

I discovered this in 1957/9, but the establishment still ignores it because it is not their discovery and there is no money in it for them from zinc sales.

There is no reason for animals to suffer Facial Eczema and farmers to lose money, because it can be prevented by applying adequate low cost LimePlus (agricultural lime, and the deficient elements based on the farm's ryegrass analysis) at least two years before the summer concerned and every year until the calcium levels in ryegrass leaves and stems are close to 0.9% in all paddocks. This is a more accurate measure than pH and increases earthworm numbers (Read Soils > Earthworms). They eat the dead grass (thatch) shown here on lime deficient pasture in which Facial Eczema spores multiply.

The inaccurate pH measurements and MAF not using leaf analyses has caused insufficient lime to be applied in New Zealand for decades, so there were no earthworms or casts in the calcium deficient soils even after applying 3,000 kg/ha of LimePlus, and as shown there was still thatch galore.

To convince the farmer I applied another 3 tonnes/ha equivalent of LimePlus (three metres away from the above, which is the amount removed in milk in three years. The substantial increase in earthworm numbers then caused the five earthworm casts shown. The earthworms ate all the thatch and gave thicker stronger ryegrasses and clovers as shown. For more evidence read Minerals in Soils > Calcium and then the Earthworms chapter in Soils.

These Calignosa earthworms are big, slimy, healthy, clean and active because the dairy farmer fed his cows Solminix through a dispenser, some of which goes through the animals in the dung and urine. Correct minerals in animals and soils are the saviour of soils, earthworms, animals and people.

Earthworms, especially Calignosas, need good soil to do well. Good well fed soils and animal manure will increase the Calignosas. We use sheep pellets in our garden. A lot of vegetation (lawn clippings and prunings) with LimePlus and little soil, will increase Foetida (Tiger) compost earthworms.

Facial Eczema disasters in herds are still being reported annually in farming publications, which disgracefully don't give solutions. We eliminated ours in 1958 completely with good farming, applying LimePlus on both our farms increasing earthworm numbers from an average of about 5 per spade spit, to 30. This number of earthworms consume all the dead thatch on which Facial Eczema spores breed, and increase pasture production.

When Ca is low (ryegrass 0.6% Ca or lower) applying LimePlus based on a ryegrass analysis, doubles the pasture yield, paying for its applications and increasing the earthworm numbers, which is worth a lot in more than just Facial Eczema prevention. See Soils > Earthworms.

Applying the above helped us win the NZ Dairy Board's "Most improved dairy farm in the Waikato



award in 1959. The establishment not acknowledging lime's need has cost our farmers millions of dollars in total, and animal suffering enough to prosecute them for animal suffering.

MAF researcher David Musgrave in Palmerston North agreed with me that adequate lime and its synergisms reduced Facial Eczema, but he didn't explain why and then left MAF to grow linseed in Canterbury. AgResearch, LIC and DairyNZ (the 'establishment') have still not used or promoted my findings, and still recommend costly zinc (Zn) which lowers copper levels in animals and causes other problems.

It is a pity that the daily paper (Waikato Times) in the centre of New Zealand's top farming area now doesn't have an agricultural editor who knows farming like they had in the past.

Facial Eczema symptoms were first reported in New Zealand in 1887. In 1938 Facial Eczema was so bad that Togo Johnstone, a Waikato sheep farmer, who owned thousands of ewes, had to slaughter 90% of them, to save them suffering. Farmers called a meeting, and the government offered unlimited funds to the Ruakura Animal Research Centre to research it.

Forty years ago the Waikato Times farming editor Peter Bourke who knew farming, supported top farmers like Gladys Reid who discovered that zinc protected animals against Facial Eczema caused liver damage, saving farmers millions and animals' suffering.

Ruakura attacked the evidence and Mrs Reid, but Peter Bourke with many farmers' successes could see who was right and kept supporting her and zinc. Ruakura scientists at their farmers annual conference were forced by director Dr Gordon Edgar to check it. They found that zinc treatment worked, but stupidly didn't look for the Facial Eczema cause, which I did, and found getting rid of the thatch which was the spore breeding area prevented Facial Eczema.

In 1960 I discovered that applying enough LimePlus, increased earthworm numbers to about 30 per spade spit, which then ate all the thatch on which Facial Eczema spores bred, so they ceased to exist on farms that applied LimePlus that all Waikato farms need, but which Doug Edmeades (a so called consultant) ex Ruakura, said was not needed anywhere in New Zealand! He was promoting fertiliser company's products at \$400/tonne and more per tonne, not opposition company's lime at \$25/t. Australia has the excellent rule that consultants are not allowed to get commissions. If NZ had it, our vast number of consultants would be honest and more accurate.

Facial Eczema symptoms were first reported in New Zealand in 1887. In New Zealand in 1938, Facial Eczema was so bad that Togo Johnstone, a well known Waikato sheep farmer who owned thousands of ewes, had to slaughter 90% to save them suffering. Farmers called a meeting, and the government offered unlimited funds towards research at the Ruakura Animal Research Centre in Hamilton. Despite this, it took dairy farmer Gladys Reid using zinc as a treatment, and we got rid of the cause using LimePlus which increased the earthworm numbers to get rid of the cause.

The 'establishments' fertiliser recommendations and the incorrect no-lime surface applications on peat, increased spore numbers. Doug Edmeades, an ex Ruakura bureaucrat, said that no soils in New Zealand need calcium, so double check his, Ruakura and DairyNZ advice before using it. The main reason farmers join GrazingInfo is because they are not happy with bureaucrats and fertiliser company recommendations. Many say that they wish they had read the www.grazinginfo.com eBook when they bought their farm.

In the late 1950s, the cause was found - a fungus, *Pithomyces chartarum*, that multiplies in dead plant material called thatch, under pasture in warm humid conditions. The very small spores contain sporidesmin, which affects in the liver varying from slight mottling to severe distortion.

Ruakura then took 10 years to find an effective spore killer which was costly and had significant disadvantages, including causing spring eczema in cattle. As happens frequently, seeking a killer instead of a preventer, meant that the establishment recommendations were back to front.

