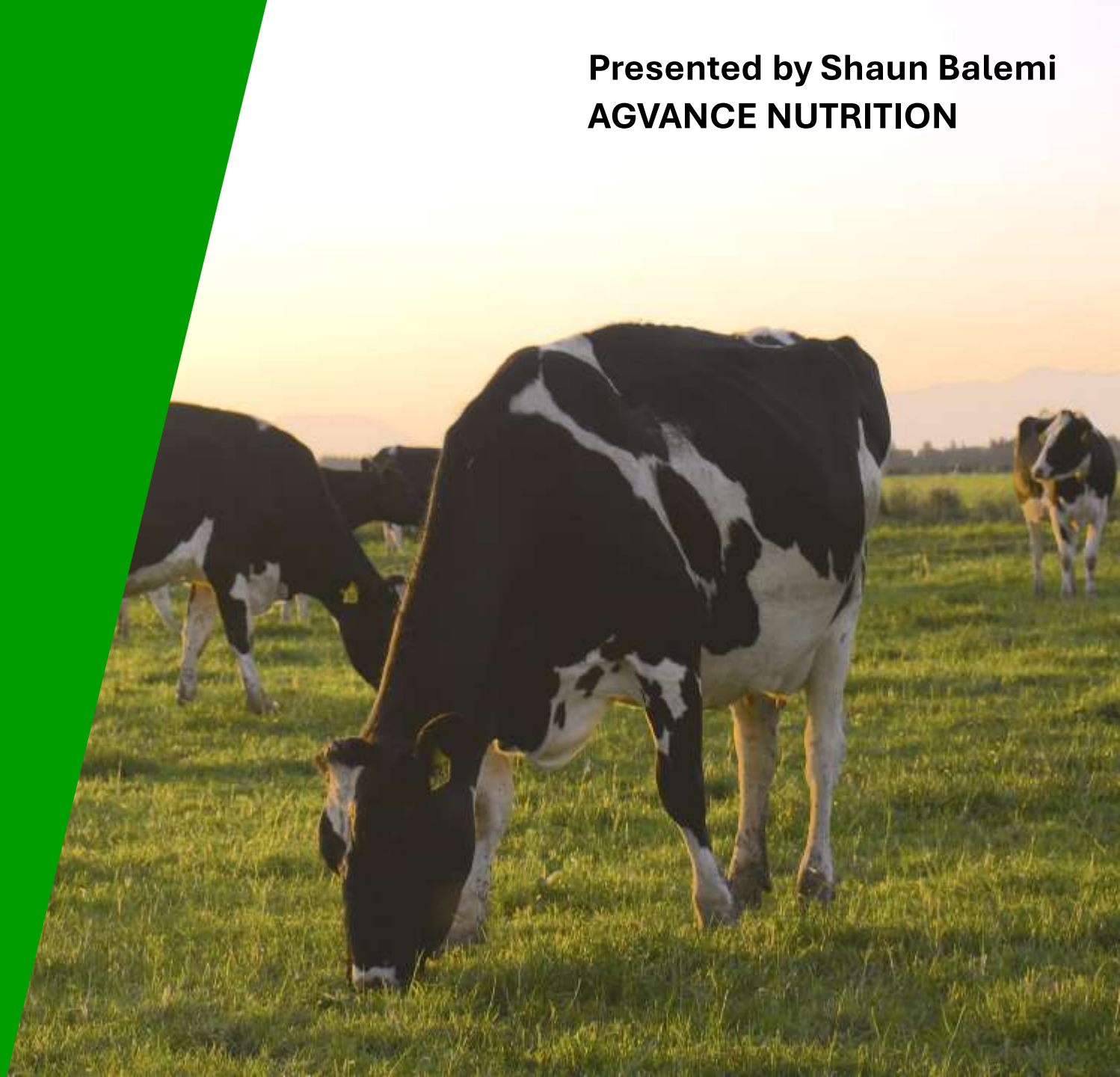
AGVANCE
Success. Together.

Presented by Shaun Balemi
AGVANCE NUTRITION

WEBINAR SERIES

Facial Eczema

Part 1



Overview of facial eczema

Mode-of-operation of facial eczema

The role of copper and zinc in facial eczema

Facial eczema and the liver

Preparing our cows for facial eczema

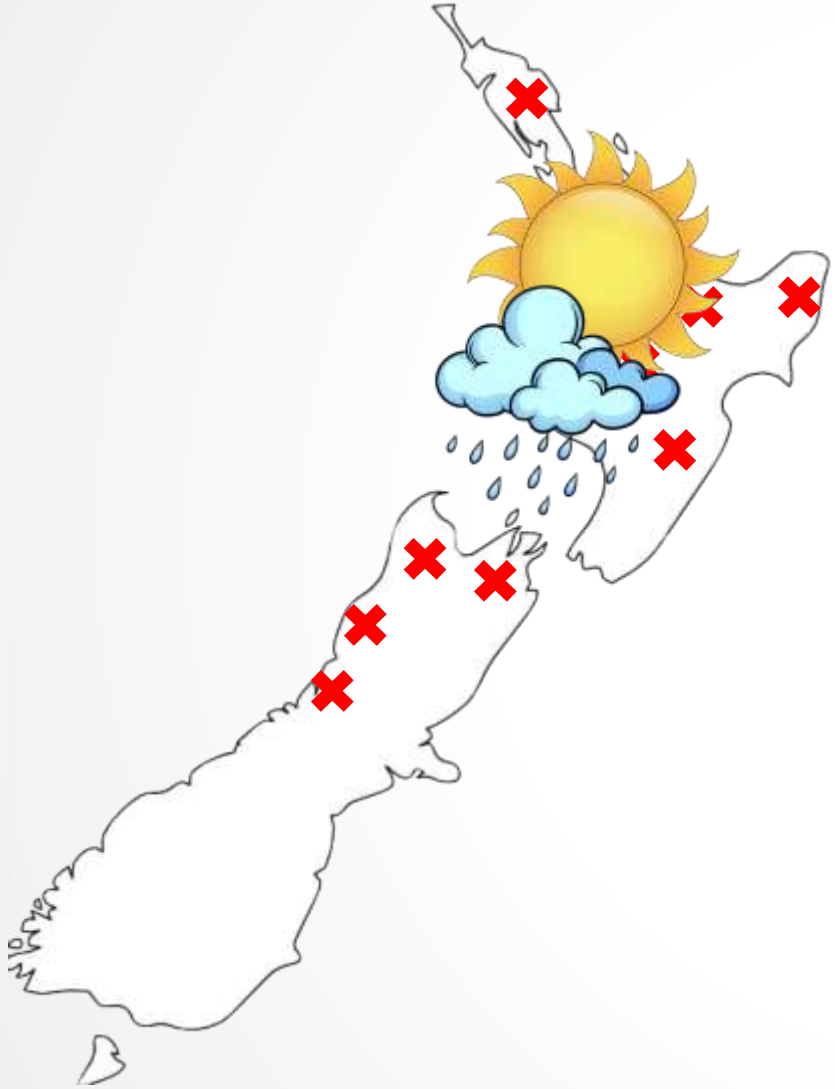
Facial eczema disease is caused when the fungus *Pithomyces Chartarum* releases spores which are ingested and oxidised in the cow

