

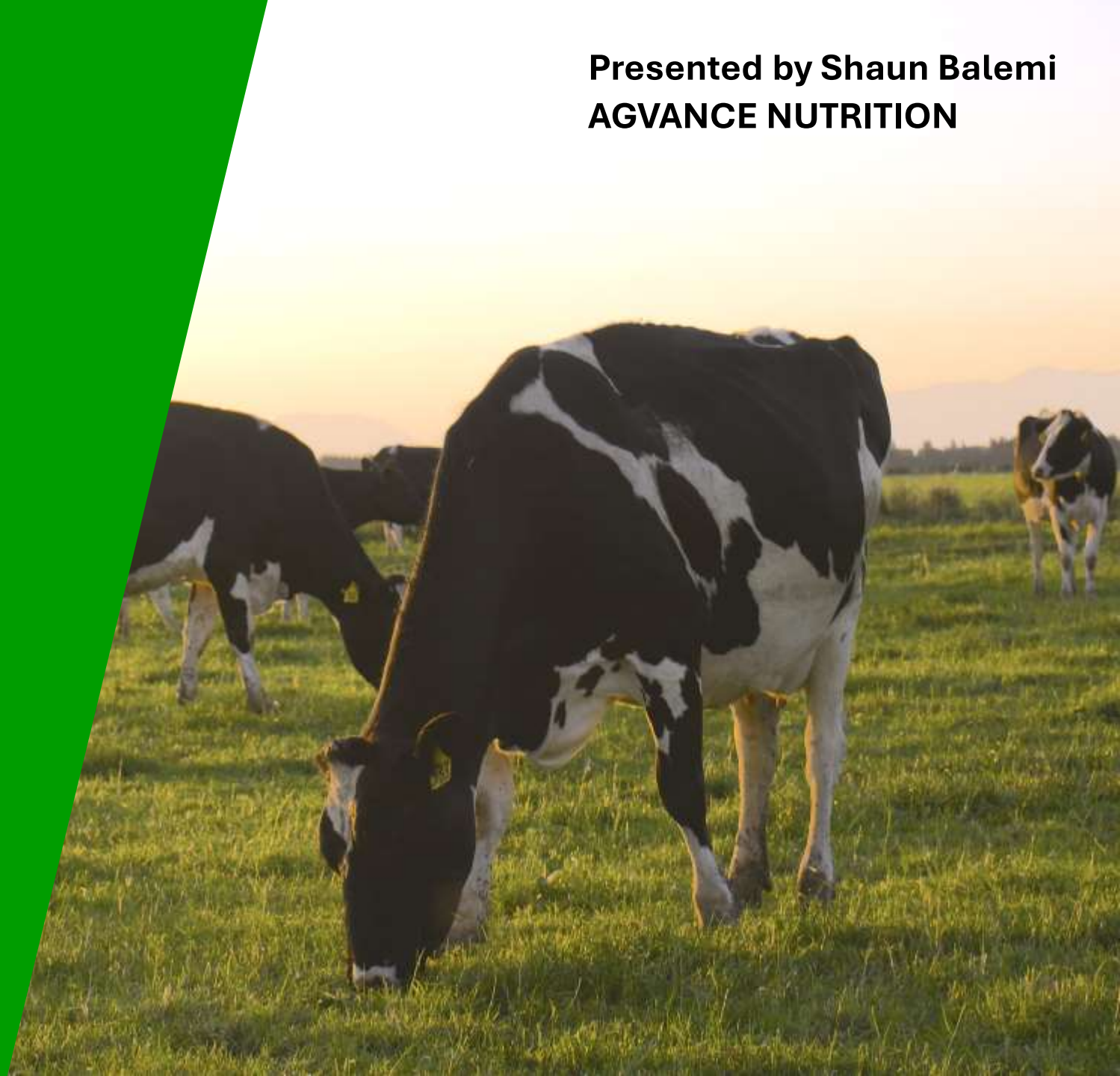


WEBINAR SERIES

Facial Eczema

Part 2

Presented by Shaun Balemi
AGVANCE NUTRITION





Overview of facial eczema



Preparing our cows for a facial eczema challenge



Prevention strategies for facial eczema



Measuring the level of protection and challenge

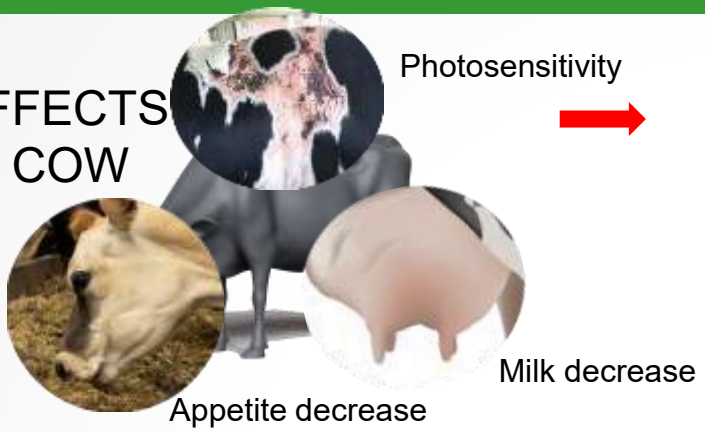


Treatment strategies for facial eczema

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

EFFECTS IN COW



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.

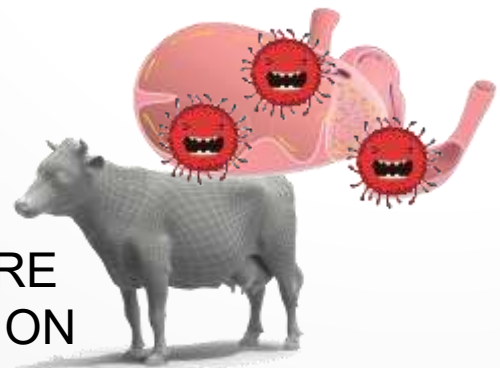
Oxidised spores arrive in the liver via the blood.
Once in the liver they are targeted by antioxidants.
Once reduced by antioxidants they are excreted via the bile.
Any of these oxidised spores that are not reduced and excreted start damaging the liver and hurting the cow.

FE SPORE DAMAGE



FE SPORE OXIDATION

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





1. Monitor the facial eczema risk
 - Watch the weather
 - Watch the regional spore counts
 - Monitor on-farm spore counts when regional count >10,000
 - Analyse cow liver health status



2. Pre-build zinc levels from December
 - Remove any non-rumen protected copper sources
 - Dosing as little as 3-5g/cow/day zinc sulphate
 - Putting a ½ dose of zinc oxide in-shed



3. Prep/strengthen our cows' livers
 - Trace minerals and vitamins
 - Seaweed
 - Beta-key betaine



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



TRACE MINERALS

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

- Selenium is useful for liver repair and protection against ROS challenge via glutathione peroxidase production
- Copper and zinc are both useful for liver protection against ROS challenge via superoxide dismutase
- Zinc is useful for liver repair
- Cobalt provides B12 which is a critical B-group vitamin for gluconeogenesis 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 gluconeogenesis production in the liver
- Vitamin E works with selenium to protect the cow against ROS

