

The dairy producer's guide to trace mineral supplementation

# WHY USE SULPHATE FREE TRACE MINERALS



**RUMEN**

**FOOTBATH**



Westside

# Sulphate trace minerals may do more harm than good

The use of sulphate trace minerals has traditionally been seen as a low-cost way to incorporate necessary nutrients into the ration. While **many producers now supplement with hydroxy and/or organic trace minerals**, sulphate trace mineral use was the common practice for decades. But that trend is changing as more producers and nutritionists learn that sulphate trace minerals may actually do more harm than good.

## What makes sulphate trace minerals harmful?

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### High rumen reactivity

Sulphate trace minerals quickly disassociate in the rumen, releasing free metal.<sup>1,2</sup>

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### Harm to rumen microbes

Free metal in the rumen harms rumen microbes.<sup>3,4</sup>

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### Reduced fibre digestion

Cows fed sulphate trace minerals show a decrease in neutral detergent fibre digestion (NDFD) compared to cows fed less reactive trace minerals.<sup>1,5</sup>

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# Sulphate trace mineral characteristics

Held together with weak ionic bonds that disassociate too easily in the rumen where they can do harm

Highly unstable; very reactive in rumen

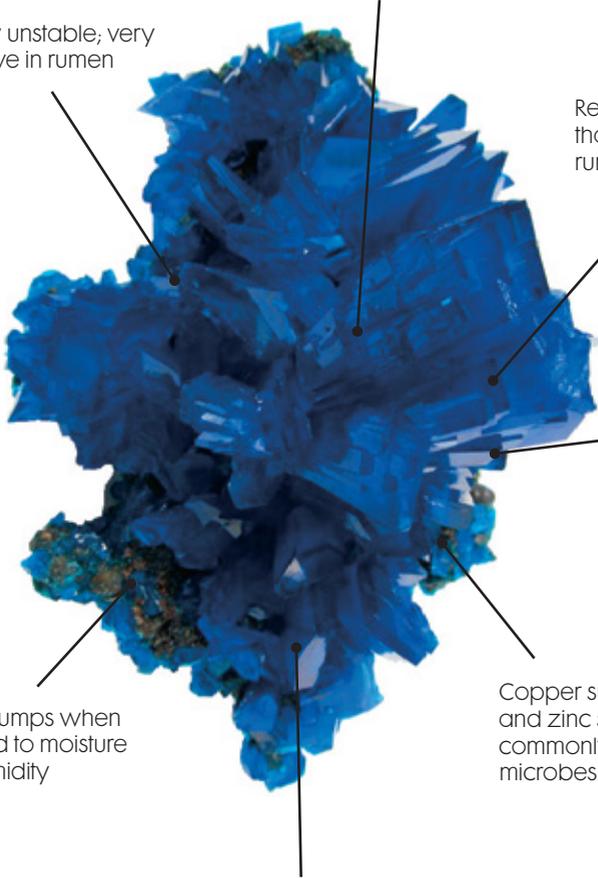
Releases free metal that harms beneficial rumen microbes

High dust particle

Forms clumps when exposed to moisture and humidity

Copper sulphate and zinc sulphate are commonly used to kill microbes in footbaths

May reduce bioavailability



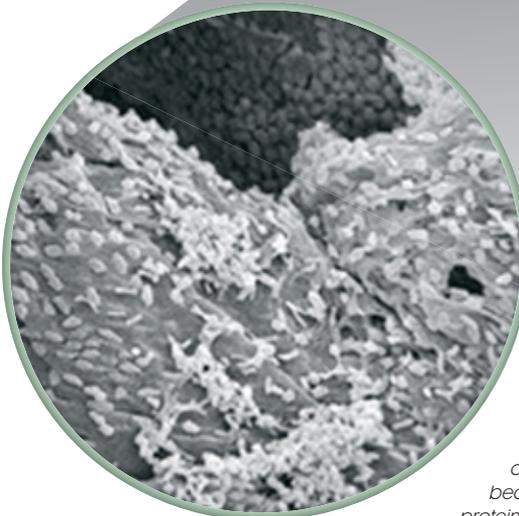
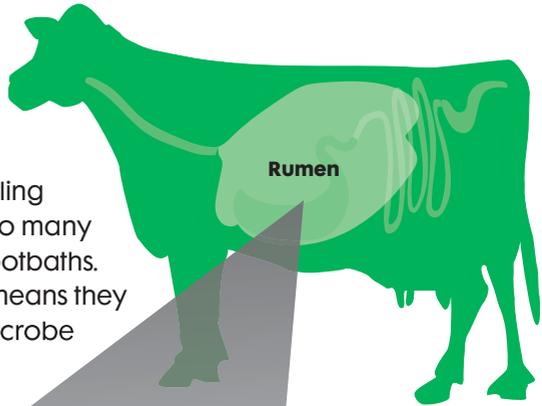
# Sulphate trace minerals interfere with digestion

## Reactive in rumen

Once they enter the rumen, sulphate trace minerals quickly become unstable, disassociate easily and release free metals.

