

**Sollus**  
building healthy cows



**Lactisol Z** The science behind the battle with facial eczema



# Introduction

Sollus Lactisol Nucleus Z is an ACVM registered form of Lactisol, containing higher (over 13 X higher) levels of Zinc than are in Lactisol 400, 500 & 600. This is the active ingredient aiding in the prevention of facial eczema.

The activity of zinc on facial eczema has, of course, been known about for many years. Zinc is effective at **preventing** facial eczema to a large degree but it's rarely 100% successful and it presents us with a number of challenges – every medicine has side effects.

In this guide we'll discuss those challenges and how we set about addressing them.



# Facial eczema causes and importance

First of all, let's look briefly at the problem. Facial eczema has been written about extensively so it's not our intention to recover that ground in detail.

The fungus, *Pithomyces chartarum*, thrives on dead / dying leaves at the base of a grass sward, favouring perennial rye. Like most fungi it flourishes under warm, moist conditions – e.g in North Island summers. Cattle and sheep grazing the sward will ingest fungal spores which then release a toxin – sporidesmin. In the presence of copper sporidesmin releases free radicals – reactive oxidative species, or, ROS for short. These ROS are what cause tissue damage – in this case to bile ducts and liver. Liver damage means animals can't process breakdown products from chlorophyll present in green feeds. These accumulate in tissue, including skin, making animals sensitive to sunlight.

The liver damage can be fatal if not caught in time and, even where symptoms are not obvious, sub-clinical damage can reduce glucose production, waste processing and, consequently, animal performance. Matthews et. al. concluded in the New Zealand Veterinary Journal that the overall effects of sporidesmin consumption on milk production by the national herd are hugely under-estimated, especially considering effects on subclinical cows<sup>1</sup>.

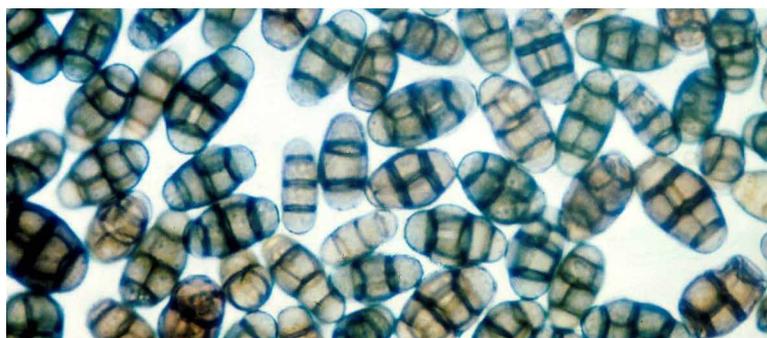


Figure 1 *Pithomyces chartarum* spores - the causal agent of facial eczema

Towers & Smith concluded in the same journal that milk production losses in cows exposed to sporidesmin, not exhibiting symptoms, may be falsely attributed to seasonal or other factors<sup>2</sup>.

There are limited options for treatment once animals are sick. The best strategy is prevention – monitoring spore levels, dosing with zinc when they reach a critical threshold and / or spraying pasture with an appropriate fungicide. Grazing management, alternative crops and utilising supplementary feeds can all help to reduce exposure.

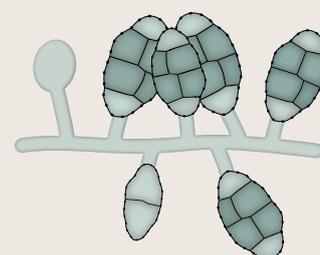
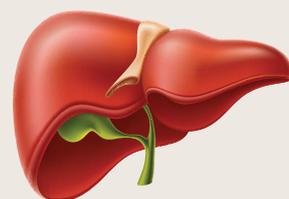
## Numbers to be aware of

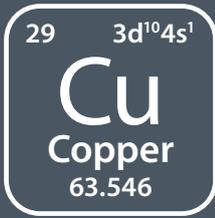
### 1 BLOOD:

- GGT (gamma glutamyltransferase) is an enzyme produced by the liver, positively correlated to liver damage. Scores greater than 300IU/L of blood indicate moderate to severe liver damage<sup>3</sup>. It's important to note that elevated GGT levels will be seen after damage has already occurred. Matthews et. al. reported that reductions in milk production occurred before any recordable increase in GGT levels<sup>1</sup>.
- Blood zinc levels greater than 18 umol/L indicate elevated zinc intake and therefore that animals are receiving a level of protection. Blood is not an accurate method of determining individual animal consumption because zinc bloods are not tightly correlated with zinc intake. Have 10 animals tested and look at the average, not the low outliers.