SEAWEED

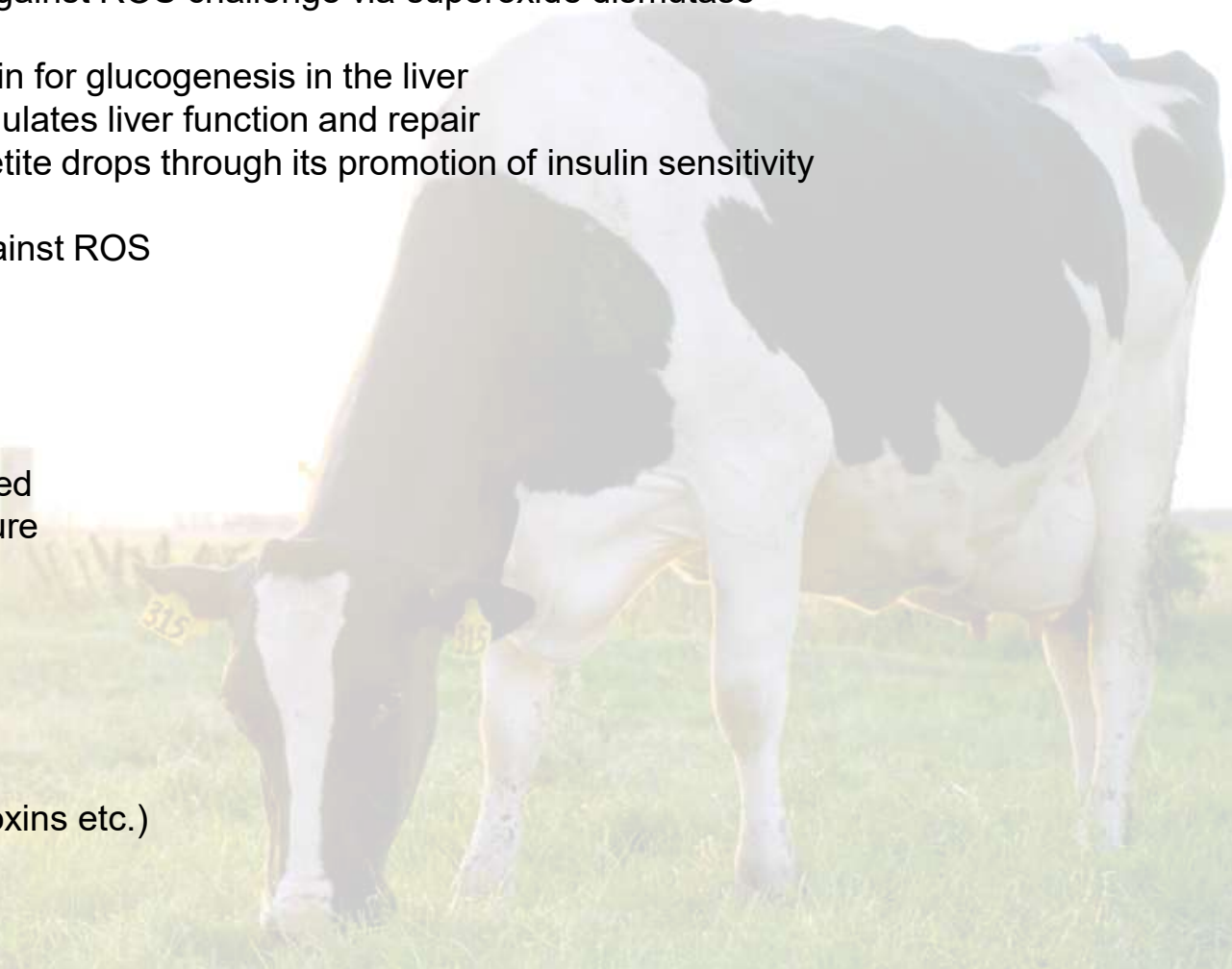
Useful liver tonic promoting liver repair and health

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

BETA-KEY BETAINES

Methyl-donor helping with liver repair and function

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



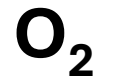
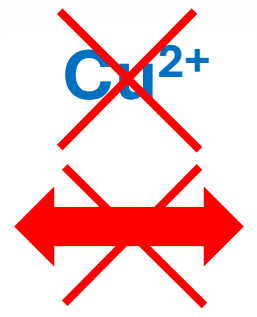
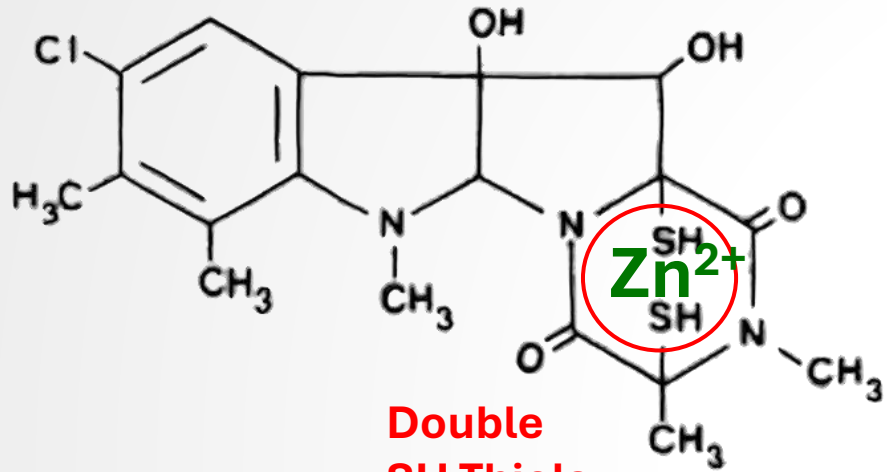


1. Remove as much free-copper as possible
2. Add zinc to the water
3. Drench zinc
4. Blend zinc into the feed
5. Give a zinc oxide bolus
6. Pasture spray & management
7. Breeding
8. Potential future strategies



PREVENTION STRATEGIES: ZINC AND COPPER

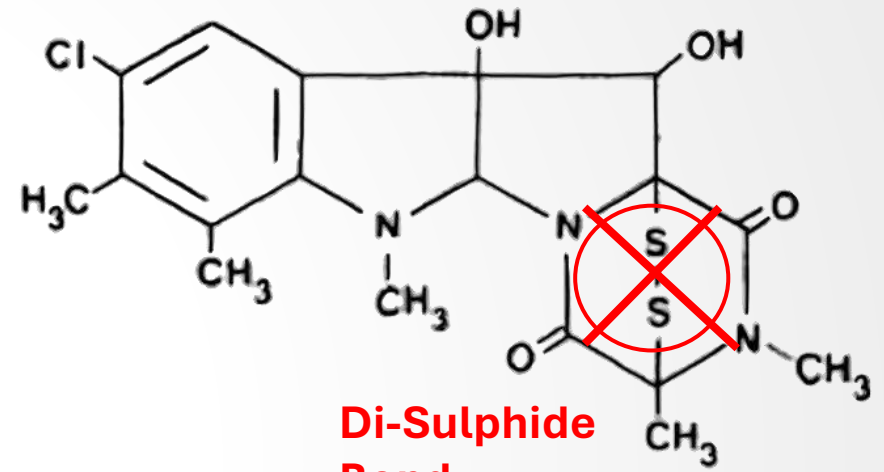
Spore - Unstable



Free Radical
Super-Oxide
(Reactive-Oxidative Species)



Spore - Oxidised



Di-Sulphide
Bond

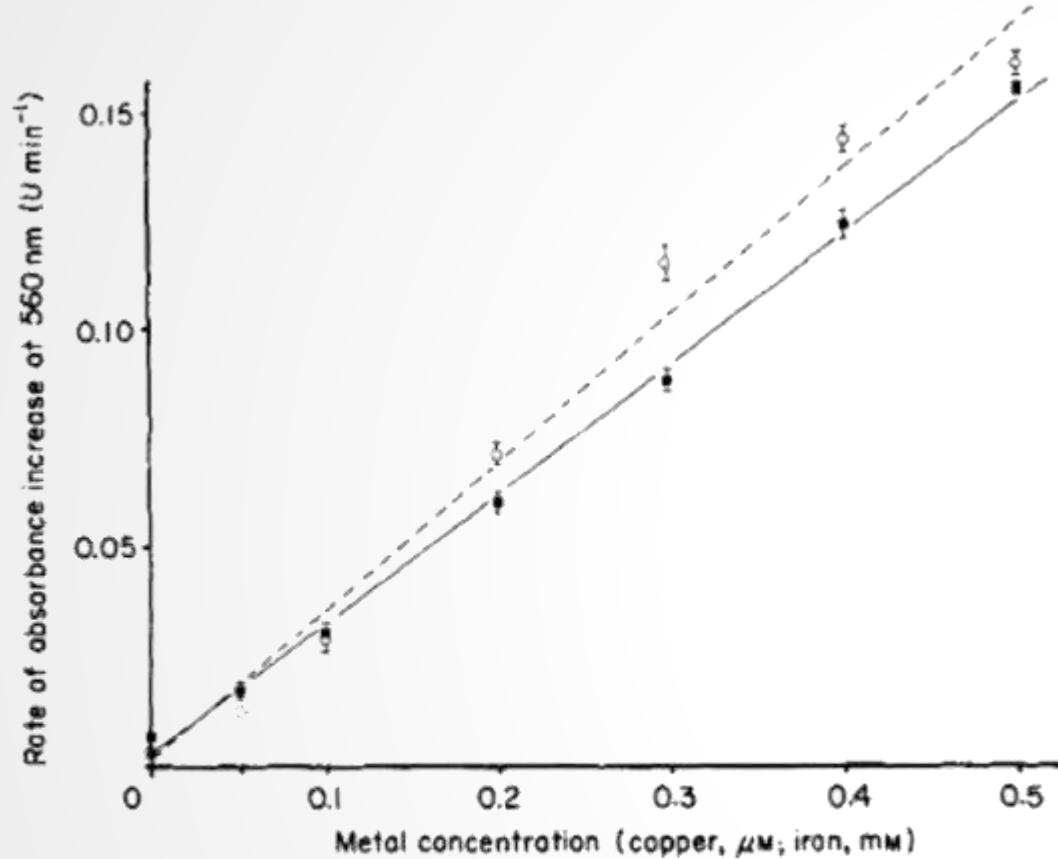


Figure 2. Catalysis of superoxide formation from reduced spori-desmin by copper and by iron. Rates of superoxide generation were measured as rates of NBT reduction, as described in Materials and Methods. Copper (■—■) was added as cupric sulphate; iron (○—○) as ferric chloride. The results shown are the means and standard errors of 4–7 determinations.



