OGFA Ad Hoc COMMITTEE ON COPPER TOXICITY IN SHEEP

Feed industry quality assurance issues
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The feed industry is very aware that sheep are more sensitive to copper as compared to other ruminants such as cattle. Actual dietary copper requirement of sheep is difficult to determine since the required level depends upon several factors including breed (three-fold difference amongst breeds, Puls, 1982), presence of other minerals (notably molybdenum, sulphur, zinc, manganese ), age, disease, housing environment (confinement versus pasture), soil type and fertilization (e.g. high copper manure from poultry or pigs or horses). The National Research Council (NRC, 1978) indicates a copper requirement of between 8 to 10 mg per kilogram of dry matter in the complete diet (8 to 10 ppm). In Table 4 of the Feeds Act which acts as the regulatory guide for the Canadian feed industry, a maximum of 8 ppm of added copper is allowed in complete diets (grain portion) for sheep.

For any feed manufacturer, copper levels in sheep diets is one of several factors considered in the daily production of feed. Feed companies adhere to strict guidelines, enforced by Agriculture Canada feed inspectors, to ensure that antibiotics, ionophores, nutrients beneficial to some species but toxic to others (for example, urea in ruminant diets, copper in swine diets) are utilized as required by the Canadian Feeds Act. In fact, the Quality Assurance Programs of many feed companies extend beyond the Federal government regulations. As regards copper, each company has its own specific protocols to ensure that all procedures and processes used in sheep feed production fulfill their responsibilities in meeting proper nutrient (including copper) levels as specified on the feed company's feed tags or labels, while conforming to Feeds Act regulations.

The following list include procedures feed companies utilize in their Quality Assurance programs. Specific information is available from the appropriate personnel within each company as regards copper in sheep feeds.

1. Batching and sequencing of feed production for compatible species. Feed plant managers will review the list of feeds to be made on a particular day and group these feeds into production batches to minimize the risk of cross-contamination between feeds and for different species of animals.

2. Flushing. When switching from feed production for one animal species to another species sensitive to an ingredient or nutrient present in the first mix, the system is flushed (usually with a grain) to ensure it is cleaned out and residues are removed.

3. Ingredient testing. Ingredients are tested regularly to ensure that nutrient and quality specifications are being met. With regards to copper, feed ingredients that contain variable levels of copper are either omitted from formulation of sheep feeds or tested regularly to ensure that levels conform to the company's quality control guidelines.
4. Feed Testing. As part of their quality control procedures, feed companies test feeds routinely to ensure that tag specifications are being met and that federal regulations are adhered to. This routine includes the testing of copper levels in sheep feeds. Companies have maximum allowable levels for copper in sheep complete feeds, supplements or premixes. Higher levels of natural copper are allowed in supplements and premixes due to their lower use rates. Producers are encouraged to contact their feed supplier to discuss these levels.

5. Labeling. A variety of methods are used by various feed companies to label feeds for ease of identification of species to be fed, product type (premix versus supplement) and/or medication. Some companies used different coloured tags, labels or bags; others use symbols.

6. Training. Most feed companies have regular in-house training sessions where their feed production and sales personnel are trained in general Quality Assurance practices relative to feed storage, handling, production and feeding recommendations for on-farm use.

7. Producer meetings. Feed Companies, OMAFRA, veterinarians and sheep producer groups hold producer information sessions to discuss a wide range of topics relative to sheep husbandry. These meetings are a forum to discuss a topic such as copper levels in sheep diets. The nature of the industry in Ontario (part-time producers, lack of regional concentration of production, low usage of commercial sheep products) lead to some logistical problems in disseminating information to all sheep producers in the province.

On-farm considerations:

The first five recommendations listed above for feed plants are especially relevant on farms that raise different species of animals besides sheep. Batching, sequencing and flushing procedures are important for on-farm mixing systems feeding animal species that are incompatible for certain nutrients or ingredients e.g. copper level in cattle diets versus that for sheep. For purchased feeds where tags are used to distinguish feed for differing species, tag removal and loss can lead to problems. Sheep producers purchasing commodities should be aware of ingredients that may contain elevated levels of copper (e.g. products from the distilling industry) and establish a regular feed analysis testing procedure for all ingredients and forages used in sheep diets. The same recommendation can be made for purchased hay which can vary considerably in its copper content (see article on "Copper content of Ontario forages" by Dr. Alan Vaage, Ron Piett and Dale Cowan), and which is probably the number one risk factor concerning copper levels in sheep diets.

Due to the factors mentioned previously, the specific requirement and tolerance for copper can vary substantially for various sheep flocks in Ontario. Feed company nutritionists strive to provide the required level in the overall diet for sheep, but this level is affected either by variation or lack of knowledge of the copper content of on-farm feeds and/or presence of minerals, e.g. molybdenum that interfere with copper absorption. NRC (1978) recommends a copper level of 8 to 10 ppm in the diet of sheep. If the feedstuffs on farm are high in molybdenum (due to high soil molybdenum), then copper requirement for sheep is likely above this level. If forage copper levels are elevated (due to high soil copper content), then copper supply from other feeds (minerals or concentrates) need to be reduced if possible. Sodium
molybdate, zinc and sulphate can be added to feed to reduce copper availability, but should be done only under the guidance of a nutritionist. It should be recognized that all feed ingredients (i.e. soybean meal, corn, silage, hay, pasture, mineral mixes, supplements) will have a natural level of copper, so all sheep feeds will contain "copper" even though no copper products are added.

Sheep feed tags stating "No added copper" indicate that no ingredient source of copper supplementation (e.g. copper sulphate) has been added to the product. However, the amount of natural copper in a 13% Ewe Ration, for example, could range from 6 to 12 ppm. If on-farm feeds do not contain elevated levels of copper, this level of copper in the Ewe ration will be utilized by the animal to meet its copper needs. Therefore, finding some copper on analysis of this 13% Ewe ration that carries a tag stating "NO ADDED COPPER" does not necessarily reflect poor production practice on the part of the feed manufacturer. Additionally, other feed products including other ruminant, swine and poultry feeds, milk replacers and mineral products do routinely contain higher levels of copper supplementation and should never be fed to sheep or lambs, unless stipulated by a nutritionist or veterinarian familiar with the specific farm situation and with the producer's consent in writing. Note also that feed tags for complete feeds for other species often do not list concentrations of trace minerals (e.g. copper) even though trace minerals may be added. Tags for feed company supplements, minerals and premixes will list copper concentrations unless these are custom mixes. Custom mixes are feeds produced specifically for one farm and require the written consent of the producer.

In summary, the feed industry is aware that copper is a critical nutrient to consider in the formulation of sheep diets and in the development of sheep programs in Ontario. Through its Quality Assurance protocols, the industry strives to ensure that copper toxicity is never a problem in the flocks of our customers. Each feed company values its producer customers on a long-term basis and recognizes that its economic success runs concurrent to that of its customers. As such, the feed industry perceives little value in feed production practices that promote poor performance of livestock.