### 2 SPORE COUNTS:

- The toxin is cumulative so it's important to be aware of both spore count and the number of days it has been at this level. For example, a cumulative account of 600,000 can be reached after six days at 100,000 or 20 days at 30,000. Zinc is a prophylactic treatment so treatment needs to commence before sporidesmin accumulates to damaging levels.





## The problem with copper

Copper is doubly difficult. Sporidesmin uses copper to catalyse ROS formation and cause liver damage and, at the same time, copper and zinc seem to compete for absorption. So, just when we need zinc to be in the blood doing its thing, copper can block it. Hall et.al. reported a 20% decrease in zinc adsorption when dietary copper was raised from 3 to 24mg/kg<sup>4</sup>.

In part we overcome that challenge simply by loading up Lactisol Nucleus Z with very high levels of zinc, out-competing the copper. Think of it like rush hour at a train station. If there's 10,000 zincs rushing for a few doors it makes it very hard for a few hundred coppers to squeeze on board.

Just as all forms of zinc are not the same, neither are all forms of copper. Copper salts, for example copper sulphate, may be absorbed faster, possibly because they're more soluble. Copper that is naturally present in feeds is less rapidly absorbed, so presents less of a competitive challenge to zinc. The same can be said of copper supplemented in chelated or organic forms, however, once these forms are absorbed by the cow, sporidesmin treats all forms of copper the same. They all catalyse ROS.

In Lactisol Nucleus Z we play it safe and leave supplemental copper out altogether. There is generally enough background copper in feed to meet the short term requirements of the cow.

At the end of the facial eczema season, if you have been using any therapeutic form of zinc, it's worth considering having blood tested for copper levels and, if deficient, using injectable copper to restore levels quickly. Follow up with a good source of dietary copper eg. Lactisol 400, 500 or 600.



## How zinc works

Zinc itself has three distinct modes of action. Firstly, high levels of dietary zinc reduce copper absorption<sup>5</sup>. The mechanism is speculative, but one possible explanation is that there is a protein in the gut required for the absorption of copper. High levels of zinc may out-compete the copper for binding sites on this protein.

Secondly, once zinc has been absorbed, sporidesmin is a thiol compound and thiols react with certain metals to form stable compounds. (preventing ROS from being formed.) These stable compounds are called mercaptides. As well as zinc, there are several more volatile / toxic metals that sporidesmin can react with, such as cadmium and mercury, to form mercaptides – these are clearly too toxic to be viable animal feed additives. Zinc itself can be toxic if overdosed and the margin for error is not huge. Care with dosing is therefore important.

Thirdly, zinc is an antioxidant. We cover antioxidant mode of action and the effect on facial eczema in more detail in the last section but zinc acts in a different site to the other antioxidants present in Lactisol Nucleus Z.



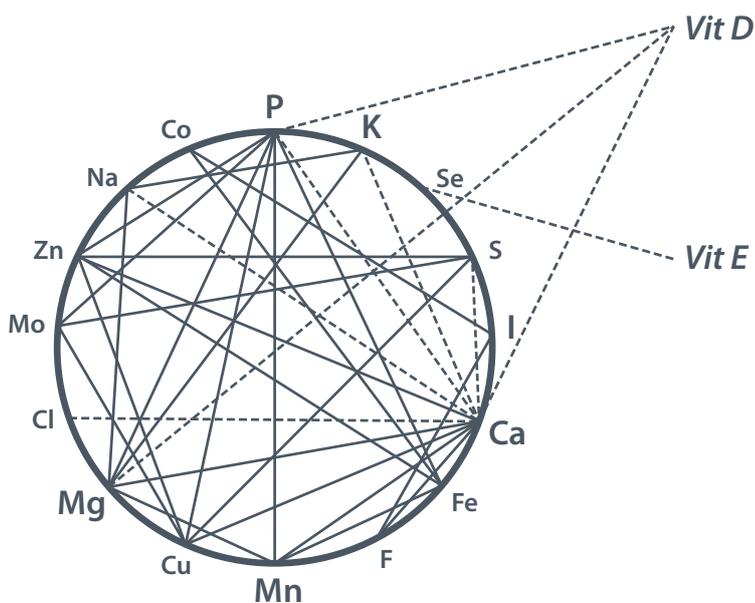
# Mineral antagonisms

When we supplement a specific mineral we need to be aware that may have unintended consequences. Increasing one mineral beyond a certain level may decrease the availability of another one equally as important. The below diagram illustrates how complex these relationships are.