It appears that both stored liver levels of zinc, along with daily administered levels, are important for facial eczema protection ^{6, 12}

Facial eczema zinc and copper oppose each other and work together in a complex relationship²²

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

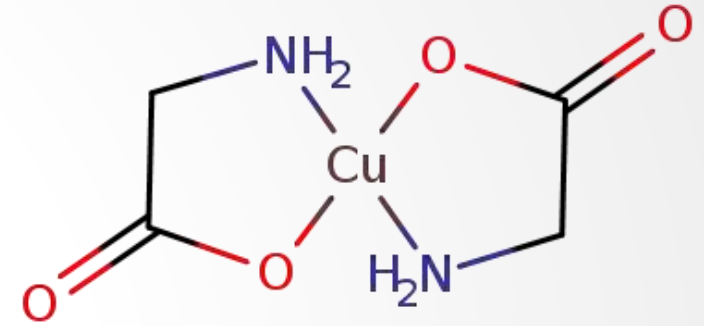
Heavy zinc supplementation may have a secondary effect by reducing the amount of free copper which can be absorbed passively ⁶

Reducing free copper in the diet will reduce facial eczema risk ^{6, 24}

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



- Yes, free copper competes with Zn for passive absorption
- The copper chelate **MUST** stay intact in the digestive system – no zinc competition⁵
- The copper chelate **MUST** stay intact after being absorbed – recognised as a protein, delivered to cells – not to the liver⁵



1. Smaller chelate = STRONGER
2. More ligand bonds = STRONGER
3. More heterocyclic rings = STRONGER

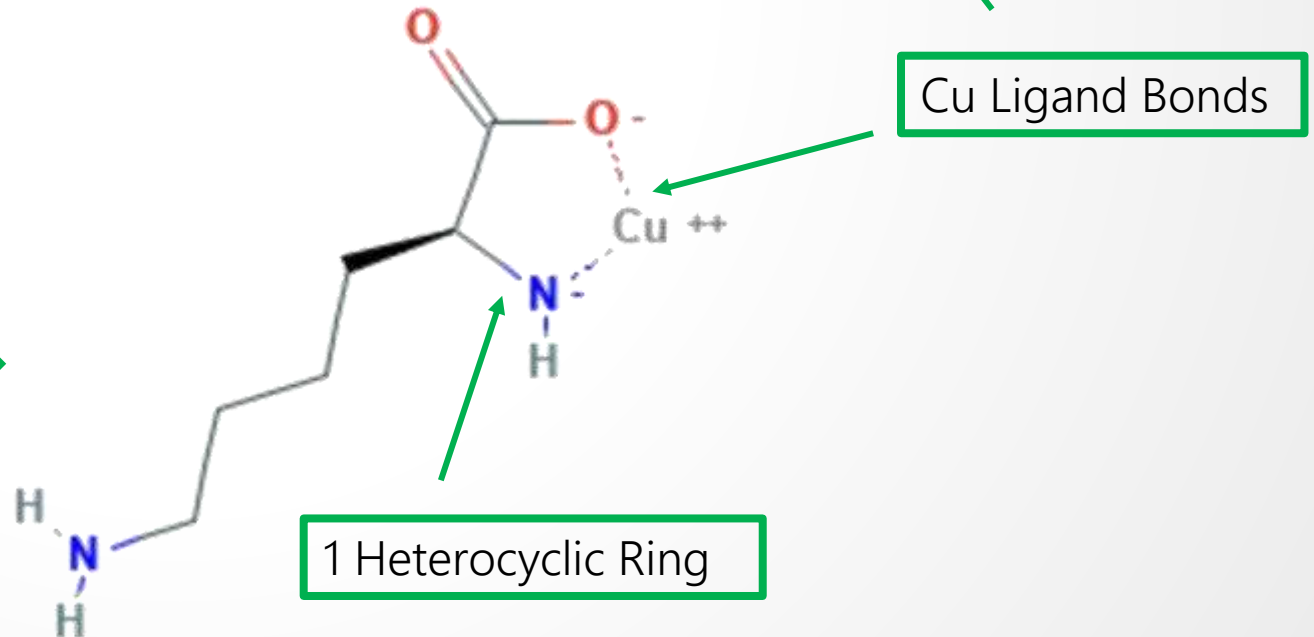
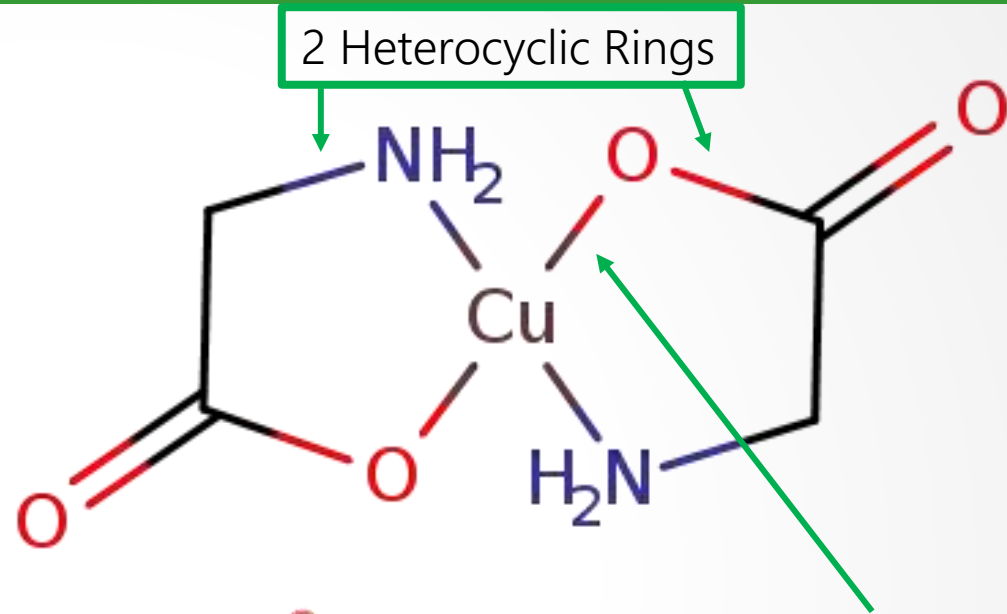


SAFE Cu CHELATE

1. 2 heterocyclic rings
2. Strong ligand bonds
3. Proven stability in rumen
4. Small molecule
5. Passes spectrometry analysis

UNSAFE Cu CHELATE

1. 1 heterocyclic ring
2. Large molecule
3. Weak ligand bonds
4. Unproven stability in rumen
5. No spectrometry analysis