Cuttance et al., 2021 showed a 0.06kg MS/cow/day drop when FE exposure pushed GGT levels above 40IU/L[14]

Costs NZ farmers $100 million per year in lost milk production but as much as $274 million in combined production and animal health related costs[2]

Facial eczema, despite its name, is a disease of the liver, caused by the damage that ingested and oxidised sporidesmin inflict on liver tissue in the cow

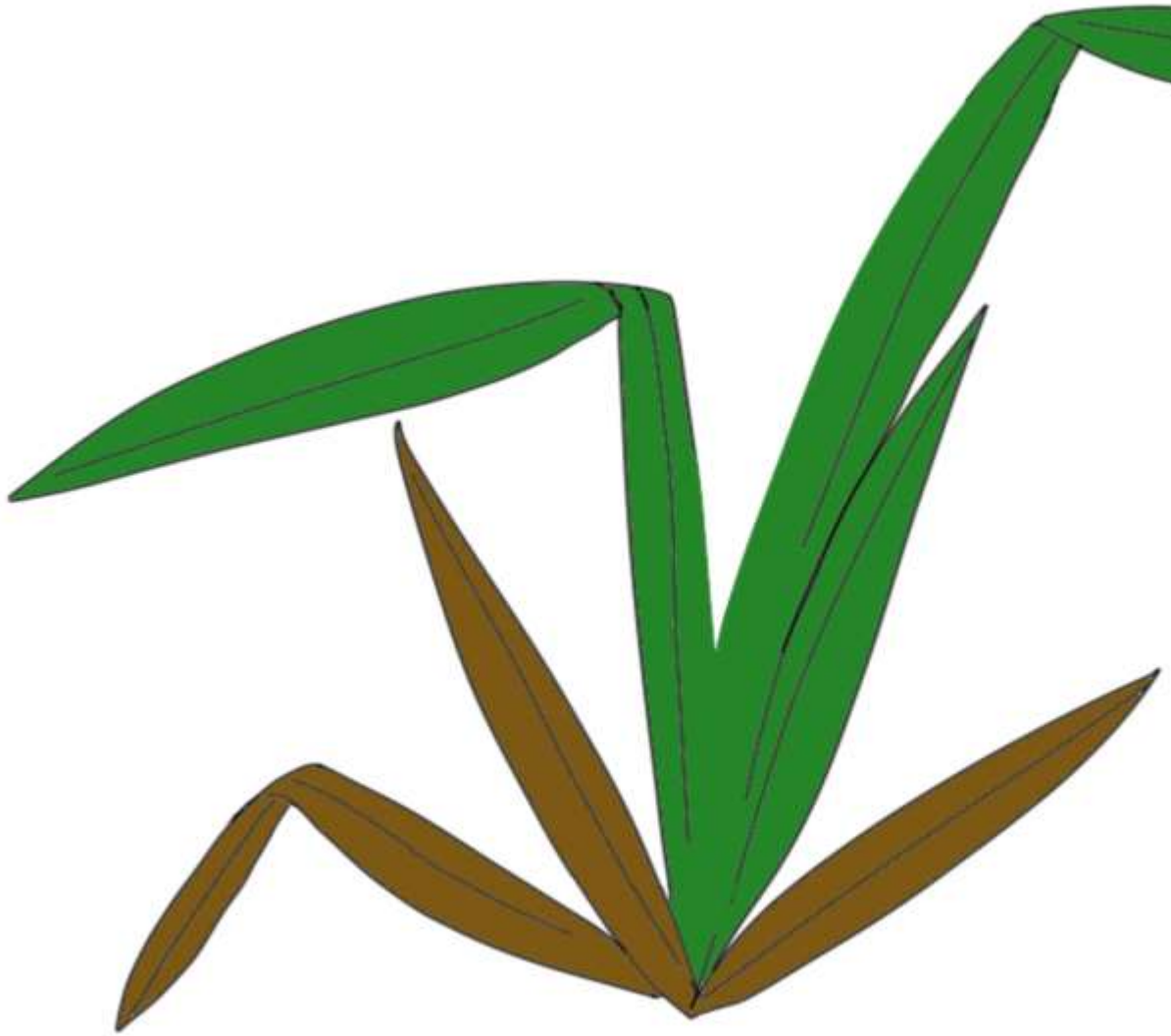
TEMPERATURE & HUMIDITY

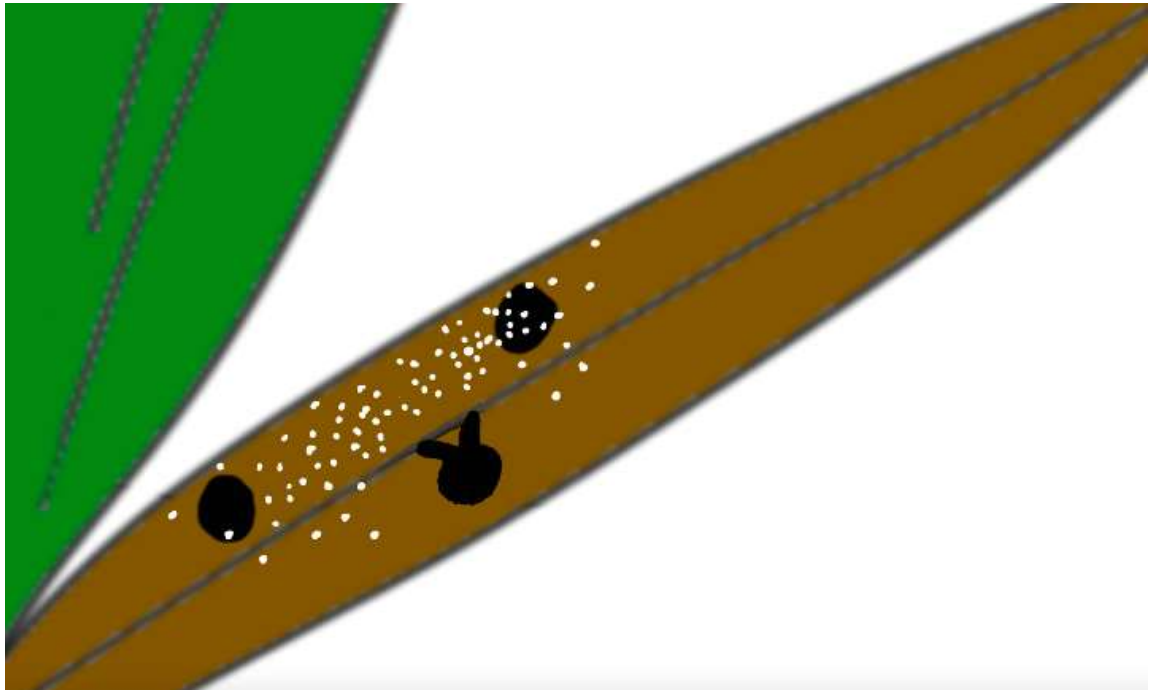


12 – 27°C

100% humidity

LOCATION





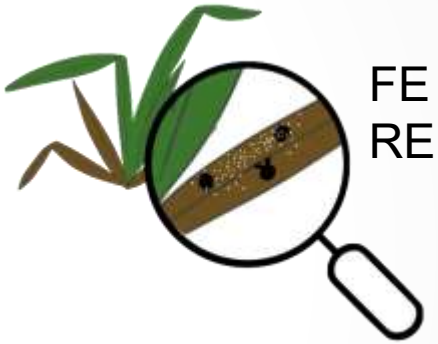
MODE OF OPERATION

AGVANCE
Success. Together.

