

NADIS Sheep Disease Focus

Copper Deficiency and the Prevention of Swayback

Diseases associated with copper deficiency have become uncommon in British sheep, partly due to widespread use of copper supplements and partly due to the level of concentrate feeding in intensively managed flocks. However, a few cases of swayback were recorded by NADIS last spring.

Clinical diseases associated with copper deficiency in sheep

The most obvious sign of copper deficiency is swayback in young lambs, although in recent years there have been few confirmed reports of this disease. Swayback occurs as a consequence of severe copper deficiency in mid to late pregnant ewes. Most outbreaks of swayback have been seen following mild winters when little supplementary feeding was provided during mid pregnancy.



Congenital swayback is characterised by stillbirths and the birth of small and weak lambs, which may show fine tremours of the head. Less severely affected lambs are bright, but uncoordinated with characteristic weakness of the hind limbs, which results in a swaying or stumbling gait. These lambs are often fine boned and dull coated. A delayed form of the disease is occasionally seen in older lambs, sometimes initiated by gathering or handling.

The other clinical signs associated with copper deficiency in sheep are osteoporosis and bone fractures in young lambs, discolouration of coloured wool and loss of wool crimp. Copper deficient lambs may be more susceptible to neonatal disease than copper-sufficient lambs, but ill thrift is not a consistent feature of copper deficiency in sheep.

Diagnosis of swayback

The diagnosis of swayback is based on clinical signs and flock history of copper deficiency. However some of the clinical signs associated with spinal abscessation or border disease are

similar, so liver copper assay and brain or spinal cord histopathology are often needed to support the diagnosis.

Causes of copper deficiency in sheep

Most cases of copper deficiency in sheep result from high dietary levels of interfering factors such as molybdenum and sulphur, which form complexes with copper in the forestomach and prevent its absorption. Copper deficiency is sometimes seen following pasture improvement, because raising the pH of soil can make molybdenum more available. Forage crops such as kale have a high sulphur content, and may be implicated in cases of copper deficiency.

Copper absorption and retention are also influenced by the breed of sheep and nature of the feed. Texel and Suffolk sheep retain copper efficiently, whilst Scottish Blackfaces retain copper relatively inefficiently and are more susceptible to disease. Copper is well absorbed from feeds which are low in fibre, such as grains and brassicas, but poorly absorbed from pasture. Lambs are not usually born with higher copper reserves than their dams, but their copper absorption is extremely efficient when compared to that of their dams.

Determination of the need for copper supplementation

The need to supplement copper during mid pregnancy for the prevention of swayback is clear-cut in many hill Blackface flocks, based on a history of copper deficiency problems.

However, supplementation is often unnecessary in lowland flocks and is potentially dangerous in breeds such as the Suffolk and Texel. In these cases, the diagnosis of copper sufficiency relies on appropriate sample collection. Soil and pasture copper concentrations alone are poor indices of deficiency, because most copper deficiency is induced by interfering factors. The interpretation blood and liver copper concentrations is based on the following principles –

- copper in excess of requirements is efficiently stored in the liver, which contains up to 70% of the total body copper reserves
- blood copper concentrations are maintained for as long as the liver stores are adequate
- when net copper absorption is insufficient to meet metabolic requirements, liver stores are mobilised to meet the shortfall
- the blood copper concentration remains constant until the liver becomes depleted
- blood copper concentrations fall only when the liver reserves are already depleted and metabolic requirements continue to exceed net absorption

- clinical deficiency only occurs when the levels of copper at the essential sites fall

The choice of diagnostic samples, therefore, depends on the reason for sampling. In cases of poor animal performance, both blood (serum or plasma) and liver is appropriate. However, liver is the only useful sample when the reason for sampling is to determine if reserves are adequate to last throughout the winter.

Liver samples can be obtained during post mortem examination of casualty animals or from slaughterhouse material. While slaughterhouse samples can be useful for monitoring purposes, they are of limited value for the diagnosis of clinical deficiency, because copper depleted animals are unlikely to reach slaughter weights. (In New Zealand, where flock sizes are large and even small production losses due to trace element deficiencies are economically important, liver samples are routinely collected by biopsy as the basis of a rational scientific approach to determine any need for supplementation. However, sheep liver biopsies are not routinely performed in Britain.)