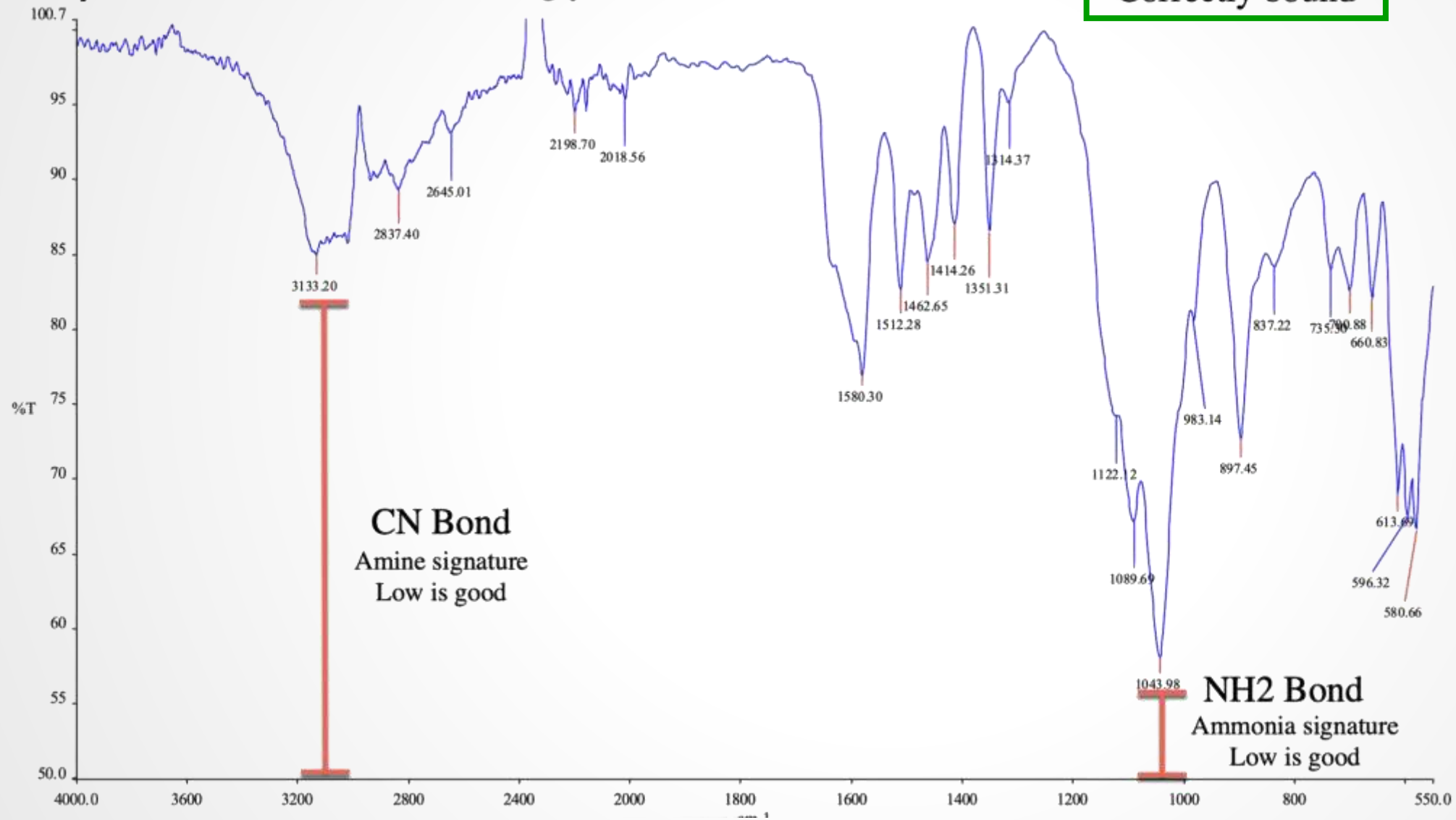




PREVENTION STRATEGIES: DOSING COPPER SAFELY

Cu-Glycinate 8/2020 German Monoglycinate

Correctly bound

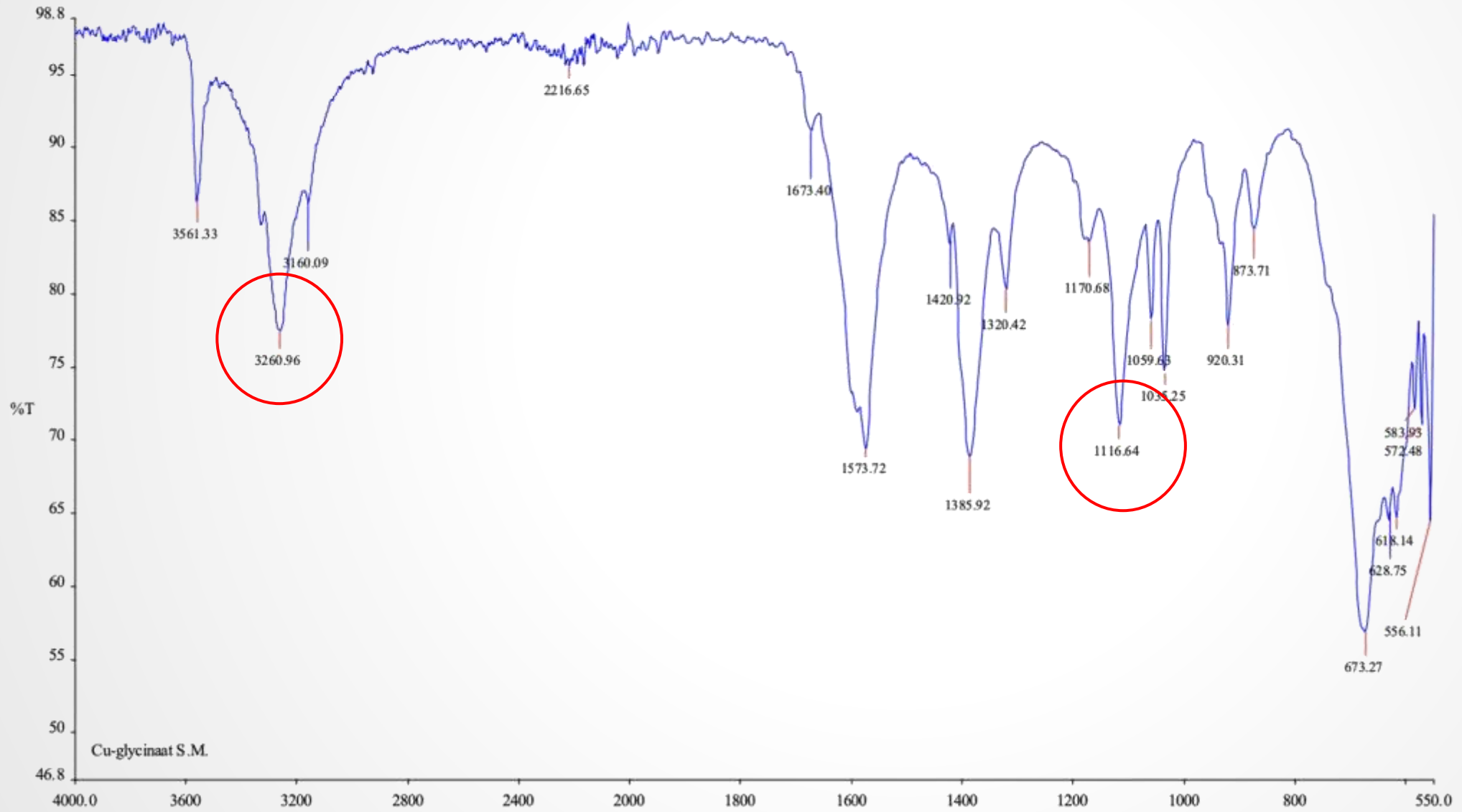




PREVENTION STRATEGIES: DOSING COPPER SAFELY

Cu-Glycinate (F3580/19) reference 2

Poorly chelated copper glycinate





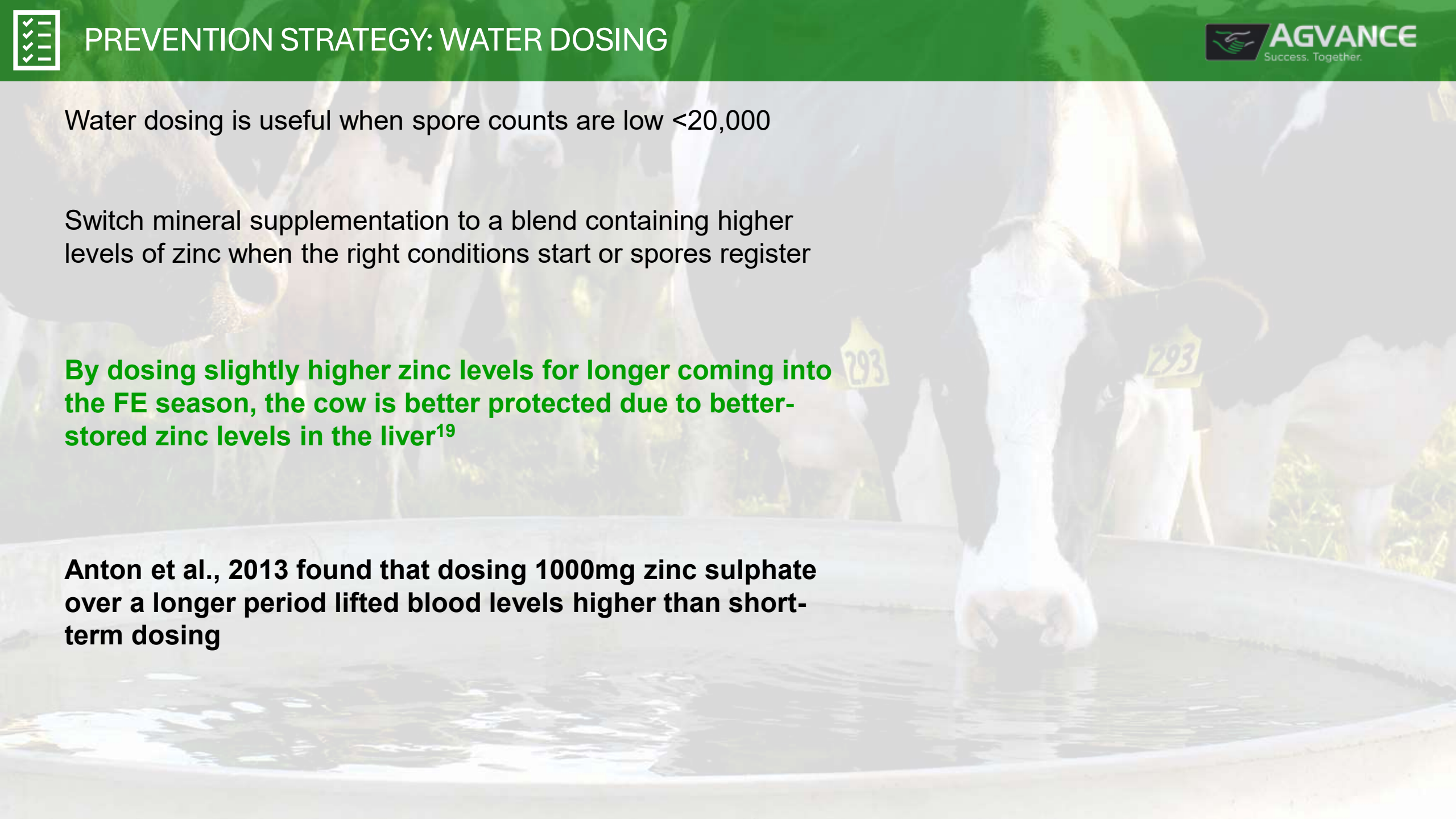
PREVENTION STRATEGY: WATER DOSING

Water dosing is useful when spore counts are low <20,000

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

By dosing slightly higher zinc levels for longer coming into the FE season, the cow is better protected due to better-stored zinc levels in the liver¹⁹

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





PREVENTION STRATEGY: WATER – 10 STEP STRATEGY

Dose rate for a 480kg cow

STEP 1 *Start* zinc monohydrate dose at **8g/cow/day** in December
Research shows that a low dose helps to build liver stores, giving better protection when spore counts rise

STEP 2 *Monitor* regional spore counts
Once spore counts get up to 20,000 spores/g, start on-farm monitoring

STEP 3 *Increase* zinc monohydrate dose to **18g/cow/day**
This prepares the cow for increased zinc in the water once spore counts get up

STEP 4 *Monitor* on-farm spore counts
Pick a couple paddocks and knock in pegs to mark sample spots

STEP 5 *Increase* zinc monohydrate dose to **26g/cow**
Once spores get up over 30,000 spores/g, go to full dose and monitor milk production

STEP 6 *Test* blood for zinc and GGT
Two to three weeks after full zinc dose started, bleed 6-10 cows for zinc and GGT levels.
Zinc needs to be >20umol/L
GGT levels <40umol/L

STEP 7 *Monitor* regional spore counts
When regional spore counts drop below 30,000 spores/g check on-farm spore levels

STEP 8 *Drop* zinc monohydrate dose to **18g/cow/day**
When on-farm counts get below 30,000 spores/g

STEP 9 *Monitor* regional spore counts
When regional spore counts drop below 10,000 spores/g, check on-farm spore levels

STEP 10 *Drop* zinc monohydrate dose to **8g/cow/day**
Keep this going until the end of the FE season in case spore counts go up again

Pros

1. Easy to adjust dose - add/remove
2. Well-absorbed by the cow
3. Cheaper than boluses
4. Easier to achieve consistent blood zinc levels than water dosing

Cons

1. Slightly more expensive per dose than zinc sulphate
2. Some cows don't eat in-shed or get pushed off the feed on the feed-pad



PREVENTION STRATEGY: FEED – 10 STEP STRATEGY



Dose rate for a 480kg Cow

STEP 1 *Start* Solutrace FE feed dose at **6g/cow/day** in December
Research shows that a low dose helps build liver stores, giving better protection when spore counts rise

STEP 2 *Monitor* regional spore counts
Once spore counts get up to 20,000 spores/g, start on-farm monitoring

STEP 3 *Increase* Solutrace FE feed dose to **12g/cow/day**
This prepares the cow for increased zinc in the water once spore counts get up