IDEAL FE CONDITIONS

12 – 27°C
100% humidity.
Warm and moist conditions.

FE SPORE RELEASE

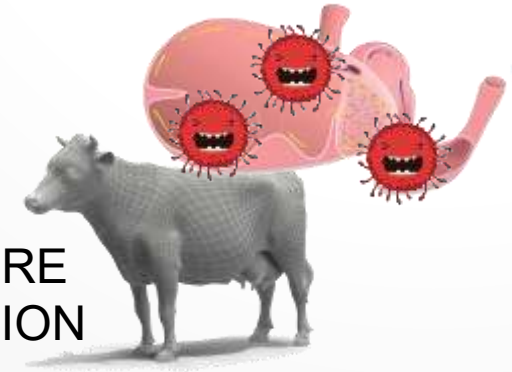


Fungus grows.
Fungus releases spores.
Happens 12-48hr after favourable conditions.

FE SPORE INGESTION

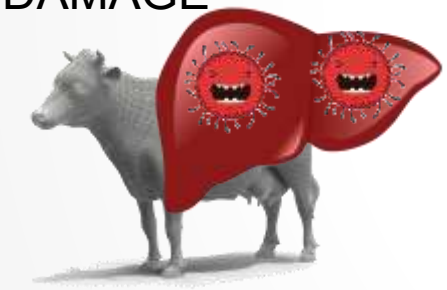
Cows ingest spores.
More spores ingested when grazing low residual pasture.

FE SPORE OXIDATION



Ingested spores are then oxidised.
Once the spores are oxidised, they become toxic.

FE SPORE DAMAGE



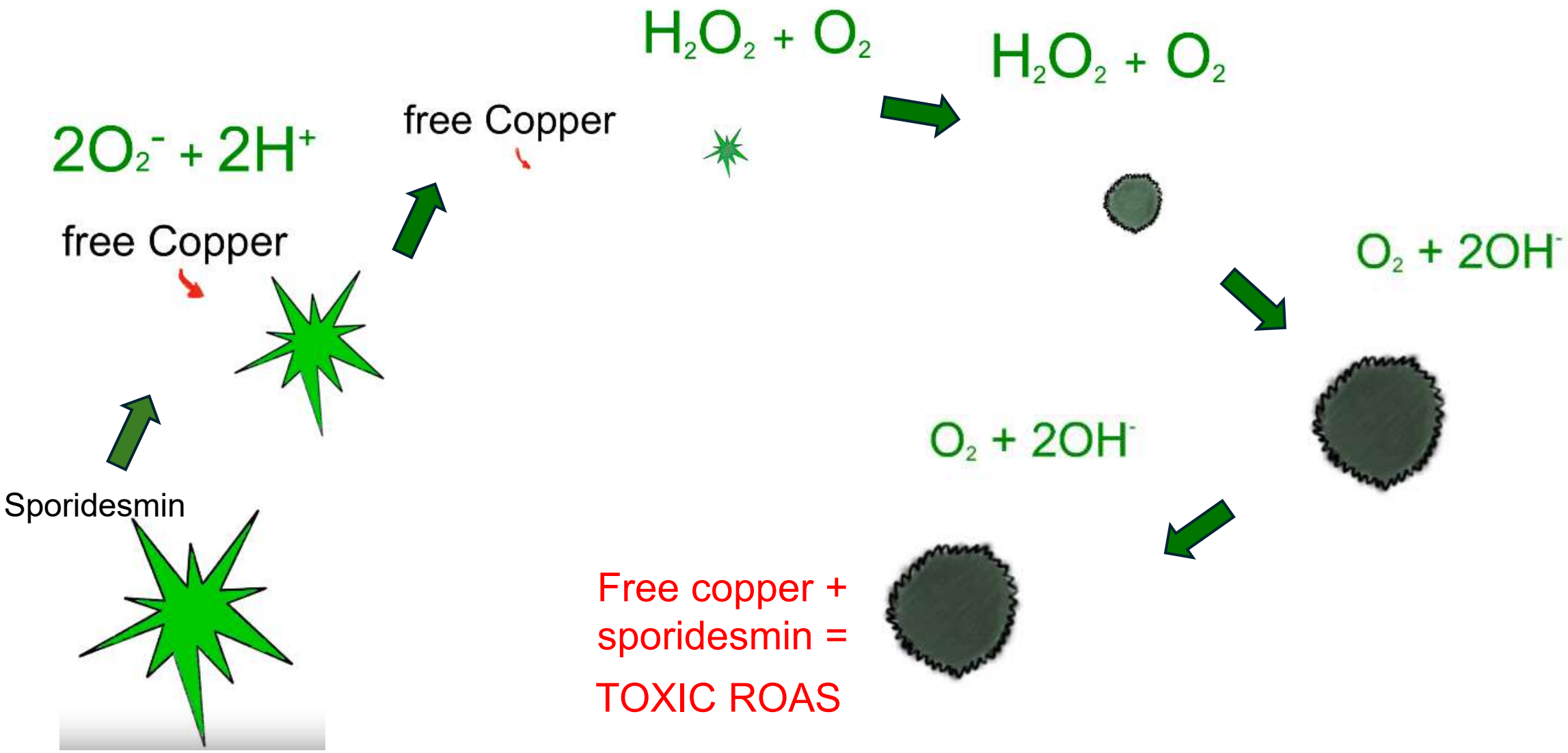
Oxidised spores arrive in the liver via the blood.
Once in the liver they are targeted by antioxidants.
Once reduced by antioxidants they are excreted via the bile.
Any of these oxidised spores that are not reduced and excreted start damaging the liver and hurting the cow.