Increasing zinc to prevent facial eczema has antagonistic side effects. One unfortunate consequence of significant increases in zinc are that the adsorption of calcium and phosphorus are reduced. Both are required for bone strength and, of course, milk. The unintended side effect of protecting a cow against facial eczema therefore, may be a production drop, reduced bone deposition and possibly milk fever. That's a challenge Lactisol is uniquely able to address.

**Lactisol Nucleus Z contains DSM's unique Hy-D®.**

Hy-D helps the cow take dietary calcium and deposit it on her bones, helping to offset the mineral antagonism.



## Different types of zinc

Zinc makes its way into cows in a number of different forms. In feed it's typically as zinc oxide. Zinc oxide isn't soluble so, in water systems, the more soluble zinc sulphate is used. It's important to be aware that zinc sulphate is less palatable, but conversely carries greater risk of poisoning from overdosing and is more likely to cause gut lesions. Smith et. al. found that dairy cows were protected against sporidesmin by oral dosing with zinc sulphate but drew attention to the risk of zinc salts (such as sulphate) causing toxicity and residues in milk<sup>2</sup>. Variable water intakes compound the risk.

**Lactisol Nucleus Z uses zinc oxide.**



# The effect of Antioxidants

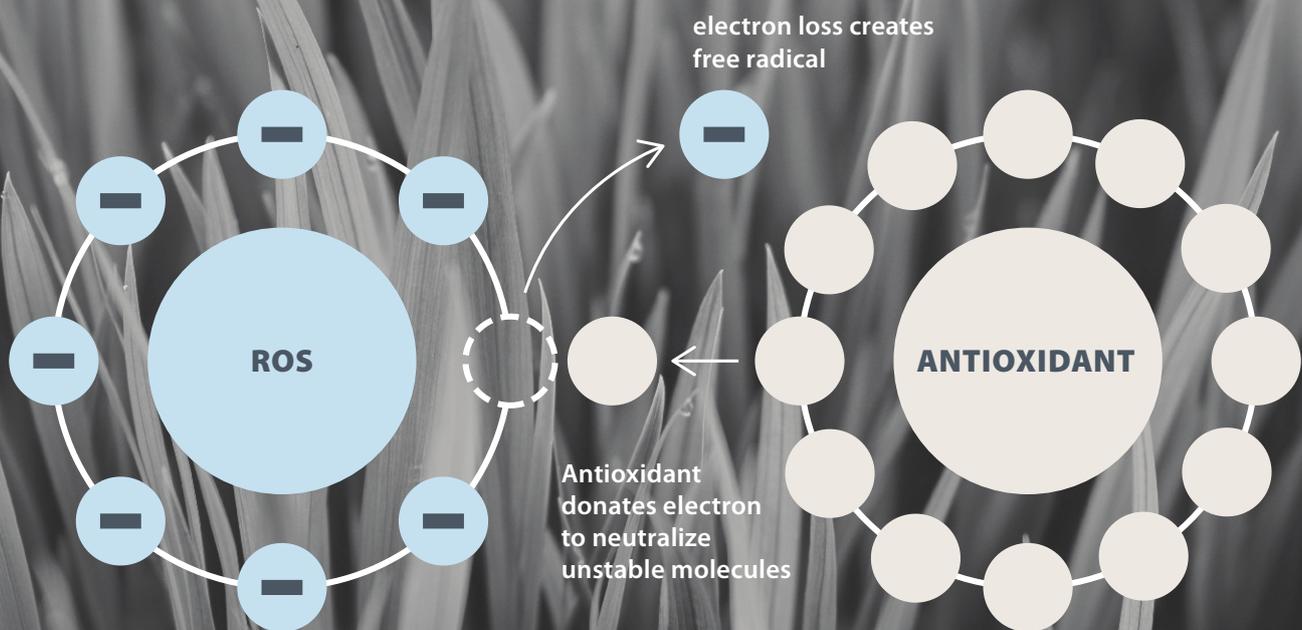
ROS – reductive oxidative species, or free radicals, are unstable molecules because they are short an electron. The damage they cause, called oxidative stress, occurs when they rob molecules in tissue cells of their electrons to make up the deficit.

Antioxidants are molecules that willingly give up an electron to a free radical, thus saving tissue cell molecules from having to do so and preventing or reducing oxidative stress. They are sometimes referred to as free radical scavengers and are thought to provide many health benefits.

Well known antioxidants include vitamins A, C & E, beta-carotene and selenium.

