‘Silvering’ in Fleeces - The Explanation?

On behalf of members, Eric Medway took the problem to an expert.

It has been generally accepted for some time that a loss of pigmentation in coloured cattle and sheep is due to copper deficiency. Two members who were particularly plagued by the problem had blood tests performed on their lambs and, to everybody’s surprise, the affected lambs were reported as having normal, or even high, levels of copper in their blood. Knowing that excess levels of copper are toxic to sheep, breeders have been reluctant to provide copper in the hope of curing the problem, particularly given the results of these blood tests. Various other mineral supplements have been tried with unconvincing results.

On behalf of members I took this problem to Dr Stuart Telfer at the Department of Animal Physiology & Nutrition at Leeds University. I knew that he had a particular interest in mineral nutrition and had recently been responsible for the re-launch of the Cosecure bullet which provides Cobalt, Selenium and Copper supplementation. As soon as I described the symptoms to Dr Telfer he was sure that what we were seeing was Clinical Copper Deficiency and then went on to explain how it might occur and why tested lambs showed normal blood levels of copper. I shall summarise the mini-lecture I received.

The Need for Copper

Copper is needed in the diet of sheep because it is necessary for inclusion in a number of important enzymes. Without copper, these enzymes won’t work. These enzymes include, among others, the one for producing melanin, the pigment found in hair or wool; that responsible for the myelination and development of the nervous system, hence the condition of “swayback” in lambs born to copper deficient ewes; cytochrome oxidase, a critical enzyme in respiration and the release of energy in cells; and enzymes concerned with reproductive performance. These enzymes have a fairly long life and are replaced only slowly, although in growing lambs more enzymes need to be produced daily. In adult sheep, therefore, the effects of copper deficiency may take a very long time to show. Experimentally, sheep and cattle can be made copper deficient, with virtually no copper in their blood, without showing any clinical symptoms.

The Effects of Molybdenum

Symptoms of copper deficiency will appear much more suddenly when animals consume molybdenum ions. In the rumen these molybdenum ions will be combined with sulphur in various proportions to form thiomolybdate ions which are readily absorbed into the animal’s blood. Thiomolybdates can bind copper very strongly indeed; so strongly that they can pull copper ions out of the enzymes that contain them, producing a sudden onset of “copper deficiency” symptoms in animals that may, in reality, have a reasonably high level of copper. The “copper deficiency” is really thiomolybdate toxicity. But if there is free copper in the rumen, the thiomolybdates will, of course, combine with this. The copper-thiomolybdate complex cannot be absorbed into the blood and thiomolybdate toxicity will be prevented.

Iron's Influence

One other element has an influence on an animal’s copper balance; this is iron, which animals usually consume in soil although many coloured (yellow / red) mineral blocks have iron in. In the rumen, iron, sulphur and copper combine to form a complex which cannot be absorbed into the blood. This traps copper in the gut making it unavailable to the animal, and it is lost from the

animal in faeces. It is worth noting that very few areas of Britain have copper deficient pasture, yet "copper deficiency" symptoms are widespread due to the effects of molybdenum ions.

How Much Copper Is Enough?

Copper bound up with iron and sulphur cannot, at the same time, combine with thiomolybdates. If thiomolybdate toxicity is to be prevented there must be enough copper in the rumen to combine with all the iron-sulphur and with all the thiomolybdate. For long term health, there must stilp be a little copper left over to supply the animal's needs.

Blood Tests

And what of the blood tests? Copper is carried in the blood in a variety of ways and conventional blood tests measure only the total copper content. Of this, usually only about 3% is available for use in enzymes. In cases of thiomolybdate toxicity, this will be grasped by the thiomolybdate ions.

Management

It seems likely that lambs showing silvering of the fleece are suffering, temporarily, from thiomolybdate toxicity. This could be caused by an increase in consumption of molybdenum ions but is more likely to be due to a decrease in the amount of copper available for combining with and detoxifying thiomolybdate ions in the rumen. This decreased availability of copper could be caused by many things, including an increased ingestion of iron. Whatever the cause, thiomolybdate toxicity can be prevented by allowing the ions to combine with copper in the rumen.

Several management issues are worthy of consideration.

- Limiting the ingestion of iron by reducing stocking, providing fodder when grass is short.
- Limiting the ingestion of sulphur by resisting the temptation to increase grass dry matter yield by the application of sulphur fertilisers.
- Recognising that improved pasture has a much higher molybdenum level than unimproved.
- Where symptoms of clinical copper deficiency do occur, considering the provision of additional copper to bind up the thiomolybdate ions on the rumen.

Genetic Factor?

Before you all rush out and provide your lambs with additional copper, a word of caution. We have known for a long time that the silvering of the fleece will affect some lambs in a flock and not others. This could be due to genetic variation (some animals absorbing thiomolybdate with more ease than others), a variation in the rumen flora (it is the activity of rumen bacteria that produces the thiomolybdates), or a behavioural difference (studies in Swaledale sheep have shown that the consumption of soil - and therefore iron - by members of a flock will vary between virtually zero and 30% of dry matter intake). Some breeders have noted a familial tendency to show silvering in the fleece, which gives support to a genetic factor. It will be less easy to identify animals carrying this factor if they are treated with copper.

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