EFFECTS IN COW

Once the liver is “overloaded” and the oxidised sporidesmin are damaging the liver we see:

1. A drop in appetite
2. Drop in milk production
3. Photosensitivity

AUTO-OXIDATION PROCESS - COPPER

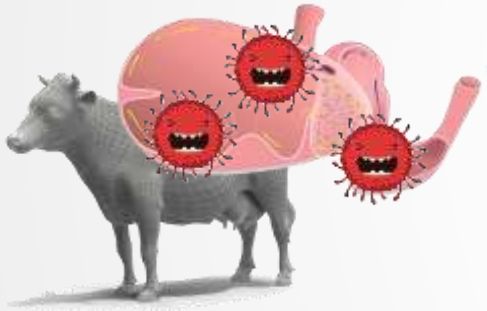


ROLE OF COPPER AND ZINC

Zinc and copper work together in the body as antioxidants for immune system and liver function, bone strength, and nervous function

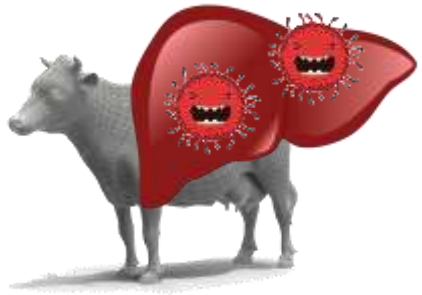
HOWEVER, in relation to facial eczema zinc and copper oppose each other and work together in a complex relationship[22]

DIGESTIVE SYSTEM



1. Copper increases the oxidation of the spore toxin, zinc blocks this toxification/oxidation process reducing spore toxicity[5,6]
2. Copper reduces adsorption and storage of zinc in the liver, affecting long-term protection

LIVER SYSTEM



1. Both copper and Zn is apart of SOD, a key antioxidant and both are critical for liver function
2. Copper and zinc at normal levels help increase liver storage capacity of both minerals

ROLE OF COPPER

Copper catalyses the oxidation of the sporidesmin to a Toxic Reactive Oxidative Species (ROS)[6,20]

=

Increasing the toxicity of the spores that the cow has ingested[6]

Munday 1985 showed that removing free copper from the diet, by binding it in a chelate, helps to reduce the production of ROS[6]

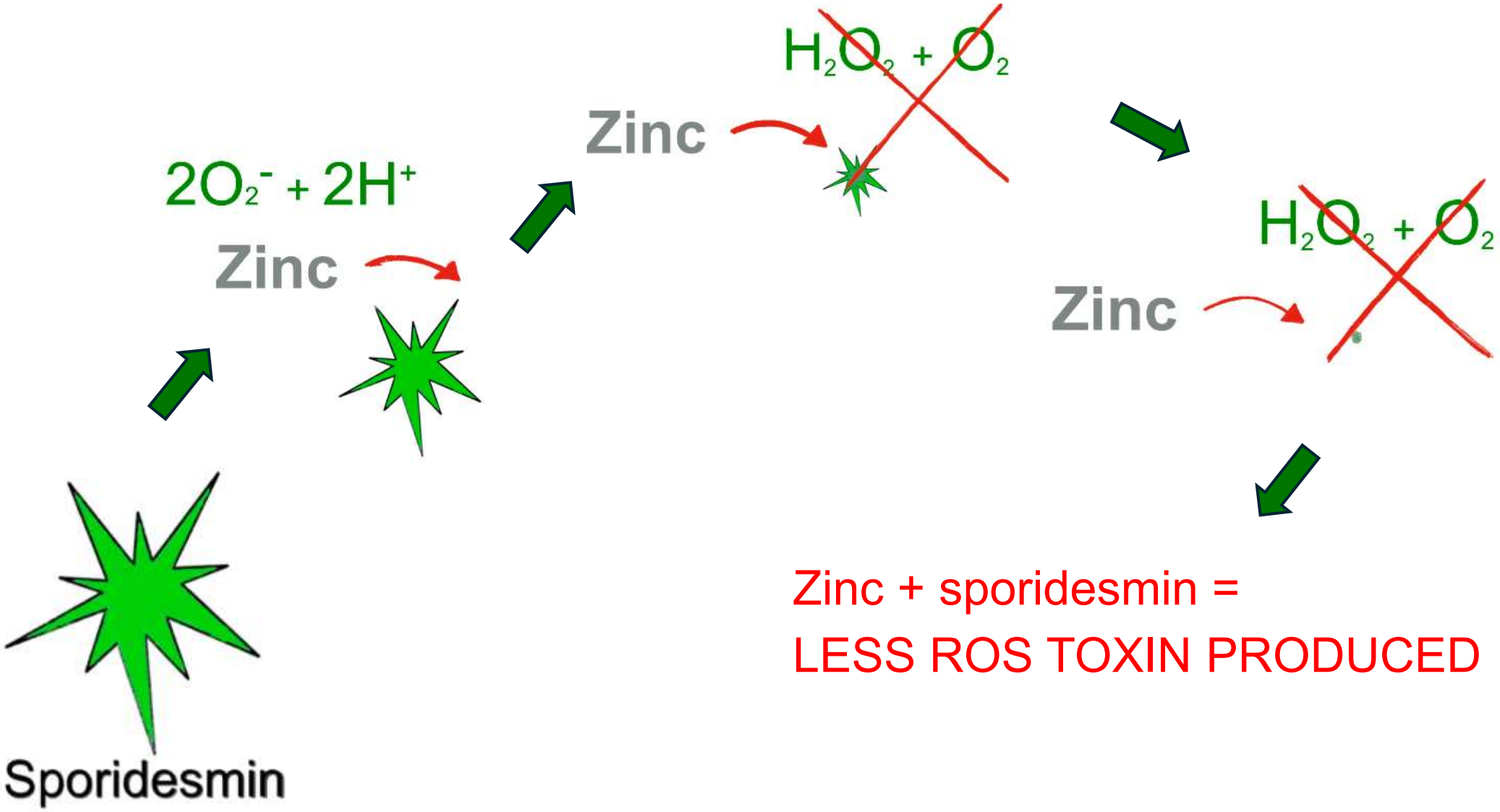
Munday 1985 also showed that the strength of the chelate bond was important[6]

Munday 1985 also showed that trace levels (0.1-0.5uM/L) of copper is all that is needed to catalyse the sporidesmin oxidation[6]

Johnson et al., 2020 showed that increased levels of copper in the blood correlated to increased GGT levels[24]

Supplement ONLY a proven strongly-bound copper chelate[6,21]

AUTO-OXIDATION PROCESS - ZINC



Zinc + sporidesmin =
LESS ROS TOXIN PRODUCED

ROLE OF ZINC

Zinc blocks the sporidesmin thiol reducing its oxidative/toxic potential[4,5]