As well as in New Zealand, Facial Eczema occurs in African and South American countries, Australia, UK, and France, and I've seen symptoms in animals in Canada and the USA states of Wisconsin and Maine, where animal owners had never heard of it, so didn't know what it was, or the cause, until they read my article in the USA Stockman Grass Farmer, and then wrote to me.

Zinc oxide, used by some farmers to control Facial Eczema, is a fertiliser and should not be fed to animals. Zinc chloride, used by some, is worse, because it damages the animals digestive system, which observant vets have confirmed. Also, zinc is a cost, and lowers copper and selenium in pastures and so in animals.

LimePlus also reduces the toxic aluminium level in soils, which is the major cause of soil hard pans and ryegrass pulling. Ryegrass roots grow horizontally above the aluminium layer (often called a hard pan), rather than growing down through it. The ryegrass pulling is actually an agricultural lime (with its synergisms) deficiency, for which Grass grubs then Black beetles were blamed. This has gone on for fifty years, and they now blame Black beetle for the ryegrass pulling.

Calculate the amount of lime and its synergisms required for your farm, using Hill Laboratories ryegrass analyses, and the LimePlus software. Follow it with the Number of Cows to Milk for Maximum Profit and the Vaughan Jones 40% Grazing Rule. Lincoln University now agrees with both. They looked at the information in 1990 and reported favourably to me on it, but not publicly until 2011.

From our first farm in 1955 until 1987, when we sold our second farm and invested in towns for double the net profit (Read Investing), we had no Facial Eczema and only one slight case of spring eczema. At the same time neighbours had bad facial eczema, simply because they didn't apply the correct amount of agricultural lime with its synergisms, that I now call LimePlus, which is a description, not a registered name. Critics called me the "Lime King", but thanks to lime, our pasture and milk production per cow and hectare exceeded that of all our neighbours (See the photos in Author) and those in our Peat chapters, by a long way, and outproduced our previous employer with 160 cows on good land at Tatuani. However, very few farmers did the same because it was too simple, and lime at between \$16 and \$26 a tonne, which is a twentieth the price of fertiliser, doesn't have the margins that allows fertiliser companies pay some agricultural consultants \$12 a tonne commission, to promote their fertilisers. In Australia it is illegal to pay any consultant a commission, and should be the same here.

Scientists haven't researched lime because of the NIH 'Not invented here' syndrome and because no one pays them to and a commission on limes' \$25/tonne is nothing. Most scientists want to make themselves famous with something 'new of theirs'. Little do they know that they could do so by recommending LimePlus, which is lime plus deficient elements - read Minerals in Soils > Calcium. It is new to most editors, scientists, writers and farmers and the 'new' should be emphasised for it's increasing profits, which farmers need.

These large fat, healthy Calignosa earthworms were in the 6 t/ha limed area. They were big, strong and healthy because the farmer at Ngahinapouri, south west of Hamilton, where I did this trial, fed Solminix including salt through their dispenser, so the earthworms got some of it out of the cow manure.

On the same day, this Whatawhata, Waikato pasture a few km north of it had not been limed for 20 years, because the soil pH was about 6, partly caused by too much potash being applied for years. The thatch at the base of the pasture was so mouldy and smelly that the cows would not graze it short, so were hungry and had to be fed silage. There were almost no earthworms, and Facial Eczema damage to cows, even with zinc treatment, had been very bad. A LimePlus trial that I did on this farm grew more clover within months and the earthworms increased by ten times, so ate more of the mouldy smelling thatch that had stopped cows grazing down to the correct height.

A Google earth photo of his farm showed that the two paddocks limed as trials, were a lot greener, which meant more growth and less dead material. The farmer, who had repeatedly been told by fertiliser companies that no lime was needed, then limed the whole farm, which improved it and also improved their milk quality substantially.

Many animals suffer liver damage from Facial Eczema without the farmer noticing, or if they do, without knowing the cause and how to prevent it. Livers get damaged, weakening the animals and increasing the likelihood of dying from a double whammy of mild milk fever or the slightest bloat, to the surprise of farmers and vets.

This calf had Facial Eczema damage as shown by the jaundiced, yellow coloured skin on the body behind the front legs which is



next to the liver that Facial Eczema damages. This calf was low in sodium (rough hair), copper (colour lacking in hair), cobalt (long hair on top of neck) and selenium (low tail with muck on it and on its rump).

In February 1988, this Ruakura Facial Eczema infected pasture can be seen to be suffering from a lack of LimePlus, so was brown and dry, low in selenium (cow's heads below back level), salt (dry lustreless coats and dry noses), and unnecessary malnutrition, because the then Ruakura farm manager would not apply lime and trace elements. On the same day, our farm two kilometres north on Greenhill Road was green.



Ruakura scientists, Cor Feyter, Mike O'Conner and another visited our farm on Greenhill Road in 1986 and from the hill at the front said, "You've had rain." I pointed to the Ruakura buildings and farm a few kilometres away, and asked if they didn't, and showed them that our neighbour's farms were like Ruakura's - brown and with buttercup. (Read Author.) They then asked me what I was doing.

See Soils > Cultivation, Earthworms, Calcium. As well as being green and growing (mainly because we had limed at 6,000 to 8,000 kg per hectare), while Ruakura and many other farms were brown, we had no Facial Eczema from 1958, while our neighbour, Burton Trust (not the others), had 30 cows with Facial Eczema in their back paddock next to ours with none.

Ruakura then applied some lime to one paddock and later their whole farm, but not enough, and without the synergistic elements of boron and magnesium.

In 1920, the Irish found that not grazing pastures low reduced the incidence of Facial Eczema. Many NZ farmers still graze to the ground and get away with it by pumping zinc into their animals, but suffer low animal production and lower profits than those who use correct farming techniques.

Dead ryegrass leaves just above ground level are the main feed of spores.

We bought our first farm on Piako Road, Gordonton, north east of Hamilton in 1955, and soon saw the need for LimePlus to grow more clover and grass and be more palatable with less thatch.

In the autumn of 1959 there was a widespread outbreak in Eastern Victoria, Australia. High minimum air temperatures at night, and 50 mm of gentle continuous rain are considered to have caused the increase in their Facial Eczema spore numbers.