Copper supplementation

Whilst the indiscriminate use of expensive *ad-lib* free-access minerals, mineralised drenches and other forms of supplementation, may provide some insurance against production losses from copper deficiency, it is sometimes wasteful and can be associated with toxicity problems. There are no recipes for trace element supplementation, so a detailed evaluation of each individual situation is required to determine the most appropriate programme. The most effective supplementation method depends on soil type, stocking rates, handling facilities and the availability of labour. Your vet can advise you about the most appropriate form of supplementation for your flock.

Oral drenching with copper salts: The amount of copper that can be administered orally as copper salts is limited by the potential for toxicity, therefore, a single oral drench with a safe amount of copper salts only provides a short-term boost to body copper stores. Swayback can be prevented in some flocks by oral dosing of ewes with copper sulphate solutions 8 and 4 weeks before lambing. Whilst copper salts are frequently added to anthelmintic drenches, the copper content and availability from these products is low, so they are not necessarily useful for the prevention or treatment of dietary induced copper deficiency.

Free access minerals: Dietary mineral supplements can be useful where there is an opportunity for precise formulation of total fed requirements, but their *ad hoc* usage is potentially problematic, due to variable intakes. Because of the risk of toxicity associated with variable intake, the amounts of copper which can be included in free access minerals is small and the majority of animals can remain inadequately supplemented.

Copper injections: The parenteral injection of chelated copper supplies relatively small amounts of copper and is a convenient method of supplementation for a period of 2 - 4 months. In many flocks, where the period of deficiency is only for a few months, copper injection of ewes during mid pregnancy provides an efficient method for the prevention of swayback.

Copper capsules: On most properties during most seasons, the oral administration of capsules, which contain particles of copper oxide wire, provides an effective long-term supplementation option. The capsules quickly dissolve in the rumen and release the copper oxide particles, which gradually move to the abomasum, where they are retained. Ionised copper is released within the low pH environment of the abomasum and subsequently absorbed from the small intestine. Release of ionised copper occurs over a 3 - 4 week period, which enables efficient storage in the liver, without the risk of acute toxicity. Elevations in liver copper levels can persist for a period of almost 300 days. Copper oxide capsules are often given to weaned ewe lambs on severely deficient hill farms.

Unlike oral copper sulphate supplements, copper oxide particles have the advantage that they are not exposed to the interfering effects of molybdenum and sulphur in the rumen. However high iron intakes, through the ingestion of soil during wet and muddy seasons, can interfere with absorption and probably account for the occasional failure of copper capsules to elevate liver copper stores. Severe gastrointestinal parasitism may also reduce the efficacy of copper oxide particles due to accelerated flow of digesta through the abomasum.

Pasture top-dressing: Effective copper supplementation can be achieved on some farms by regular top-dressing of pasture, but this method has lost favour during recent years due to fluctuations in the cost of copper sulphate. Careful stock management is required. It is important to keep stock off top-dressed pasture for 3 weeks, or until after heavy rain, so that any copper which is adherent to pasture is cleared and the risk of toxicity avoided. Un-

weaned lambs should not be grazed on recently top-dressed pasture because of their higher absorption efficiency and the risk of toxicity.

Sustained release ruminal boluses: Sustained release ruminal boluses, which contain copper, cobalt, selenium and iodine along with other minerals and vitamins can provide a useful supplementation method in some flocks. These boluses provide a sustained and constant copper supplementation for about 240 days, but on some farms the daily release of copper may be insufficient for times of peak requirements. The boluses are relatively expensive, and supplementation with the other trace elements included may be unnecessary.

Copper toxicity

Excessive copper supplementation is potentially toxic to all breeds of sheep. As a general rule, sheep should never be provided with more than one source of supplementary copper. Lambs should not be supplemented before weaning, because of their efficient copper absorption. Furthermore, animals should not be supplemented shortly before they are housed and provided with an improved dietary supply of available copper with concentrate feed.

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