=

Decreases the toxic effects of the sporidesmin in the liver

First discovered by Gladys Reid in the 1970s

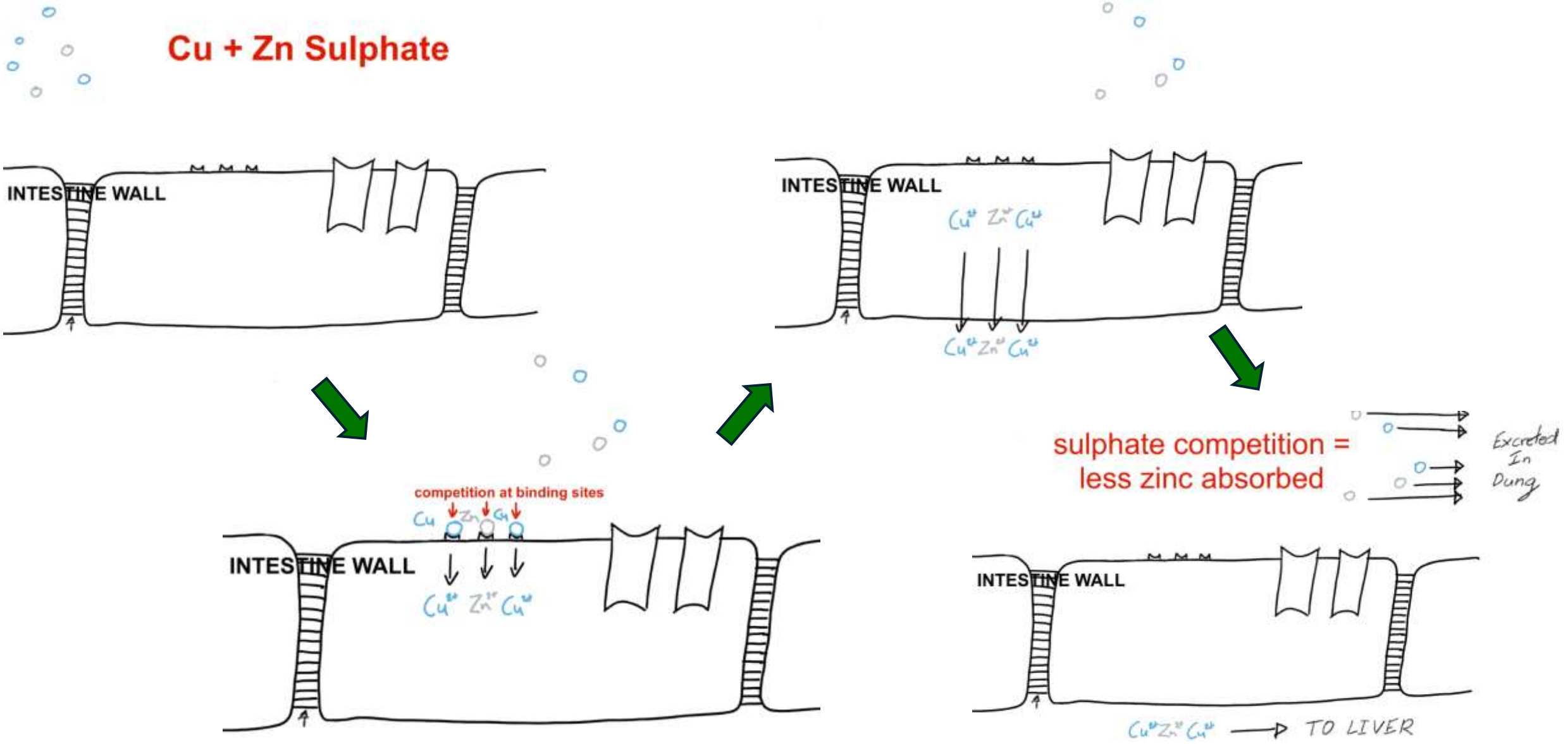
Zinc removes sporidesmin from the auto-oxidation cycle, stopping it from producing reactive oxygen radicals which do damage[4,5]

Only effective when zinc levels are built up prior to high sporidesmin exposure[12]

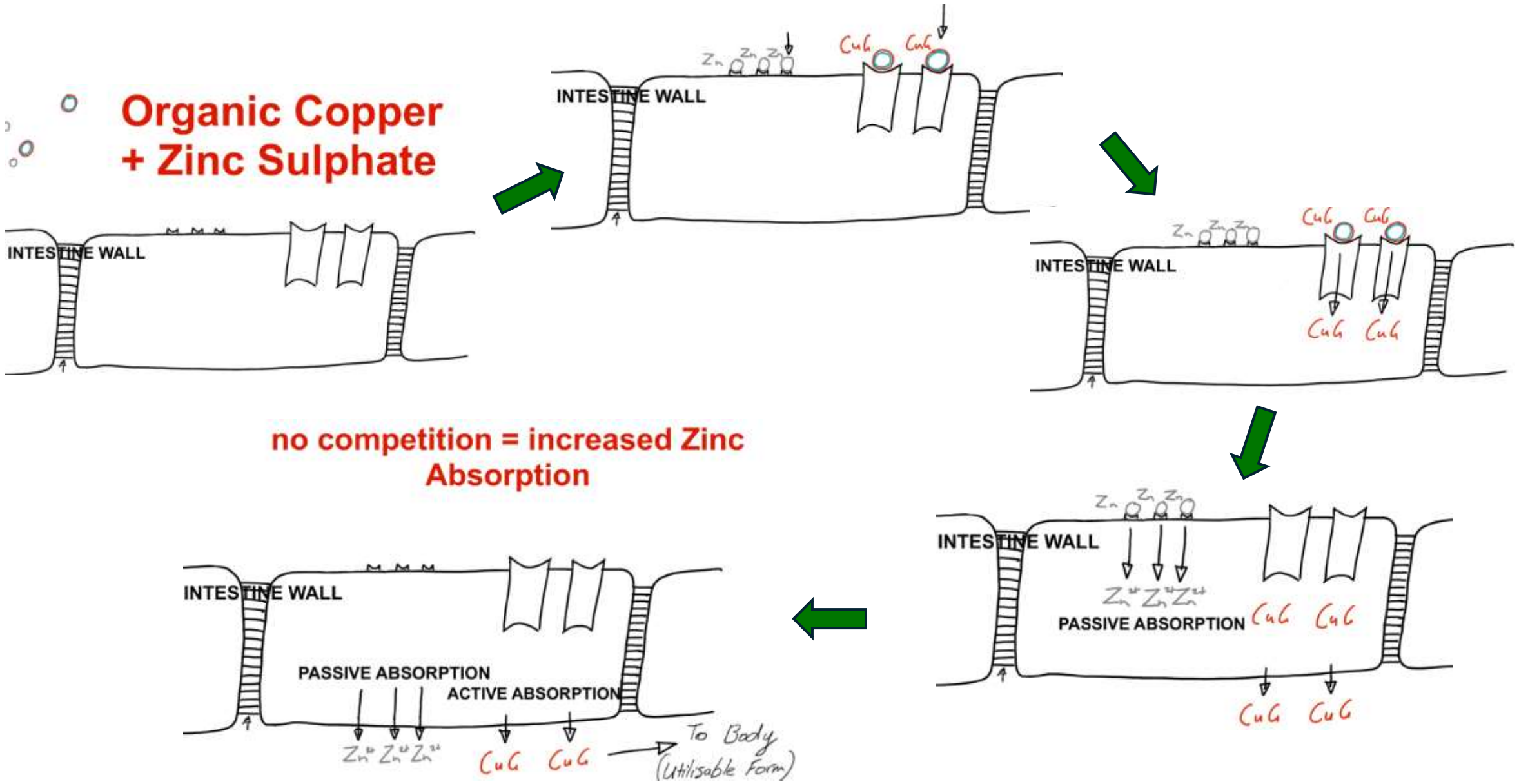
20-34umol/L in the blood is required for eczema protection[23]