STEP 4 *Monitor* on-farm spore counts
Pick a couple of paddocks and knock in pegs to mark sample spots

STEP 5 *Increase* Solutrace FE feed dose to **18g/cow**
Once spores get up to over 30,000 spores/g, go to full dose and monitor milk production

STEP 6 *Test* blood for zinc and GGT
Two to three weeks after full zinc dose started, bleed 6-10cows for zinc and GGT levels
Zinc needs to be >20umol/L
GGT levels <40umol/L

STEP 7 *Monitor* regional spore counts
When regional spore counts drop below 30,000 spores/g, check on-farm spore levels

STEP 8 *Drop* Solutrace FE feed dose to **12g/cow/day**
When on-farm counts get below 30,000spores/g

STEP 9 *Monitor* regional spore counts
When regional spore counts drop below 10,000 spores/g, check on-farm spore levels

STEP 10 *Drop* Solutrace FE feed dose to **6g/cow/day**
Keep this going until the end of the FE season in case spore counts go up again



- Keeps zinc levels in cattle above 20umol/L in blood for 28 days²²
- Delivers around 6-7g of elemental zinc per day

Pros

1. Good option for youngstock when water/feed dosing is a non-option
2. Quick acting (levels come up in days)²²
3. Reliable protection

Cons

1. Health and safety risk and dosing is more complicated
2. More expensive than oral forms
3. Short-time and variable protection (based on spore counts and cow liveweight)
4. Around six weeks' efficacy so needs to be used at the right time!



- Not grazing pastures down too hard when counts are high
- Before the FE season starts, make sure pastures contain low levels of dead matter
- Identifying paddocks with higher dead matter levels – make baleage or graze lightly
- Look into paddock history, avoid paddocks with high spore counts
- Low flat areas often have higher spore counts
- Know local spore counts
- Avoid pasture topping



- Variable effectiveness
- Timing is everything, reduces spore production so must be used when spore count is low, just before spore growth rate is going to increase
- Pasture must be growing as the fungicide needs to be taken up by the plant to be effective¹
- Must be applied to shorter pasture so the fungicide can reach the dead matter at the base of the plant
- Can last up to six weeks
- Spraying zinc onto the pasture?



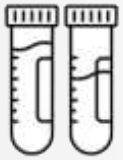
- Ram selection for FE resistance has rewarded the industry with sheep which are now 4-5 times more resistant to FE.
- Morris et al., 1990 showed heritability of FE resistant genes in dairy heifers.
- Further research by Morris (1998 & 2002a), and Cullen (2006 & 2011) have shown that heritability is sufficient to be used as a tool to fight and eventually maybe eradicate FE effects in NZ dairy cattle.
- Other NZ researchers E Cuttance (EpiVets) & A Heiser (AgResearch) have also more recently put forward thoughts on how breeding could have a significant effect in reducing the effects of FE.