However, the real cause is insufficient earthworms to eat all the dead pasture at the base of grasses, which is because very few farmers apply enough agricultural LimePlus and correct edible reactive phosphate fertilisers, which earthworms need to thrive, not superphosphate. Also Australia has dung beetles which eat a lot of what earthworms would eat, so earthworms there don't increase as much as they could. New Zealand is investigating importing dung beetles, so should keep this in mind, and also the fact that earthworms improve soils much more than beetles do. How to increase earthworm numbers is what should be researched, and promoted to farmers and the establishment (Ruakura, MAF, AgResearch, DairyNZ and LIC.)

From Soils > Earthworms, "How I first learned how much earthworms needed minerals, was when a water trough, that had Solminix, a soluble mineral mix I developed, overflowed for a few days. Earthworms gathered thickly in the soil at the overflow point and were trying to climb up the side of the trough for more. The soil was moist from rain, so moisture was not what they needed."

Then, to be convinced, I spread a level tablespoon of Solminix over half our two metre by one metre compost and earthworm breeding bin, which attracted more earthworms to where it had been spread.

The grass used in the compost was from our lawn, which had been fertilised with correct minerals based on a pasture leaf analysis, so was not severely mineral deficient, but, as with grazing animals, more minerals are needed than can be supplied by pasture, however well it was fertilised.

The good effects of lime on controlling Facial Eczema will not occur if less than 6,000 kg per hectare of LimePlus with deficient trace elements are not applied at least nine months before the summer, and preferably two years before, because it is mainly the increase in earthworms that reduces thatch in which spores multiply. However, some farmers have applied more than that in August after spring calving, and achieved excellent results in preventing Facial Eczema.

Don't apply straight lime three months before calving, but LimePlus with adequate magnesium as

in Graymont with its 2.4% Mg and boron are applied about two months or more before. See Calcium and Calcium Successes and milk fever. Boron with the lime and magnesium reduce the incidence of milk fever. A client in the late 1960s, Ian McDonald, at Patetonga limed well and had 500 cows calve every year with only one case of milk fever every year - the same cow.

Horses don't show eczema, but Sporidesmin can damage their livers.

No practical solutions found by science

No worthwhile solutions were found by New Zealand scientists (or in other countries) or by researchers in the 21 years from 1938, because typically they were seeking treatments, not preventions, but Waikato dairy farmer Gladys Reid, an ex dental nurse, and avid reader and researcher, knew that zinc helped heal human gums and was conscious of the ill health of the average Waikato dairy cow. She noticed in the 1959 USA Yearbook that Zn could benefit animals suffering from liver damage and muscle weakness. She started using Zn on a trial basis on one of her two dairy herds at Shaftesbury in the Eastern Waikato. In the autumn of 1960 she was astounded when her zinc treated herd not only had no Facial Eczema, but also during the Facial Eczema period produced about 30% more milk than her control herd. Even the tanker driver asked why her one herd had not dropped in production, while others in the area had dropped. That shows what LimePlus can do by reducing Facial Eczema. The Plus is because lime reduces Zn

She observed that the Zn deficient animals had weaker muscles, so some had difficulty standing after milk fever. Low boron causes more milk fever and difficulty standing up, and even walking, especially in the South Island's west coast high rainfall, so high leached soils.

Low selenium levels also cause weak tail muscles so dung sticks on tails and around the rear end.

An increased incidence of salmonella occurred in some sheep and cattle after zinc drenching, and more so when two to three weeks' zinc requirements were in one drench. Sheep should be drenched at no longer than ten-day intervals. On salmonella risk farms, if Time Capsules® can't be used, and long drenching periods are necessary, vaccinate for salmonella before zinc starts. Sheep and young cattle are much more susceptible than others, so need proportionately more zinc and better care - all because of very acid low calcium soils.

First successful use of zinc

Gladys Reid in 1960 pioneered zinc for Facial Eczema control. In 1974 she told MAF Ruakura staff that adding zinc to the drinking water reduced the toxic symptoms of Facial Eczema and held milk production, as she had found with the trials between her two farms, and that Zn was acting as an antioxidant against the spores that damaged livers and caused Facial Eczema.

Unfortunately she was not believed, and was even ridiculed by some Ruakura people, including their PR person, for about seven years. He said on the National Radio farming programme that zinc was not helping and that the next gimmick as a prevention could be a daffodil in the nostril of cows!

Gladys's international contacts, and her extensive reading helped her to get even the exact high zinc dose rates right - the same rate as finally recommended by Ruakura and still used today through ignorance.

Estimates of the cost to NZ farmers before zinc control, were 80 million dollars in a bad year.

In 1981 NZ lost half a million breeding ewes worth \$30 to \$40m.

In 1982, Ruakura accepted zinc as a preventer of Facial Eczema, but didn't give Gladys any credit. They claimed that they knew about it and the delay was because of having to work out the dose rates and having to test for zinc residues in milk, the time for which could have been one year, not seven. The delay was accentuated by the NIH (not invented here) syndrome of some research people.

Ruakura's Rex Mundy was on her side. Neil Towers, Barry Smith, John Scott and Ruakura chairman Gordon Edgar, were against her, presumably because they felt threatened.

Peter Burke, Agricultural Editor of the Waikato Times, supported Gladys Reid.

At a Ruakura conference of about 500 farmers discussing Facial Eczema, Gladys stood up and introduced herself. The farmers stood up and applauded her. The chairman, Dr Gordon Edgar, whispered to the scientists at the top table, "You guys had better research zinc."

Some farmers had followed Gladys's advice before it was officially recommended, and used zinc for successful Facial Eczema control from 1974. In 1975 the New Zealand Animal Remedies Board (ARB) stated through the NZ Herald that, "Zinc in water troughs was completely useless as a form of

treatment or prevention of Facial Eczema in livestock” and they threatened to prosecute the vendors of zinc who promoted it for Facial Eczema control. Despite this, sales of zinc increased.

Incidentally, Gladys also then recommended applying agricultural lime to friends and local farmers so it gradually spread to farmers up to about 20 km from Te Aroha where she lived.