## Harm to beneficial rumen microbes

Sulphates are great at killing microbes, which is why so many producers use them in footbaths. Unfortunately, that also means they may kill the beneficial microbe populations inside the animal as well. <sup>1,2,3,4,5,6</sup>



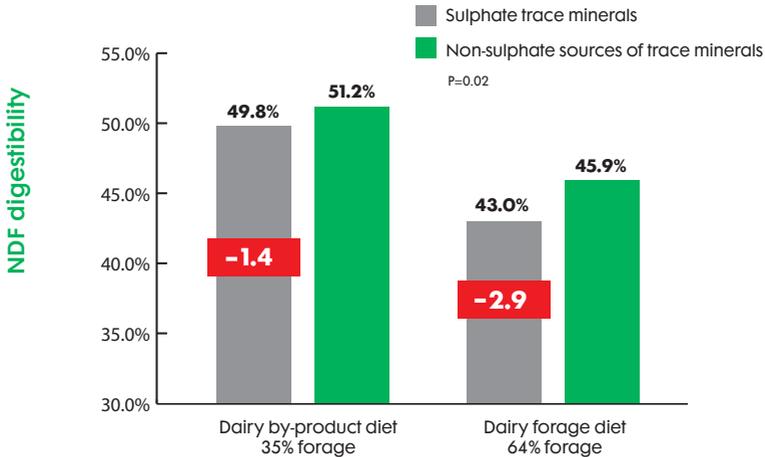
## The importance of rumen microbes

*Ninety percent of fibre digestion takes place in the rumen.<sup>7</sup> When rumen microbes break down feed, they produce volatile fatty acids, which are used by the cow for energy and milk production. As the microbes digest fibre and other carbohydrates, they multiply and become a high-quality source of protein for the cow when they flow out of the rumen and down the digestive tract. These microbes provide about half of the total dietary protein a dairy cow needs.<sup>7</sup>*

# Reduced fibre digestibility

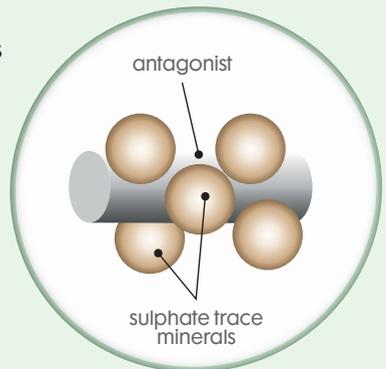
This recent study shows that dairy cows fed sulphate trace minerals have lower neutral detergent fibre (NDF) digestibility compared to cows fed a ration free of sulphate trace minerals.<sup>5</sup>

## Trace mineral source effect on NDF digestibility



## Sulphate trace minerals can bind to antagonists

- Antagonists are minerals or compounds that reduce the availability of another mineral by forming a complex that is no longer available to the animal.
- When sulphate trace minerals break apart in the rumen, free metals may bind to antagonists.
- This makes the trace mineral unavailable for absorption in the small intestine.



# Sulphate trace minerals: An expert's perspective



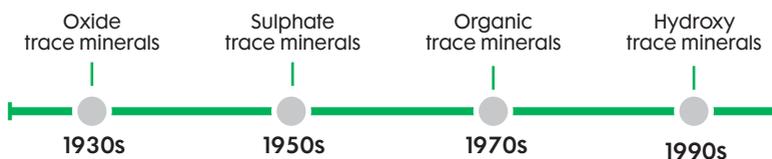
## Dr. Jerry Spears

Professor Emeritus  
Department of Animal Science  
North Carolina State University

**F**or decades, dairy producers have recognised the value of supplementing their cows' diets with trace minerals. Though fed in very small amounts, trace minerals like copper, zinc and manganese are vital to an animal's health and productivity, supporting processes like immunity, fertility and metabolism. The preferred solution until recently seemed to be both simple and economical: add sulphate trace minerals to the ration.

Today, we understand much more about the downside of sulphate trace minerals. Highly unstable and reactive in the rumen, sulphate trace minerals can actually harm beneficial rumen microbes and decrease NDF digestibility. Because they break down so easily and bind to antagonists, sulphate trace minerals are also poorly absorbed. So, the cost savings achieved with sulphate trace minerals are quickly lost due to the negative effects on performance. Most producers find they're actually paying for a supplement that's hurting their bottom line.