Animals do produce some antioxidants themselves, known as endogenous antioxidants, but these are not enough, so antioxidants that come from feed – exogenous antioxidants – are a critical source. Green feeds for example contain high levels of beta carotene and vitamin E. Beta-carotene is stored in fat but vitamin E is not stored for long periods in the animal. That makes it particularly important to boost when supplemental feeds, typically low in vitamins, are being used.

*As well as 8mg of selenium, Lactisol Nucleus Z contains double the level (500mg) of vitamin E that is found in Lactisol 500 (250mg).*



**LACTISOL NUCLEUS Z CONTAINS ANTIOXIDANTS – SELENIUM AND ELEVATED LEVELS\* OF VITAMIN E**

\* Lactisol 500 contains 250 IU of vitamin E. Lactisol Nucleus Z contains 500 IU of vitamin E.

# Summary

- ✓ **LACTISOL NUCLEUS Z CONTAINS ZINC OXIDE TO AID IN THE PREVENTION OF FACIAL ECZEMA.**
- ✓ **LACTISOL NUCLEUS Z CONTAINS NO COPPER – MINIMIZING THE EFFECT OF FREE COPPER ON SPORIDESMIN.**
- ✓ **LACTISOL NUCLEUS Z CONTAINS HY-D TO INCREASE THE ADSORPTION OF CALCIUM AND PHOSPHORUS, MINERALS THAT HIGH LEVELS OF ZINC DECREASE THE ADSORPTION OF.**
- ✓ **LACTISOL NUCLEUS Z CONTAINS THE POWERFUL ANTIOXIDANTS – SELENIUM AND VITAMIN E.**

## Rates

Lactisol Nucleus Z Nucleus is formulated for users wishing to supply their own lime and salt and is used at 25g/cow/day.

# Lactisol Nucleus Z

Lactisol Z is available in two forms. Lactisol Nucleus Z is the registered form and is available for farmers to purchase and feed themselves. Lactisol Blender Z is also available in the Complete form – containing lime and salt. It is available to feed manufacturers only.

## LACTISOL NUCLEUS Z & BLENDER Z\*

INGREDIENT	Nucleus 25g dose	Complete 200g dose
Vitamin A	●	●
Vitamin D3		●
Vitamin E	●	●
Rovimix Biotin	●	●
Rovimix Hy-D	●	●
Cobalt	●	●
Copper		●
Iodine	●	●
Zinc	●	●
Selenium	●	●
Magnesium Oxide	●	●
Magnesium Sulphate	●	●
Magnesium Chloride		●
Sodium Chloride		●
Calcium		●
Monensin		
Lasalocid		
MOS		

\* Lactisol Blender Z Complete is available to feed manufacturers only

## REFERENCES:

1. ZM Matthews, MG Collett, JC Marshal, AC Partridge & PJB Edwards. Effect of a one-off sporidesmin challenge on the milk production of dairy cows. *New Zealand Veterinary Journal* 66(5) 2018.
2. Towers NR, Smith BL. The protective effect of zinc sulphate in experimental sporidesmin intoxication of lactating dairy cows. *New Zealand Veterinary Journal* 26, 199–202, 1978
3. Towers NR, Stratton GC. Serum gamma-glutamyl transferase as a measure of sporidesmin-induced liver damage in sheep. *New Zealand Veterinary Journal* 26, 109–12, 1978.
4. AC Hall, BW Young, I Bremner. Intestinal metallothionein and the mutual antagonism between copper and zinc in the rat. *Journal of Inorganic Biochemistry*, 1979
5. WF Fischer, MR L'Abbe. The effect of dietary zinc on intestinal copper absorption. *American Journal of Clinical Nutrition*, 1981.

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## Your team



**ERIN STABLES** Business Development Manager  
NORTHLAND | NORTHERN WAIKATO | CANTERBURY

erin@sollus.co.nz  027 714 4148



**BRUCE HEMINGWAY** Account Manager  
BAY OF PLENTY | TARANAKI | HAWKES BAY

bruce@sollus.co.nz  021 241 0104



**TONY CASSIDY** Account Manager  
WAIKATO

tony@sollus.co.nz  021 224 5175



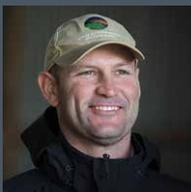
**ZANE INSLEY** Account Manager  
SOUTHLAND

zane@sollus.co.nz  021 992 608



**JASON BOYCE** Account Manager

jason@sollus.co.nz  021 927 838



**DR JOE MCGRATH** Nutritionist

**0800 SOLLUS**  
**www.sollus.co.nz**



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