In the 1989 Ruakura 50 Years of Research book, there were many pages on toxic spraying to control Facial Eczema, five lines on zinc and two lines on lime that I was using, showing how scientists look for complicated things they can write papers about for degrees, rather than simple preventions that many farmers were already using successfully, but few still use today.

Gladys Reid, criticised by scientists, won more awards than scientists. In 1975 Waikato Woman of the Year for Facial Eczema results and in 1983 OBE for Services to Agriculture, in particular for research in Facial Eczema.

Facial eczema was common in the northern half of New Zealand, and later occurred in southern areas, including northern parts of the South Island, and Australia, South Africa and some Northern Hemisphere countries, for longer periods. If farmers don't know the symptoms, they won't know that their animals have it.

Alpacas are highly susceptible to Facial Eczema, possibly because for thousands of years, in their drier and cool high altitudes, they've never been subjected to it. Another reason is that they often graze close to the ground where the spores are higher. For them, changing pastures from perennial ryegrasses to any other grass helps, but liming regularly until grass levels are 0.9% is the saviour.

Cause

As mentioned previously, Facial Eczema is caused by the fungus *Pithomyces chartarum* producing the toxin sporidesmin, that increases rapidly in some pastures during warm, damp weather, after hot periods, when grass minimum temperatures exceed 12°C (54°F) two nights in a row, combined with heavy dew or as little as 3 or 4 mm (0.15 inches) of rain. Sporidesmin damages the liver when it can't rid the body of wastes fast enough, making exposed and non-pigmented skin sensitive to sunlight.

Heavy rain washes the spores off, but they grow again. Spores multiply on dead vegetation near the ground.

Counts exceeding 50,000 per gram of leaf are extremely dangerous, and spore counts of 30,000 over a few months can cause Facial Eczema. 10,000, the figure on adequately limed soils, can be safe. Many animals recover from mild Facial Eczema, but some can die, even some time later when another illness occurs, such as bloat or milk fever.

Perennial ryegrass thatch harbours higher levels of spores than other grasses. Legumes and herbs (chicory, plantain, etc.) have the least or none, and seldom enough to cause animal problems. All new pastures should have mainly Bealey NEA2 ryegrass and other suitable grasses, include Tonic Plantain for many reasons. Read Pastures.

Reasons for increase

Initially, severe Facial Eczema occurred only in some North Island areas about every decade or so, and only in late summer. Now it is occurring over a much wider area, and for longer periods, i.e., from late November to May (Southern summer and autumn). Some blame the warming climate, but there are much simpler reasons, including the previously mentioned higher stocking rates causing closer grazing, and reduced earthworm populations, caused by excess urea, which kills half the earthworms after each application, and high potash use, and reduced or no lime applications for decades. In New Zealand, the same total of lime was applied on more land in 2006 than in 1986.

Liming, where needed, increases earthworm numbers, which reduce the spores. Liming trials I organised in the 1970s on clients' farms showed only one tenth the number of Facial Eczema spores in pasture that had lime three years prior, and large numbers of earthworms, compared with adjacent paddocks that got no lime for five years. These paddocks that didn't get lime had ten times the spore counts. Client, Gavin Armstrong ex Roto-O-Rangi in Waikato recorded a sixth the number of spores on limed paddocks, and 20 times as many earthworms in areas that had been limed, compared with adjacent paddocks that had not been limed.

In about 1970, MAF in Palmerston North found that limed earthworm active soils had fewer Facial Eczema (Facial Eczema) spores than soils with no earthworms. Nothing more was done with this information because there is no money in it, whereas many vets and companies are still, in 2015, selling zinc to control Facial Eczema, so they don't want lime to fix it.

Farmers have also found that soils with high earthworm populations have lower facial eczema spore counts, because the earthworms decrease the amount of dead organic matter in which the spores multiply. See the photo on page one.

In 1986 on our second peat farm near Hamilton East we had no Facial Eczema, while a neighbour had 20 cows they had to dry off.

It is amazing that, despite these many benefits, few researchers, agricultural consultants and farmers encourage, breed and/or buy earthworms.

Lower trace element levels than are necessary for healthy earthworms are also a reason for fewer earthworms.

Pippa Grierson (15) at Katikati College in 2007 recorded that facial eczema spores were not as high on paddocks where lime was spread compared with superphosphate. When will Ruakura and all their descendants down to DairyNZ wake up?

Some species of earthworms come out at night and consume or take down the dead litter, on which the fungus would otherwise multiply. Soils that have low earthworm numbers usually have more dead pasture, more thatch (surface layer of dead vegetation), and higher spore counts. There are now more heavily stocked, short dense ryegrass pastures, with less clover, providing conditions favouring higher spore counts, and less hay, silage and crops fed, so the proportion of spore intake is higher.

The first known, serious problems associated with facial eczema occurred with sheep, possibly because they graze lower, but now even dairy cows are made to graze closer to the ground. Over the decades Facial Eczema has increased in dairy herds.

Symptoms

If farmers don't know what to look for, animals can suffer. After reading my article on Facial Eczema in a 1995 USA Stockman Grass Farmer monthly, a dairy farmer client in Vancouver Island, Canada, emailed me that he had seen it in his calves, and didn't know the cause.

The first symptom (photosensitivity) can occur one to three weeks after ingesting toxic amounts of spores, but symptoms may not show until the next spring, when stressed from spring eczema, calving, feed shortage, metabolic disease, bloat, etc.

Photosensitivity affects deer more than other animals. They become more restless, seek shade and lick their muzzles and lips. Their tongue tips become ulcerated. Around the eyes becomes affected and some may go temporarily blind, so take care when moving them to avoid injury. Skin lesions in deer are not as severe as in cattle and sheep.

Some animals show no clinical signs, however early signs of infection are cows trying to lick their udders, seeking shade and being restless. Milk production can drop within one to four days of consuming toxic amounts of spores, and lesions can appear 10 days later. Facial Eczema damages ruminants' livers and can cause them to show lesions on the face, ears, udder, and, in particular, on bare and light coloured parts of the body.