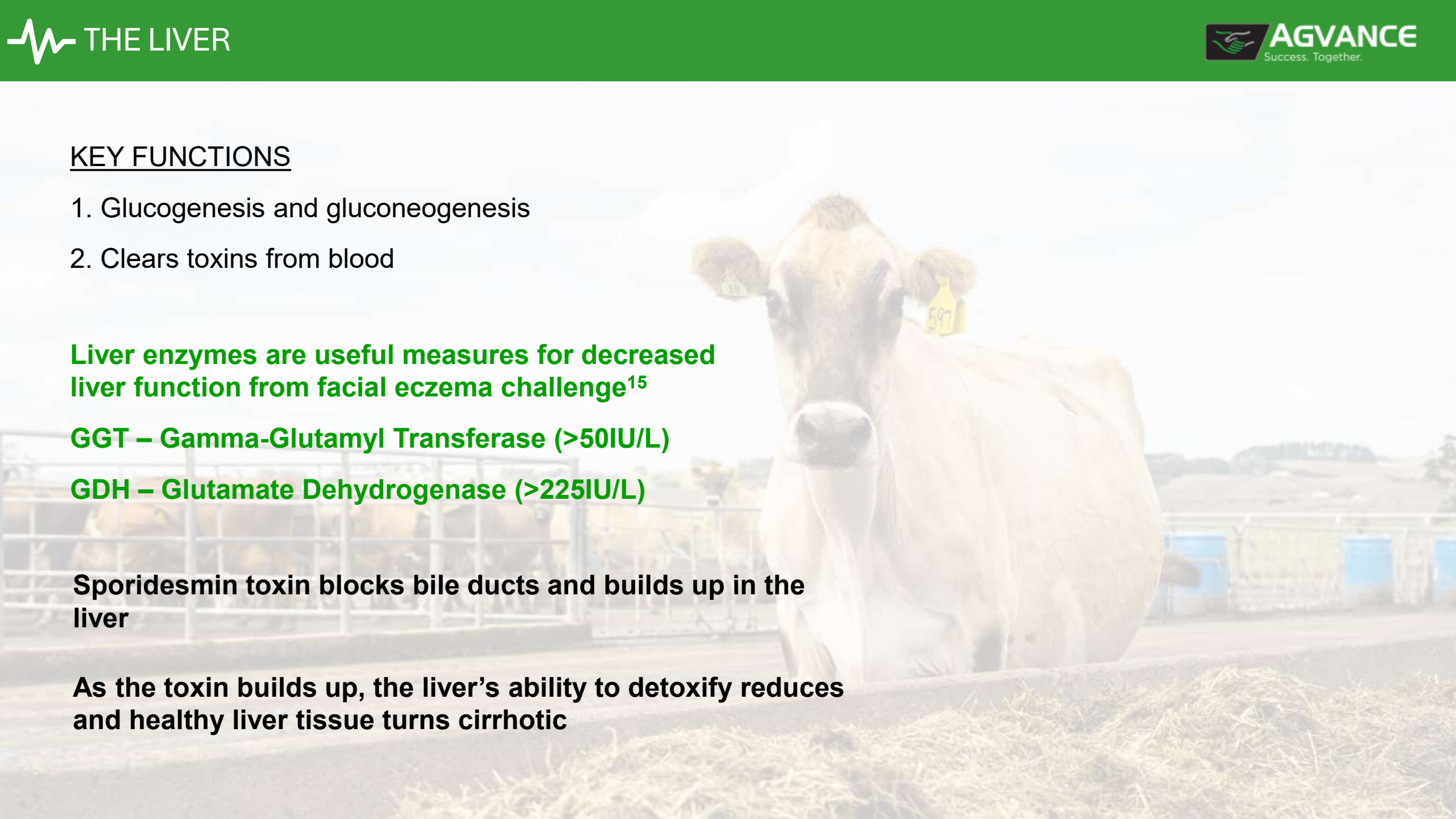
Non-rumen-protected sources of zinc are most effective - should we use a combination?

ABSORPTION OF COPPER AND ZINC



ABSORPTION OF COPPER AND ZINC





KEY FUNCTIONS

1. Glucogenesis and gluconeogenesis
2. Clears toxins from blood

Liver enzymes are useful measures for decreased liver function from facial eczema challenge[15]

GGT – Gamma-Glutamyl Transferase (>50IU/L)

GDH – Glutamate Dehydrogenase (>225IU/L)

Sporidesmin toxin blocks bile ducts and builds up in the liver

As the toxin builds up, the liver's ability to detoxify reduces and healthy liver tissue turns cirrhotic

AGVANCE
Success. Together.

TOXIN/ROS BUILD-UP

Toxin damage to the reproductive system

Toxin damage to the immune system

Increased phylloerythrin/Increased photosensitivity

REDUCED GLUCOGENESIS

Reduced appetite and insulin production

Increased risk of cow condition loss

Decreased milk production and FCE

Increased risk of aborted pregnancy

Decreased immune system function

WHAT TO LOOK FOR

AGVANCE
Success. Together.

Change in milk and cow data

- Drop in milk
- Decreased fat%
- Then decreased protein%
- Drop in activity
- Then drop in rumination

Change in cow behaviour

- Jumpy, on edge
- Lethargic
- Signs of stress

Drop in appetite

- Check feed NDF
- Check cow grazing behaviour

Skin photosensitivity

Check blood liver analytes

- **GGT** Gamma-glutamyl transferase (problem >50IU/L)

Enzyme marker for liver damage, particularly damage to the bile ducts

- **GDH** Glutamate dehydrogenase (problem >225IU/L)

Indicates liver damage, specifically mitochondrial leakage into the blood, useful alongside GGT