SPORES



COWS



BLOOD



FEED



- Variation in counting: three aliquots tested from each sample and recommended three consistent samples before decisions made.¹
- Variation in sampling: sample the same paddock and use marker pegs to take samples from the same areas each time.
- Where to sample? Spores will be highest in flat paddocks, particularly in the lower areas of these paddocks where the moisture level is highest.
- Farmers should be spore-counting their own farm rather than relying on regional counts.

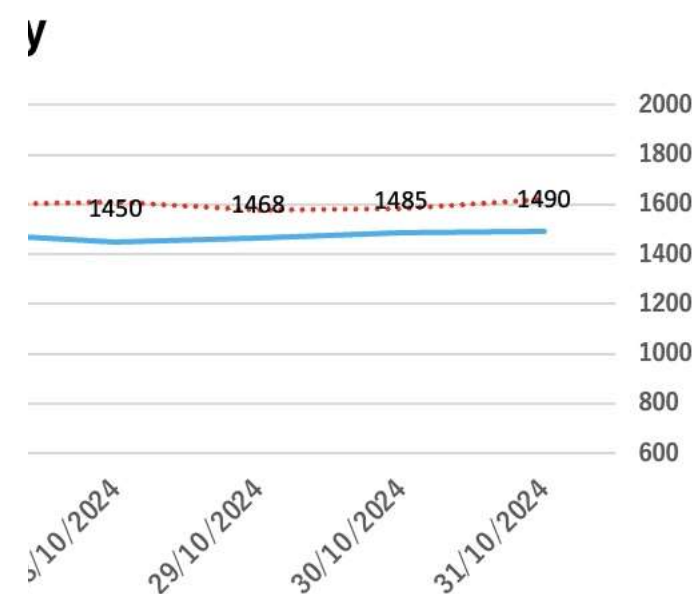
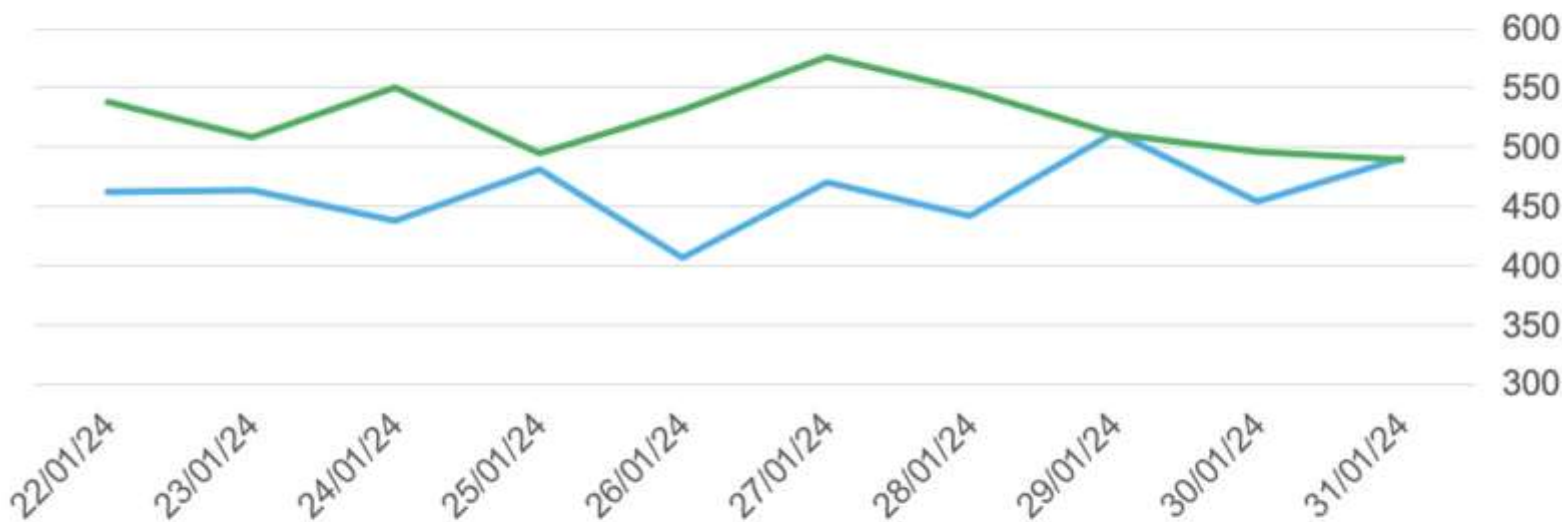


RUMINATION

EATING

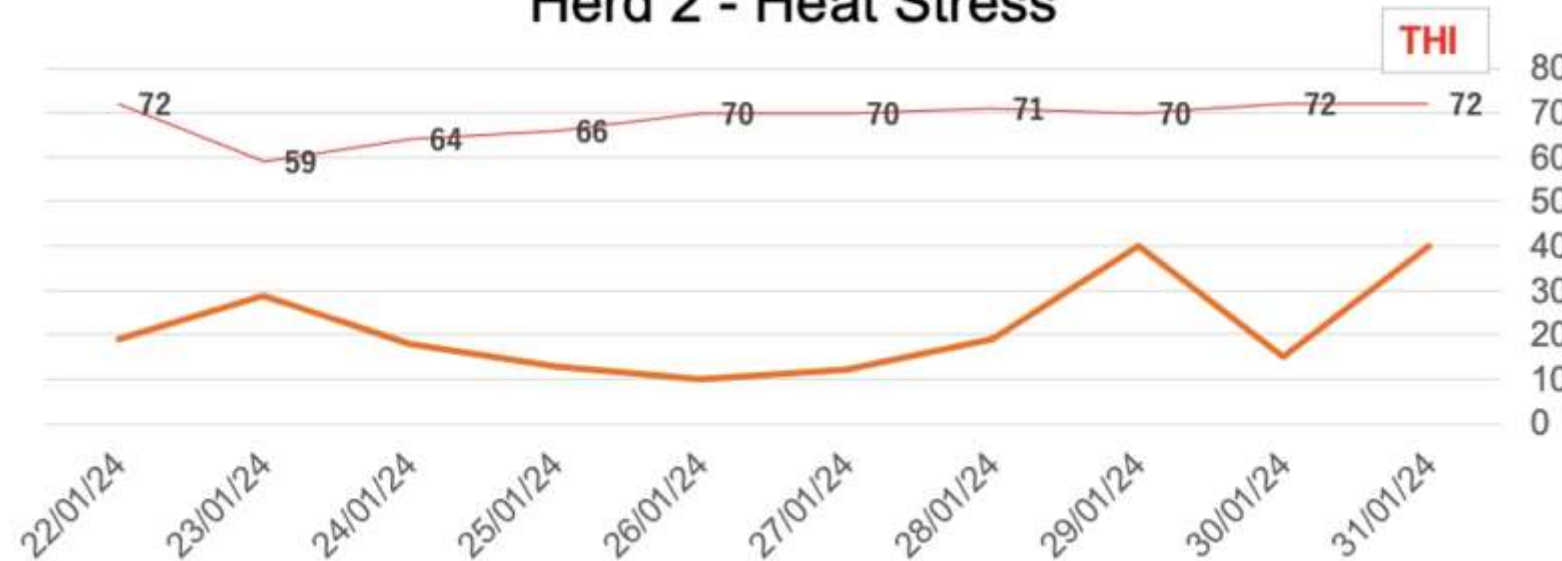
Herd 2 - YOUNG HERD

FAT %



Herd 2 - Heat Stress

THI



RUMINAT

22/10/24
23/10/24
24/10/24



ZINC

- Levels need to >20 up to 34umol/L
- Best tested two weeks after dosing commenced
- Bulk milk zinc can be used ^{17 18}, but best backed up with bloods

FE CHALLENGE

Gamma-glutamyl transferase (GGT) levels in the blood:

- <30IU/L – Well-functioning liver
- 30-1000IU/L – Moderately impaired liver function
- >1000IU/L – Severely impaired liver function

Laven et al., 2022 showed that combining GGT and GDH (glutamate dehydrogenase) to measure liver function is a more effective tool