Affected sheep show increased restlessness and can shake, scratch and rub their heads and avoid sunlight. Ears can droop. The exposed areas of skin on the face, ears, vulva and above the hooves become swollen and thickened. Then the affected areas ooze and form scabs. Skin damage increases as they rub the affected areas.

Mild Facial Eczema cases cause liver damage, so the animals' skin becomes jaundiced which can be seen on the skin on the brisket and just behind the front legs. The stronger the jaundice colour and the larger the area, the worse the liver damage. Severe cases cause skin peeling from the face and other tender areas, such as the teats and udder. Never buy an animal with these symptoms because it won't do well, and if another ailment occurs, it can get worse and even die. In sales pens jaundice is not easy to see.

Spring Eczema can cause similar, but different symptoms. See below.

Body weights and production of meat, wool and milk suffer, as does sheep fertility if it occurs just before mating.

Avoid buying animals with any of the symptoms. Any affected ones you own should be removed from the infectious pasture, and well fed and cared for with energy and mineral supplements.

Liver damage

The liver is the body's largest and most complex organ, controlling many aspects of the body. It produces and stores necessities essential for health. When it lacks anything (zinc, copper, etc.) or is

damaged, an animal can show symptoms such as sunken eyes, dull sick hair and jaundice, especially under the front legs.

Facial Eczema damage can be measured in blood. When a liver is Facial Eczema damaged, it releases a protein enzyme into the blood. This occurs for a week to a month after infection and can be measured. Livers can re-grow liver tissue, but it is usually distorted and not as good as originally.

Livers and other organs can also be damaged by a range of toxins, such as prussic acid from sorghums, nitrate poisoning from excessive nitrogen, excessive protein, high copper through gut damage, low copper through molybdenum scours and/or zinc used to control facial eczema suppressing copper, endophyte toxicity, liver fluke, weeds such as ragwort, and even toxic grasses such as Panicum summer grass, which grows in pastures in some areas. It is prostrate with dark green leaves and almost red stems. A build-up of a little liver damage from year to year can, after a few years, be enough to cause skin symptoms, or even death, if another stress factor is added to the snowball. Animals can gradually pine away and die after some other complication or stress factor arises, such as winter malnutrition, cold, calving, milk fever, mild bloat, grass tetany, and even producing heavily in late winter or spring when short of feed. In New Zealand it is now recognised that, after a bad Facial Eczema year, deaths from metabolic diseases at calving are higher, but are caused by liver damage.

Facial Eczema damage can be identified in the liver at slaughter, so livers should be checked for this each year to monitor your Facial Eczema control programme, and other possible causes.

Restoring a severely damaged liver to its original condition is impossible, but anything that decreases the load on the liver will help. Soluble mineral mixes (SMM) in the drinking water, molasses and some seaweed products have proven helpful in some cases, but are not cures.

Horses don't usually show Facial Eczema symptoms, but sporidesmin can damage their livers.

Sporidesmin causes the gall bladder ducts of ruminants (horses don't have a gall bladder) to swell and block, so the bile goes into the blood stream causing photosensitivity (skin peeling).

Some countries have Facial Eczema (photosensitivity) problems from spores on other plants, and call it by different names. See "Spring Eczema Causes."

Reducing spores

The increase in Facial Eczema in recent decades, I believe, is partly due to the reduced use of agricultural lime and increased use of urea over the same period, and the subsequent reduction in the decomposing of dead pasture on the soil surface and fewer earthworms. At my first consulting visit to new clients I ask, "Is Facial Eczema a problem, and when did you last apply lime?" Out of 150 farmers questioned, almost all with a high incidence of Facial Eczema had not applied lime as consistently as those who didn't get much Facial Eczema. However, lime won't eliminate it completely, especially if urea is being used, because every typical application of urea halves earthworm numbers.

In 1980 on client Rod Millar's Ngatea, Thames Valley, peat farm, spore counts were measured at only one sixth the number where 3,500 kg per hectare of lime had been applied two years before, compared with an adjacent paddock.

Dairy farmer clients Gavin and Diane Armstrong of Rotorangi, Waikato, whom I got to apply 3,000 kg of lime per hectare, reduced spores to 10,000 per gram of leaf, which was safe, and one tenth of paddocks not limed. In all cases where lime had been applied, earthworm numbers were much higher so ate more thatch which was always lower, and soils were more moist with better structure, or biology in organic terms. Moisture extends the earthworm and pasture growing season into the dry weather.

A client who had not applied lime, endorsed my recommendation for lime, by telling me that a neighbour who applied lime regularly didn't get much Facial Eczema, and got 50% more production from the same size farm. This is another example of how hard it is to change habits, especially for a simple thing like lime. Too many fall for humate, rock dust and other what some call silver bullets, but I call gutless empty nothings. There have been dozens of these products such as Maxicrop. Ask sales people what these products actually contain that will help soil, and ask for names of happy users after four years, otherwise you are being used as a guinea pig and joining many failures.

Formaldehyde in some kills soil bacteria which then release N and lowers soil N levels.

Maxicrop was the first I knew of. It costs \$3,000 per tonne of dry matter, as do Response and

many others. No farmers use any of them for more than four years by which time they see their farm going backwards.

Many of the clients we get are ones who have gone backwards on liquid fertilisers, Humate at \$1,000 a tonne, Rok at \$400/tonne, Fine Lime applied by air at 200 kg per hectare and Abron which has made even deep rooted plantain wilt. Being a soil, it spreads foreign weeds on farms.

Spraying pastures with fungicides to kill the spores has been done, and is sometimes the only solution for sheep (other than enough lime), but dairy farmers doing this have had spring eczema severely harm their cows, so the effects on sheep should be watched. However, as in many things, it can be the better of two evils, i.e., any possible spraying ill effects could be less harmful than the Facial Eczema damage that has been cruel to millions of animals.

Manage pastures through the late spring, summer and early autumn, to reduce build up of dead material. Graze dry high-risk pastures first and after heavy rain, which washes some spores off the dead pasture, and when nights are cold. Graze the safer ones (green, exposed, south facing and longer grass) later, and don't overgraze. With the current extended Facial Eczema periods and higher stocking rates, this is not easy.