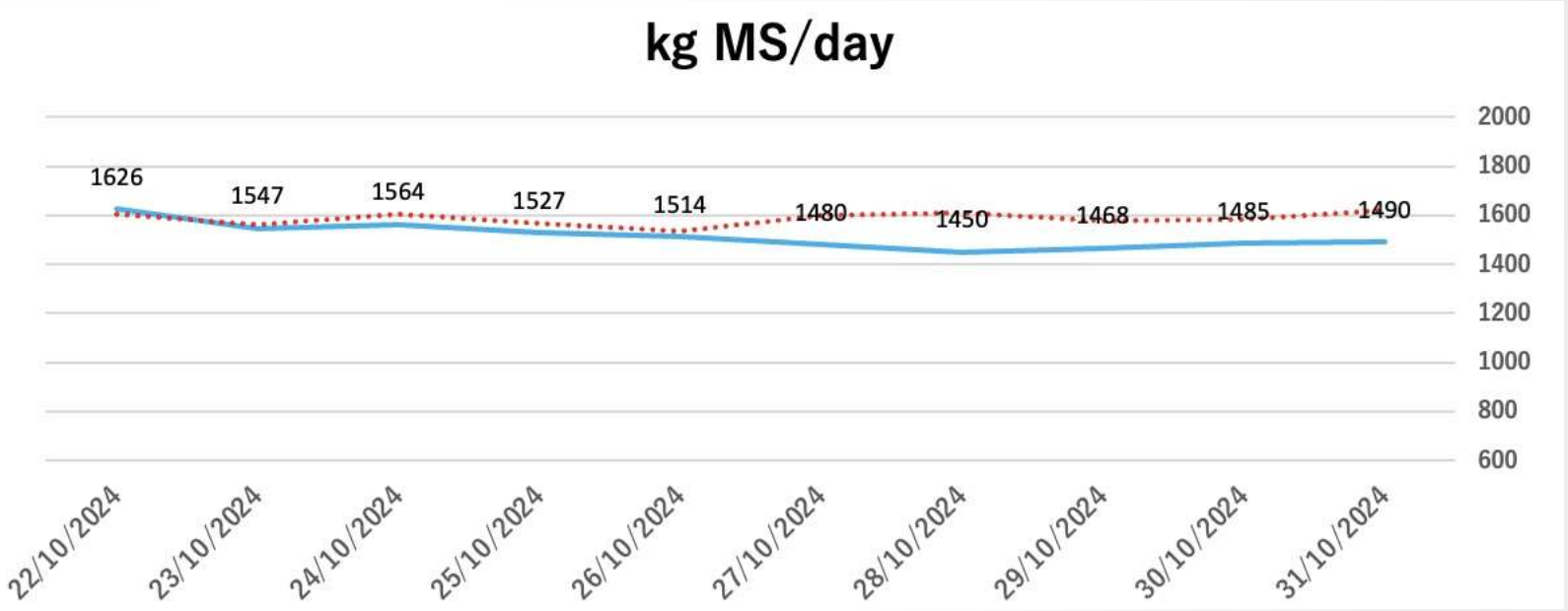
- **ALT** Alanine aminotransferase (problem >35IU/L)

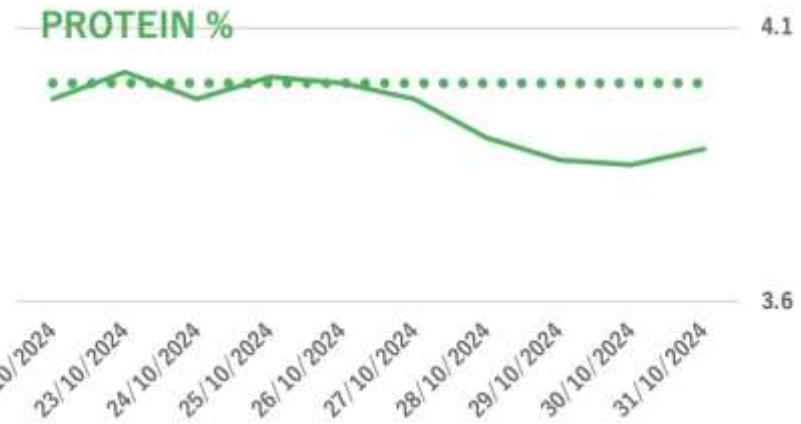
Enzyme mainly found in the liver, excess levels are released as a result of liver damage

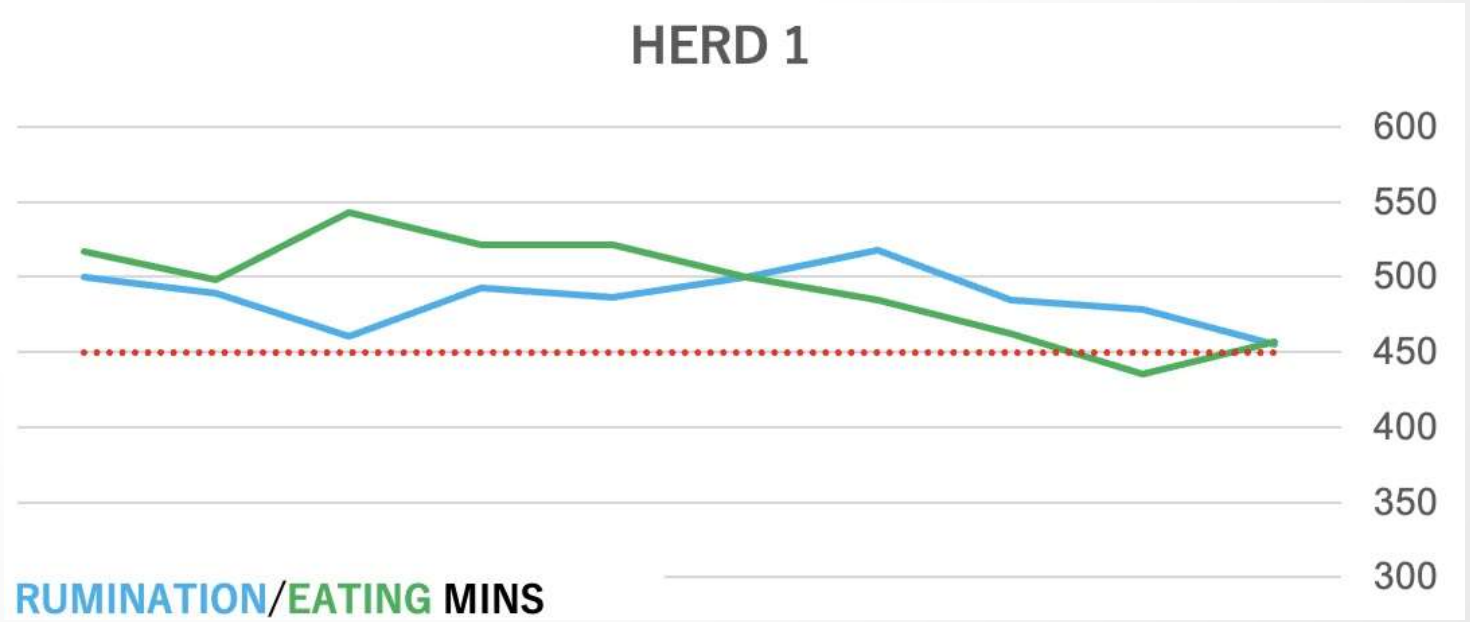
- **ALB** Albumin (problem <3g/dL)

Key protein released by the liver low levels indicate a poor performing liver along with glucose

MILK & COW DATA







PREPARING OUR COWS

1. Monitor the facial eczema risk

2. Pre-build zinc levels from December

3. Prep/Strengthen our cows' livers

MONITOR THE FACIAL ECZEMA RISK

Watch the weather
- 12 – 27°C
- 100% humidity

Watch area spore counts
- <10,000 Low risk
- >10,000 Monitor farm

Vigilant grazing
- Know high-risk paddocks
- Watch the cows when in those paddocks
- Have a plan