>200IU/L GDH indicates subclinical effects of FE

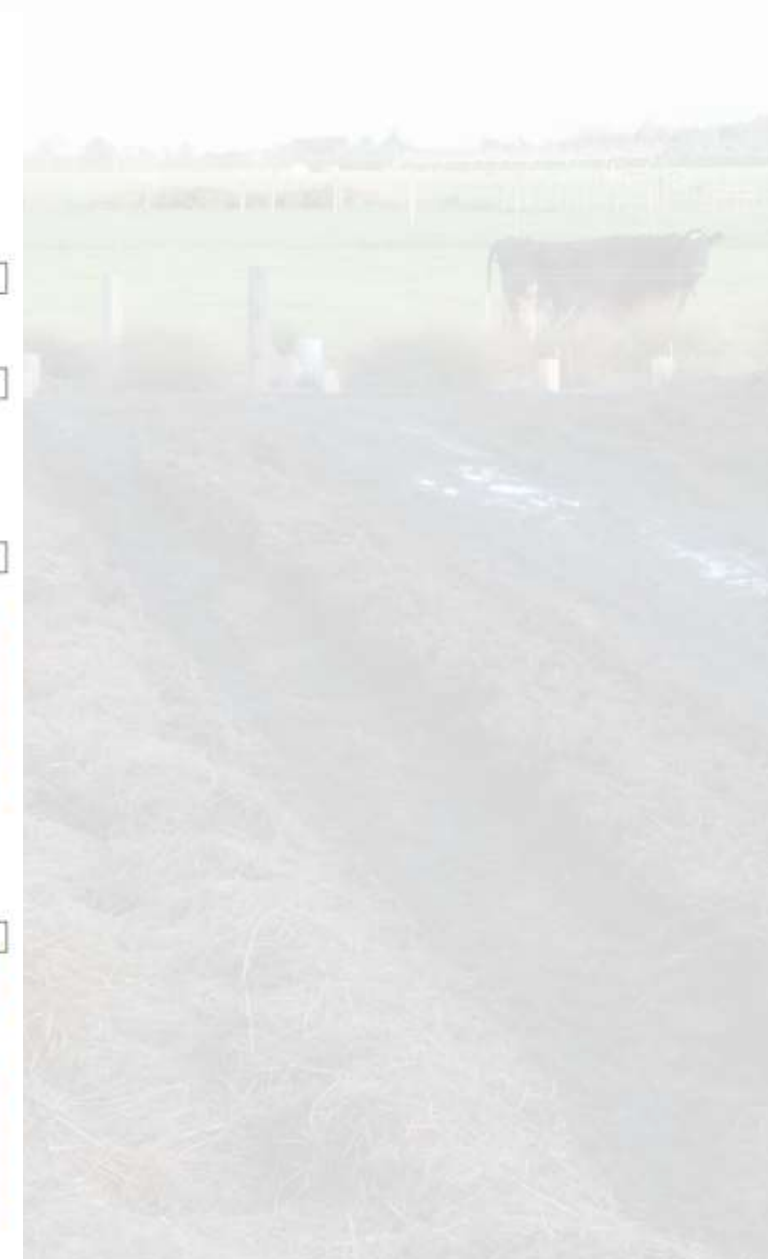
Glucose and albumin tests also indicate liver function

Haptoglobin is a protein produced by the liver when inflammation is detected



MEASUREMENT: FEED TESTING

FEED QUALITY	Units	Results	①Plant Range	①Plant Nutrition Desired	①Dairy Cows	①Animal Nutrition Desired
① NU123 Dry Matter (DM)	g/kg	169	140~180			
① NUD88 Crude Protein (CP)	g/kg dm	228	200~380			
① NUD90 Crude Ash	g/kg dm	109	70~110			
① NUE56 Organic Matter (OM)	g/kg dm	891	880~920			
FIBRE / CARBOHYDRATES						
① NUD83 Neutral Detergent Fibre (NDF)	g/kg dm	442	350~420			
DIGESTIBILITY / ENERGY						
① NUE50 Metabolisable Energy (ME)	MJ/kg dm	12.0	11~12.5			
① NUD76 Digestibility (DOMD, gOM/kg DM)	g/kg dm	748	705~801			
MACRO ELEMENTS						
① NUD46 Nitrogen	%	3.6	4~4.8			
NU268 Phosphorus	%	0.51	0.38~0.45		0.24~0.4	
NU279 Potassium	%	3.31	2.5~3		0.6~1.2	
NU341 Sulfur	%	0.40	0.3~0.4		0.18~0.4	
NU056 Calcium	%	0.86	0.6~1		0.4~0.8	
NU187 Magnesium	%	0.24	0.22~0.3		0.19~0.25	
NU324 Sodium	%	0.14	0.15~0.3		0.12~0.3	
① NUD75 Chloride	%	1.22				
① NU117 Dietary Cation-Anion Difference (DCAD)	meq/kg dm	388				
TRACE ELEMENTS						
NU196 Manganese	mg/kg	43	60~150		25~40	
NU108 Copper	mg/kg	16	10~12		7~20	
NU046 Boron	mg/kg	16	10~15			
NU394 Zinc	mg/kg	34	40~50		20~40	
NU168 Iron	mg/kg	94	60~200		10~200	
① NU097 Cobalt	mg/kg	0.72	0.1~0.2		0.04~0.2	
① NU232 Molybdenum	mg/kg	0.38	0.5~1		0.05~1	
① NU294 Selenium	mg/kg	<0.02	0.08~0.15		0.03~0.3	
① NU350 Titanium	mg/kg	<10				






Check blood liver analytes

- **GGT** Gamma-glutamyl transferase (**problem >50 IU/L**)
Enzyme marker for liver damage, particularly damage to the bile ducts.
- **GDH** Glutamate dehydrogenase (**problem >225 IU/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.



Liverade



DESIGNED TO MAINTAIN LIVER HEALTH AND PERFORMANCE

Advantages

- VITAMIN D SYNTHESIS FOR HEALTHY BONES
- BLOOD DETOXIFICATION
- STRONG IMMUNITY

WHY USE LIVERADE

Liverade is a combination of organic (chelated) minerals, amino acids, vitamins and herbs, designed to strengthen and aid in the rebuilding of body cells, particularly in the liver.

LIVERADE SUPPORTS

- Vitamin D synthesis for Healthy Bones
- Blood Detoxification
- Strong Immunity

TECHNICAL INFORMATION

Supplied as a non soluble suspend-able powder formulation to be mixed with water and drenched. 1kg net pot weight.

Dosing Instructions

Mix with water to make a suspension and then drench once daily for three days. (contains a natural suspension agent).

Dose rate: 110 grams x 3 daily doses

Adult Dairy Cattle	3 daily doses	110 grams per dose
Sheep Adult Ewe	3 daily doses	16 grams per dose

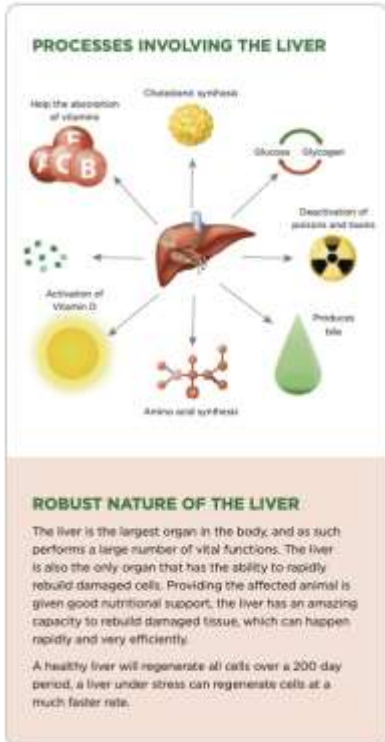
Do not dose above recommended levels, and do not repeat doses within 7 days of an earlier 3 dose sequence.

0800 BALANCE
agvance.co.nz

AGVANCE
Success. Together.