Avoid allowing pasture to become rank, with dead material at the base. Conserve more, rather than top or clip (USA term). If you do top, do so half a day before grazing, so the animals eat it, rather than have it lying on pastures as toppings to increase facial eczema spores. Start with a quarter, increasing to a third of each paddock. Mowing before grazing so that the animals eat the cut pasture, rather than topping after grazing and spreading the muck, and reduces dead material on which Facial Eczema spores breed, and is cleaner on tractors. Cut no more than will be eaten in 2 hours, to avoid dead material being left over. Fence the animals on to the mown area until all is eaten. This system reduces bloat. It also reduces parasite infestation that topping can increase, by spreading the animal manure over much of the pasture, also making it unpalatable for the next grazing unless a lot of rain falls.

Counting spores

When spore counting, remember that spore counts can vary greatly even within one paddock, so be thorough. Measure the warm areas and where there is a lot of dead pasture.

Ensure that all paddocks requiring lime get it, and deficient trace elements, before October, to encourage greener growing pastures, and to increase earthworm activity which reduces dead pasture material. This has worked for many farmers.

Immediately (not on the next day) after making hay and silage, use dry stock or milking cows for a short period to clean up the unharvested pasture in corners, and dropped hay or silage. Remove animals before they start eating any of the stubble (stems) that can be high in facial eczema spores, mould and nitrates, if earthworm numbers are low.

Prevention

Perennial ryegrasses host more Facial Eczema spores than other grasses. Where there are more species than perennial ryegrass in a pasture, there will be fewer Facial Eczema spores per cubic cm of grasses. Clovers host the least. Liming increases clovers, so reduces the percentage of spores.

The application of correct, balanced lime and fertiliser and other good farming practices also encourage earthworms and healthy soils, so decrease thatch and encourage grass to remain green for longer into dry weather.

A 2004 AgResearch survey, of 50 pairs of paddocks in the Waikato found that Quartet, a tetraploid perennial ryegrass, consistently had lower counts than perennial ryegrasses. Bealey NEA2 is a tetraploid. The reason is possibly because it is more palatable than perennial ryegrasses so is grazed shorter, leaving less dead material to host Facial Eczema spores. If this is the case, then the lesson to learn is to avoid high residuals prior to, and during, Facial Eczema periods. Other preventative measures include monitoring spore counts with a microscope, and grazing only safe pasture, feeding silage, hay and/or forage crops to dilute the amount of spores eaten from pastures. Forage crops don't have Facial Eczema spores.

Copper and selenium are depressed by zinc, so if low they should be supplemented well before, and immediately after, Facial Eczema zinc treatment stops, especially if Solminix is not fed. Facial Eczema damage to livers causes copper deficiency, because the damaged liver is unable to store copper, so it is released to the blood stream, which can be fatal if excess copper is given in any form,

such as injections or drenches. Also, copper is antagonistic to zinc and can lower its effectiveness, so, before treatment starts, ensure that your pasture Cu levels are adequate, at about 13 ppm for cattle and about 9 for sheep. Remember that PKE is very high in copper, which reduces zinc effects.

The animal genetic resistance factor should be used by not breeding from affected animals. Facial Eczema resistance is heritable, more so in sheep than in cattle.

Ruakura Facial Eczema research scientists in 1988 stated that the amount of copper in Solminix soluble mineral mix is acceptable, and does not adversely affect conception, or Facial Eczema zinc treatment, so can be fed with Facial Eczema zinc treatment without conflict. The mix has not been changed much since I first formulated it in 1986.

Facial eczema resistance

Sheep are more vulnerable to Facial Eczema, and it is more difficult to control it with zinc because sheep don't drink much. Some sheep farmers noticed that there are sheep and breeds which don't suffer from Facial Eczema. Resistance to it has a 40% heritability factor, so it is possible to make fairly rapid progress in breeding resistance into a flock.

AgResearch provide ram testing for ram breeders, known as Ramguard. Farmers who have used this for 12 years have increased their Facial Eczema tolerance four-fold. When buying rams, they say to ask the following questions -

- Who is the breeder and how long have they been breeding for resistance to Facial Eczema?
- Have they got a big flock with scope for selection?
- Is Facial Eczema tolerance at the top or bottom of their selection list?
- Have they got a good selection program or is it just talk? What percentage of ram hoggets are they testing - it should be high, and certainly not just a few. What percentage of rams are still resistant after the final test? Are the sires used in the flock selected from the top 5% of tolerant rams?
- Were the sires used as hoggets or two toothers to speed genetic progress?
- Check their paper work and figures.

Controlling with zinc - until LimePlus has worked

It has been shown that, where Facial Eczema is present, ten times the prevention cost can be returned in saved loss of milk production up to \$50 per cow, by using zinc. Savings with sheep can be even higher, but supplementing is harder. Use LimePlus which gives better soils, pastures and animals, so costs nothing, in fact increases the farm profit.

Spraying zinc oxide on pastures

For sheep, a weekly spraying gives protection. Zinc sulphate is best provided rain doesn't wash it off. The area sprayed must be sufficient to provide grazing for a 12 or 24-hour period and pasture utilisation must be high. Zinc oxide as a feed is toxic and rejected by some animals, so doesn't give 100% protection.

The spraying unit must have a high return flow through the by-pass valve to keep the liquid agitated, or zinc oxide can settle and block the inlets, nozzles and filters. Use high spray volumes and large hole nozzles. Pour the dry zinc oxide into water in the spray tank and use a high pressure water jet to mix the powder while filling the tank. Close the outlet until the tank is fully mixed, to prevent the pump from getting blocked. If high-pressure water is not available, mix 5 kg batches of zinc oxide in a bucket and add it to the partly filled tank. This is easier if you pour the powder onto the surface of the water in the bucket and leave it to settle before stirring. Do not pour water onto the powder.

Some people are allergic to oxides in zinc and magnesium. If you are, wear a mask to avoid breathing it and suffering nausea. I'm against feeding zinc to animals and people. Muscle test (See Human Health muscle testing) and you'll see why.