Cow liver health
- Ketosis? Fatty liver?
- Recent condition loss
- Toxin challenges
- Past clinical FE disease

PRE-BUILD ZINC LEVELS

1. Start excluding any non-chelated copper from the diet in Dec

2. Switch mineral supplementation to a blend containing higher levels of zinc when right conditions start or spores register

By dosing slightly higher zinc levels for longer coming into the FE season the cow better protected due to better stored zinc levels in the liver[19]

Anton et al., 2013 found that dosing 1000mg zinc sulphate over a longer period lifted blood levels higher than short-term dosing

PRE-BUILD ZINC LEVELS

RECOMMENDATIONS when regional spores are found (dose range is based on 400 – 600kg cow)

Zinc sulphate (Water only).....7-10g/cow/day

Zinc oxide (Feed only).....4-6g/cow/day

Solutrace FE (Water).....8-12g/cow/day

Solutrace FE (Feed or drench, mixer wagon, in-shed).....5-7g/cow/day

OptiPrill plus Zinc (Feed: mixer wagon, in-shed).....110-150g/cow/day

PREP THE LIVER

TRACE MINERALS

Selenium, copper, zinc, cobalt, iodine, chromium, biotin and vit E

- Selenium is useful for liver repair and protection against ROS challenge via glutathionperoxidase production
- Copper and zinc are both useful for liver protection against ROS challenge via super oxide dismutase
- Zinc is useful for liver repair
- Cobalt provides B12 which is a critical B-group vitamin for glucogenesis in the liver
- Iodine is key for thyroxine production, thyroxine modulates liver function and repair
- Chromium helps to support cow condition when appetite drops through its promotion of insulin sensitivity
- Biotin stimulates glucogenesis production in the liver
- Vitamin E works with selenium to protect the cow against ROS

SEAWEED

Useful liver tonic promoting liver repair and health

- **Dosed at 0.6-1g/cow/day**
- Could be useful helping cow previously FE effected
- Could be useful where cows have been under pressure

BETA-KEY BETAINE

Methyl-donor helping with liver repair and function

- **Dosed at 15-25g/cow/day**
- Useful when targeting liver repair
- Useful when cows under known liver pressure (toxins etc)
- Useful when the cows are suffering heat stress

REFERENCES

1. Boyd E., 2016. Management of Facial Eczema. Massey University, Manawatu, New Zealand. Thesis.
2. Ministry for Primary Industries Report, 2023
3. Grierson PJ., 2007. A preliminary study of the effects of lime application on levels of facial eczema spores in pasture. Proceedings of the New Zealand Grassland Association. 69.
4. Henderson W, Miles CO, Nicholson BK., 1995. Identification of zinc and cadmium complexes of the mycotoxin sporidesmin A by electrospray mass spectrometry. Journal of the Chemistry Society. Chemistry Communication. 889-900.
5. Munday R. 1984. Studies on the mechanism of toxicity of the mycotoxin sporidesmin 3. Inhibition by metals of the generation of superoxideradical by sporidesmin. Journal of Applied Toxicology 4. 182-186.
6. Munday R. 1985. Studies on the mechanism of toxicity of the mycotoxin, sporidesmin IV. Inhibition by copper-chelating agents of the generation of superoxide radical by sporidesmin. Journal of Applied Toxicology 5. 69-73.
7. Morris C, Burton L, Towers N, Cullen N, Rendel J, Johnson D. Genetics of susceptibility to facial eczema in Friesian and Jersey cattle. New Zealand Journal of Agricultural Research 41. 347-357.
8. Morris C, Towers NR, Tempero HJ,. 2002a. Lifetime survival of Jersey-sired cows following natural challenge with facial eczema during first lactation. New Zealand Journal of Agricultural Research 45. 165-170.
9. Cullen NG. 2006. Genetic parameters for resistance to facial eczema in dairy cattle. New Zealand Society of Animal Production.
10. Cullen NG. 2011. An update on genetic parameters for facial eczema susceptibility in New Zealand dairy cattle. New Zealand Society of Animal Production.
11. Clare NT. 1944. Photosensitivity diseases in New Zealand. 3. The photosensitizing agent in facial eczema. New Zealand Journal of Science & Technology. Section A 25. 202-220.
12. Smith BL, Embling PP,. 1999. Effect of prior sporidesmin intoxication on the pancreopathy associated with zinc oxide toxicity. New Zealand Veterinary Journal 47. 25-27.
13. Smith BL. 1987. Controlling facial eczema in sheep using zinc salts. The society of sheep and beef cattle veterinarians of the New Zealand Veterinary Association.

REFERENCES

14. Cuttance E, Mason W, Laven R. 2021. The association of milk-solid production during the current lactation with liver damage due to presumptive ingestion of spores from Pithomyces Chartarum by dairy cattle. New Zealand Veterinary Journal 69(2). 1-10.

15. Laven RA, Cuttance EL, Yang DA. 2022. Diagnosing subclinical facial eczema in cattle: does combining liver enzyme tests increase the accuracy of diagnosis? New Zealand Veterinary Journal 70(3). 131-137.

16. Johnson PL. Cameron CA, Henderson HV & Cullen NG. 2017. Brief Communication: Hot years in history and facial eczema. Proceedings of the New Zealand Society of Animal Production. Vol 77. 107-109.

17. Mason W, Cuttance E, Laven R, & Jamieson P. 2021. Quantification of zinc concentrations in serum, milk and faeces of dairy cattle as a measure of effective zinc supplementation for management of facial eczema. New Zealand Veterinary Journal 70(1). 1-17.

18. Mason W, Cuttance E, Jamieson P, Davis SR. 2021. An observational study on the relationship between zinc concentrations in bulk tank milk and in serum and farmer-reported zinc supplementation of dairy cattle for facial eczema prophylaxis. New Zealand Veterinary Journal 70(1). 1-15.

19. Anton A, Solcan G, Solcan C. 2013. The impact of copper and zinc deficiency on milk production performances of intensively grazed dairy cows on the North-East of Romania. International Journal of Animal & Veterinary Sciences. Volume 7, #8.

20. Di Menna ME, Smith BL, Miles C, O, 2009. A history of facial eczema (pithomycotoxicosis) research. New Zealand Journal of Agricultural Research. 52:4. 345-376.

21. Ashmead HD, Ashmead SD. 2009. The effects of dietary molybdenum sulfur and iron on absorption of three organic copper sources. International Journal of Applied Research in Veterinary Medicine. Vol 7, No. 4.

22. Smith SL, Grace ND, West DM, Balemi SC, 2011. Impact of high Zinc intake on the copper status of dairy cows in New Zealand. New Zealand Veterinary Journal. Vol 58, #3, Pg 142-145.

23. Smith BL & Towers NR, 2002. Mycotoxicosis of grazing animals in New Zealand. New Zealand Veterinary Journal. Vol 50.

THANK-YOU FOR ATTENDING

For more information or any questions:

- Visit our website: www.agvance.co.nz
- Talk to your local Agvance consultant
- Email me at shaunb@agvance.co.nz