DESIGNED TO

- Aid the liver in the repair of damaged hepatocytes
- Reduce current toxin load to allow repair
- Stimulate protein synthesis
- Reduce inflammation
- Stimulate glucogenesis
- Help the bile ducts to clear



TRACE MINERALS

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

- Selenium is useful for liver repair and protection against ROS challenge via glutathione peroxidase production – **Rumen-protected SmartSel @ 6mg/cow/day**
- Copper and zinc are both useful for liver protection against ROS challenge via super oxide dismutase – **Copper plexomin chelate @ 150mg/cow/day and zinc plexomin chelate @ 300-400mg/cow/day**
- Zinc is useful for liver repair – **Zinc sulphate @ 800mg/cow/day**
- Cobalt provides B12, a critical B-group vitamin for gluconeogenesis in the liver – **Cobalt sulphate @ 12-15mg/cow/day**
- Iodine is key for thyroxine production – thyroxine modulates liver function and repair – **EDDI iodine @ 15mg/cow/day**
- Chromium helps to support cow condition when appetite drops through its promotion of insulin sensitivity...**Chromium propionate @ 7-9mg/cow/day**
- Biotin stimulates gluconeogenesis production in the liver...**Rumen-protected biotin @ 10mg/cow/day**
- Vitamin E works with selenium to protect the cow against ROS – **Vitamin E @ 250-500mg/cow/day**



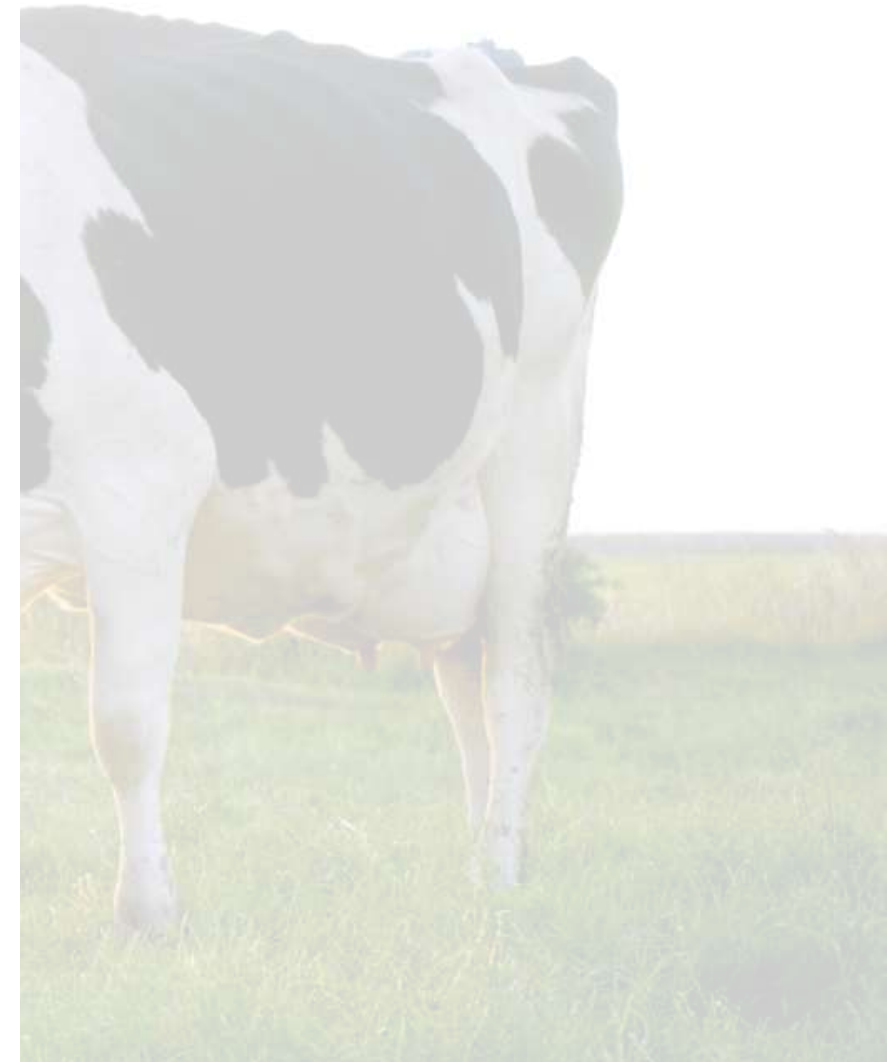
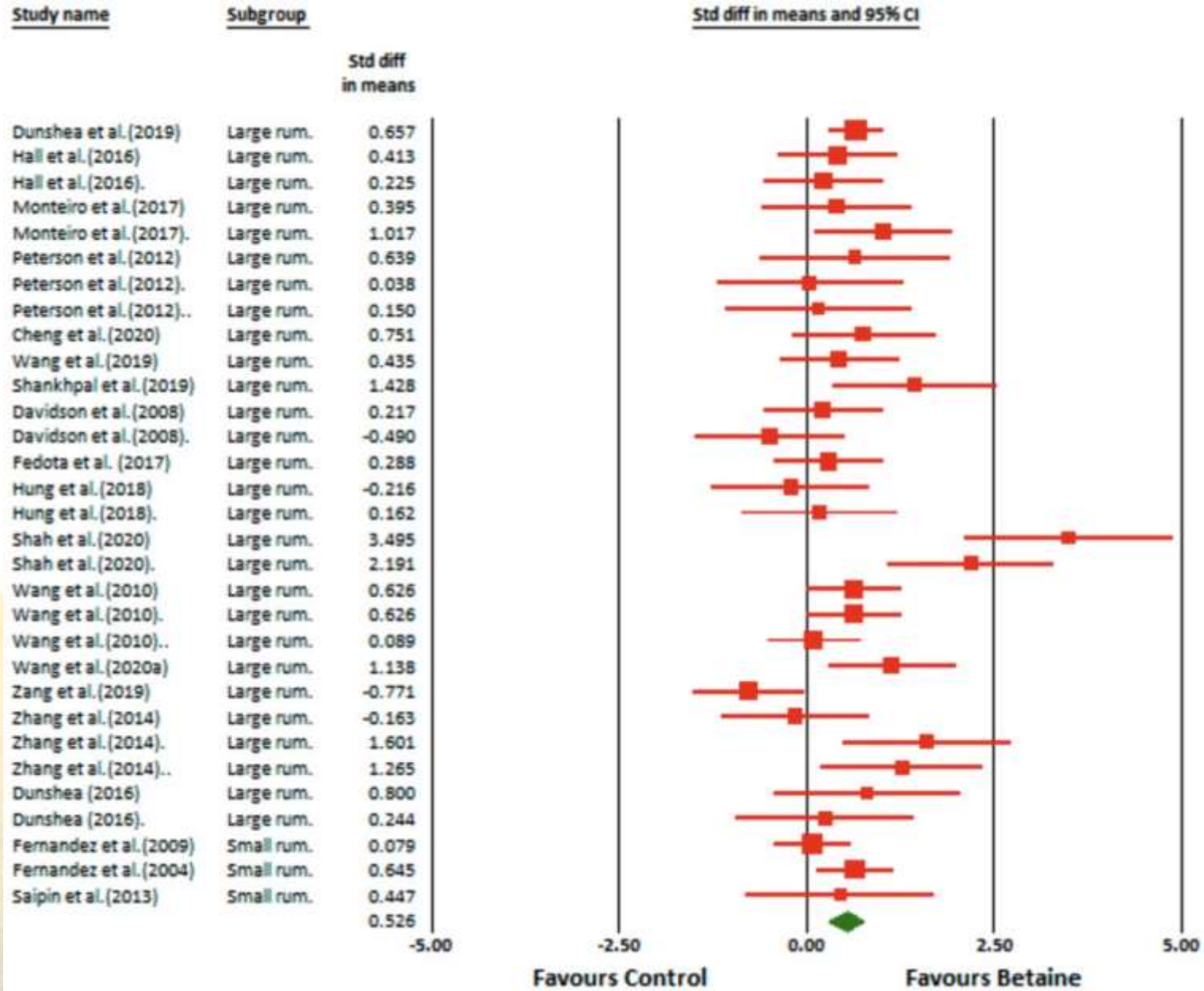
Useful liver tonic promoting liver repair and health

- **Dosed at 0.6-1gm/cow/day**
- **Useful at helping a cow previously FE-effected**
- Can be used to help strengthen the liver ahead of a perceived liver challenge
- **May operate as a low-level toxin binder**





TREATING LIVER INJURY: BETA-KEY BETAINES



For the liver to be able to repair itself the toxin load must be reduced

Reduced toxins means hepatocytes can rebuild

Glucogenesis and gluconeogenesis production is increased

Appetite and milk production begin to increase

Dosed at 8-15g/cow/day, depending on efficacy of product



Helps to reduce inflammation

Promotes protein synthesis

My directly bind some toxins



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.

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.
24. Johnson PL & Amyes NC, 2020. An association between circulating copper concentrations and gammaglutamyl transferase activity in sheep after exposure to the toxin sporidesmin. *New Zealand Journal of Animal Science and Production*, Vol 80; 34-38

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