Zinc sulphate

500 kg NZ Friesian cow	34 grams
450 kg NZ Friesian cross	30 grams
350 kg NZ Jersey	28 grams

Capsules

There are Time Capsules® to protect sheep and cattle against Facial Eczema by releasing zinc-oxide into the rumen for about four weeks. Repeats are necessary for continued protection.

Dispensing & drenching

Recommended daily supplementation for prevention with good quality Animal Remedies Board (ARB) approved zincs in grams are -

Some farmers have claimed that less can be used if treatment is started well in advance of any build up of spores, and if the known precautionary measures are also used. This makes sense, but be careful, because Facial Eczema has started earlier and continued longer into autumn in recent years - because less agricultural lime and more urea are being used, so earthworms numbers are decreasing, and thatch is thicker so more toxic.

Out of interest I have checked some farms that have had bad outbreaks. This is done by checking the starting and finishing dates of drenching or dispensing zinc, the number of animals, the amount administered and the total kg bought and remaining. In many cases I've found that the amount claimed to have been administered was not what the animals actually received. The same has happened with Solminix, so animals got less than the farmers thought.

Farmers must be more thorough.

Dispensing zinc sulphate

Zinc sulphate has a higher safety level than zinc oxide. Zinc sulphate is best used through a tank on-line dispenser because, by adding the day's requirements, it ensures that the correct amount is provided each day to all cattle on the farm. This type of dispenser overcomes the problems that metering systems have in trying to cope with the fluctuations of up to 80% in water consumption, that can occur between hot dry days and wet cool days. If a metering system is used, check total usage weekly to ensure the correct amount is being consumed.

Adding zinc sulphate to individual drinking troughs is not recommended unless stock numbers are small and/or troughs are large; however, a Peta trough dispenser (NZ made, available in many stores and in other countries) does this well. Two may be necessary with large numbers of animals.

Zinc sulphate should be added to the drinking water gradually, increasing it over a few weeks to reduce water rejection, and be up to full strength a month before spores reach dangerous levels. Caramel flavouring can be added to overcome the taste. Animals like salt, so it, or a soluble mineral mix can be used to encourage the drinking of water containing zinc. Sheep, and calves in particular, have rushed up to drink when they see DeLaval minerals being put in a trough.

If animals are to be grazed in paddocks where the zinc has not yet arrived from the dispenser, dissolve and add 1 gram of zinc sulphate per litre of water in the trough.

Zinc sulphate monohydrate has about 60% more zinc than zinc sulphate heptahydrate, so 60% more heptahydrate should be used.

When dissolving zinc sulphate, add it to the water, NOT the water to it.

The recommended zinc sulphate rate for cattle water systems is 5.5 grams of top quality zinc per 100 kg live weight per day, but check its label.

Water trough treatments don't work for sheep because they drink very little or no water, so applying enough LimePlus is even more important with them.

Drenching with zinc oxide

Zinc oxide (and magnesium oxide) are fertilisers, so should not be consumed. They can make some people who are allergic to them feel unwell and suffer diarrhoea, so be aware of this and warn your staff. Avoid breathing it in, wear gloves and wash hands after using it. If dusting pastures, wear a good mask.

Zinc oxide is virtually insoluble so must only be used in a drenching system, for spraying pasture, or placing on hay or silage, not in water troughs or dispensers. Good drenching systems keep it in suspension by stirring. Suspension agents and/or molasses, which makes it taste better (cows open their mouths for it instead of fighting against drenching), are worthwhile. There are zinc oxides that include suspension agents that can be well worth the extra cost.

Zinc oxide should never be used in water dispensing systems, and zinc sulphate should never be drenched, because doing so can kill animals.

Too much zinc oxide on pasture can cause a reluctance to feed, decreased milk production and milk fever type staggering. Weekly drenching with zinc oxide can bring on milk fever type symptoms. Daily drenching is best, and twice weekly acceptable. Although the safety rate is high (three times Facial Eczema control levels), avoid overdosing. High single doses of zinc oxide lessen

resistance to salmonella.

Zinc can interfere with calcium absorption, so large single doses can cause clinical milk fever and downer cows. This is more common when lactating dairy cows (especially smaller Jerseys) are being drenched with zinc every three or four days rather than daily, which also causes -

- Lower milk production.
- Depressed appetite.
- Impaired metabolic function.
- Rapid heart rate.
- Recumbency.
- Diarrhoea in some. Are some cows allergic to oxides, as are some humans?
- Lethargy.
- Other illnesses.
- Slower growth rates in younger animals.

Higher than normal levels of zinc supplementation over the Facial Eczema period, although effective in combating the toxins produced by fungal spores, can cause major trace element deficiencies that put stress on cows in the late autumn/early winter period.

Higher levels of zinc have been shown to deplete copper and selenium. Some farmers are not aware that good soluble mineral mixes like Solminix maintain these mineral levels without adversely affecting zinc's control of Facial Eczema.

Drenching with some zinc mixtures can make bloat remedies less effective. Solminix doesn't, but dispensers are best (after correct liming with LimePlus). The cheapest and best one is made by Cook and Galloway Engineers, <http://www.cookandgalloway.co.nz/> 5 Belfast Place, Box 5117, Frankton, Hamilton 3242, 07-847-7583, <lloyd@cookandgalloway.co.nz>

On hay or silage

Mix the required amount of zinc oxide with salt, or a Solminix, to make it more palatable, then make it into a slurry and spread over hay or silage, ensuring that animals get an equal amount.

Beware of excess copper and manganese

Gladys Reid reported that sporidesmin is 1,000 times more toxic when copper is present, compared to when iron only is present, so don't supplement with copper on its own or to excess during Facial Eczema periods. It is important to ensure that the liver copper status is adequate before the Facial Eczema season by feeding Solminix mineral mix regularly before, as well as during and after the Facial Eczema control period. Also analyse pasture tissue and fertilise with copper sulphate to keep pasture levels at 13 ppm for cattle and 9 ppm for sheep, so it doesn't have to be fed on its own.

Some say that the high rates of zinc used for Facial Eczema control make any extra copper fed in a soluble mineral mix ineffective, but there is nothing conclusive about this. If so, it would be unwise to give copper supplements during the Facial Eczema season, unless it is essential for preventing critical copper-related deficiency health problems. An excessive rate of copper-supplementation during mating reduces conception rates.

