a base line for performance. In a group of 100 lambs, leave 20 lambs untreated and treat the remaining 80 lambs. (Be careful to have the same average weight of lambs in each group to avoid bias to any particular supplement; the number of ewe lambs vs whether lambs could also be important). You could compare two different supplements (40 lambs on each) e.g. a bolus versus a drench and follow growth rate over the next two months. Monitor performance on a fortnightly basis (weighing animals at the same time of day each time).

Table 2: Example of response to supplementation

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cost of treatment</th>
<th>Average weight on 1 September</th>
<th>Liveweight on 1 October</th>
<th>Liveweight on 1 November</th>
<th>Total weight gain in two months</th>
<th>Cost/Kg Live weight gain (LWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>34</td>
<td>37</td>
<td>40.1</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td>Bolus</td>
<td>£1</td>
<td>34</td>
<td>38.5</td>
<td>43.15</td>
<td>9.15</td>
<td>10.9p/kg</td>
</tr>
<tr>
<td>Drench</td>
<td>£0.50</td>
<td>34</td>
<td>37.7</td>
<td>41.6</td>
<td>7.6</td>
<td>6.6p/kg</td>
</tr>
</tbody>
</table>

Both supplements improved weight gain over untreated controls, but the cost effectiveness of the supplements can only be assessed if lamb price and other on-farm factors are considered. Is it most important to get the lambs off the farm quickly to allow the breeding flock the best grass? Is it important for cash flow to sell animals sooner?

It is also important to make sure the composition of the bolus and drench fit the deficiency of the animals. Match the product with the need of the animal. It is also worth comparing different boluses and different drenches with each other.
Top tips

- If your animals are underperforming, assess growth rate and performance and consider asking your vet to take blood samples.
- Discuss results with your vet or advisor and consider appropriate supplementation.
- Supplement animals but always leave a few untreated so that you can measure the benefit of the chosen supplement.

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Images courtesy of NADIS