### Trace mineral innovation timeline



*Sulphate trace minerals became the main choice of ruminant supplementation in the 1950s until innovations in the 1970s and 1990s caused a decline in use.*

For this reason, a growing number of producers and nutritionists are looking to eliminate sulphate trace minerals entirely from the diet. Fortunately, making this switch is easy and cost effective. Options include feeding organic and hydroxy trace minerals, which can be used on their own or in combination with one another. Here are the options recommended to those looking to feed a diet free of sulphate trace minerals.



### Three options for a diet free of sulphate trace minerals

Trace mineral form	Cost difference (vs sulphate trace minerals)*	Considerations
<b>1.</b> 100% organic trace minerals	+ \$0.08 to \$0.12/cow/day**	There's no question organic trace minerals provide a result, but most producers find the benefits of feeding 100% organic trace minerals don't outweigh the cost.
<b>2.</b> 100% hydroxy trace minerals	+ \$0.01 to \$0.03/cow/day**	Hydroxy trace minerals are affordable. The additional cost over sulphate trace minerals is easily offset by the increase in availability and NDFD. For those reasons, many producers choose this option.
<b>3.</b> 80% hydroxy trace minerals 20% organic trace minerals	+ \$0.03 to \$0.05/cow/day**	This is an option for producers who want to keep organic trace minerals in their ration while keeping the cost of removing sulphates at a reasonable level.

The right choice will depend upon the needs of your operation, ROI targets and any special nutritional concerns you may have. The best first step is for producers and nutritionists to simply start a dialogue about formulating a diet free of sulphate trace minerals.

\*Guidelines only. Talk to your nutrition supplier for specific costs.

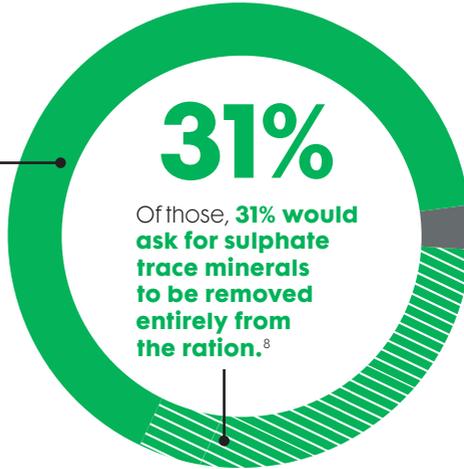
\*\* Costs expressed in American dollars.

# Sulphate trace minerals may do more harm than good

That's why producers and nutritionists are making a change.

# 97%

In a recent survey, **97% of dairy producers said they would talk to their nutritionist about making a change to the ration** if they found out their trace minerals harmed rumen microbes.<sup>8</sup>



## Start a conversation with your nutritionist about removing sulphate trace minerals from the ration.

Here are three simple questions to get the conversation going:

1. Does my ration include sulphate sources of trace minerals?
2. Based on this new information, do you think we should continue feeding sulphate trace minerals?
3. What are the benefits of improved NDFD if we remove sulphate trace minerals from my ration?

<sup>1</sup> Weigel, B., V.N. Kucharczyk, K. Sellins, E. Caldera, J.J. Wagner, J.W. Spears, S.L. Archibeque, R.S. Fry, S.B. Laudert, T.E. Engle. 2017. Influence of trace mineral source on copper, manganese, and zinc rumen solubility and release from the insoluble portion of rumen digesta following a bolus dose of trace minerals in cattle. *J. Dairy Sci.* Vol. 100, E-Suppl. 2. (Abstr.).

<sup>2</sup> Genther, O.N. and S.L. Hansen. 2015. The effect of trace mineral source and concentration on ruminal digestion and mineral solubility. *J. Dairy Sci.* 98:566-573.

<sup>3</sup> Martinez, A. and D.C. Church. 1970. Effect of various mineral elements on in vitro rumen cellulose digestion. *J. Anim. Sci.* 31:982-990.

<sup>4</sup> Sala, J. C. 1957. The effect of minerals on cellulose digestion as studied in the artificial rumen. PhD Diss. University of Florida, Gainesville, FL.

<sup>5</sup> Faulkner, M.J. and W.P. Weiss. 2017. Effect of source of trace minerals in either forage- or by-product-based diets fed to dairy cows: 1. Production and macronutrient digestibility. *J. Dairy Sci.* 100:5358-5367.

<sup>6</sup> Shaeffer, G.L. 2006. Evaluation of basic zinc chloride as a zinc source for cattle. PhD Diss. North Carolina State University, Raleigh, NC.

<sup>7</sup> U.S. Dairy Forage Research Center. 2007. Rumen microbes: Take a closer look at these interesting creatures that both work for and feed dairy cattle. USDA-Agricultural Research Service.

<sup>8</sup> Farm Journal Trace Mineral Survey. 2017.