Some products, including some worm drenches, contain copper and manganese that can negate the effects of zinc. Manganese is almost never needed in New Zealand, so should not be included in mineral mixes.

Gladys Reid reported -

"It was found that manganese increased the growth of the spores. The higher the manganese, the faster the growth of Facial Eczema toxic spores.

"As manganese levels in the Waikato are sky high in its acid soils and pastures, especially where calcium is low, I have wondered why manganese is added to fertilisers and stock minerals. Our pastures may contain up to 10 times more iron and manganese than required by livestock."

End

The bad minerals, mercury, iron, manganese and aluminium become more soluble (available) in acid soils, so more is taken up by plants. LimePlus reduces the acid-caused solubility, and so the availability of these unnecessary, toxic minerals.

Mineral mixes that contain Mn, have stressed cows and farmers. See Minerals in Soils > Manganese. Minerals in Soils Pastures & Animals and in testimonials.

The sulphuric acid in superphosphate makes the P available which is its job, but it also makes toxic elements available such as mercury, manganese, aluminium and lead. These are then taken up by plants and affect the animals (and humans) badly, and increase the toxin levels in milk. See Dairy > Milk.

Treatment of affected animals

If Facial Eczema damage does occur, dry off affected cows, treat the damaged skin regularly with a suitable zinc ointment, provide adequate zinc and tonics, shade and plenty of spore-free feed. Some farmers have found that Solminix, the best supplement of all. Some feed, Nutrimol and other oily liquids that block water pipes and foul the troughs. Solminix with its salt, zinc, copper help keep them clean.

Zinc sources

Factors to note when using zinc are that some zincs contain impurities, so ask for a complete analysis, especially if it is not pure white. The following samples taken in 1988 show the impurities in some unbranded zincs, with the maximums allowed in brackets.

Cadmium 1180 ppm (10), lead 9 ppm (less than 1), and iron 8000 ppm (200). Use only Animal Remedies Board (ARB) approved zincs. Fertiliser zincs are cheaper, but not always approved for animal use. Purchase from a reputable company, and follow the instructions carefully.

If you have old zinc and are unsure about it, you can get it analysed by a laboratory. If it is slightly polluted, spread it on your paddocks with your fertiliser at about 5 kg per hectare (4.5 lb per acre). At this rate it'll do no harm and could do some good, because many soils are low in zinc. If it is highly polluted dispose of it appropriately.

Check zinc products, drench levels and new systems with your vet and discussion group.

Warnings

It is important to understand what is written on the bags of zinc, to get the best value and control, and not lose animal production.

Start treatment a month before spores reach toxic levels, to ensure that two weeks of full level use lowers free copper and builds up zinc levels in the animals' systems before infection occurs.

When spore counting remember that spore counts can vary greatly even within one paddock. Where spore levels are not monitored, treatment should continue until spore counts indicate safety, which in 1992 was not until late autumn in many areas.

A microscope and training are required to count spores. Vets can usually provide these.

Period before slaughter

Animals to be slaughtered must have no zinc at Facial Eczema control levels for at least seven days before slaughter. Feeding good soluble mineral mixes is not a problem. Jaundiced animals can become stressed in sunlight, which can be fatal. If sent to the abattoir they will be condemned. Those showing bad eczema, but with no jaundice, can be sent to the abattoir immediately. Animals with severe jaundice should be held until the jaundice clears and body condition improves.

Failures

Some have done what they or their staff thought was the correct Facial Eczema control, but have had cases of Facial Eczema. Reasons for failures can include -

Calculations of animal weights, amounts of zinc fed and severity of spores were underestimated. The only certain way of ensuring that the correct amount of zinc is fed is to work out when the amount of zinc bought should finish. If it doesn't finish in time, correct the rates fed from then on.

- Perfect application of LimePlus can fail in prolonged dry weather because the earthworms destivate (go summer dormant) so don't eat the thatch which increases in prolonged hot dry weather, then after rain, spores breed.
- Not drenching frequently enough.
- When supplied through drinking water, other sources of water were not closed off.
- Excess copper and/or manganese were fed at the same time.
- Zinc quality was poor and/or the percentage of zinc was low.
- Mixing with an incompatible magnesium or other incompatible product.
- Started too late or stopped too early. Check yours with neighbours' and vets' spore counts at the

start and finish.

- Grazing pastures too low, where there are many more spores.
- Having a farm facing the sun, which has higher soil temperatures.
- Not reading what I've written for decades about LimePlus, at no cost, eliminating Facial Eczema completely. The extra pasture it grows more than pays its cost.

Final tips on Facial Eczema control

Remember that optimum LimePlus at least a year before, and fertiliser applications, both based on pasture tissue analyses, will grow clover. When earthworms are at more than 20 per spade spit (except in dry soils), zinc may not be necessary, but if urea is applied earthworm numbers will halve after each typical application, so that will increase.

Order your total zinc requirements early, don't run out, start prevention early rather than too late, and don't stop treatment too soon. Use the best zinc, not just what you can get, or the cheapest, unless it is also the best.

When measuring spores, remember that they can vary from 5,000 to 500,000 on the same farm, and even in similar paddocks, so measure paddocks carefully before grazing, and if near 50,000 take precautions. At spore counts of 80,000 livers can be severely damaged, but Facial Eczema is an accumulating or snowballing ailment, so one mouthful of 500,000 spores is not as bad as repeated mouthfuls of 50,000.

At the end of treating with Zn the animals' Cu levels can be low, so check liver levels and ensure that your pasture levels are 13 ppm or higher for cattle and about 9 ppm for sheep, and supplement your cattle, especially in-calf cows, with Cu. See Minerals in Soils > Copper. In the worst affected areas zinc has to be supplied daily from early summer until late autumn, resulting in more severe copper depletion in animals, which is, however, much better than Facial Eczema.

However, remember that adequate liming and other good farming practices, such as well fed animals on summer forage crops, if necessary, all help control Facial Eczema.

Sheep and young cattle are much more susceptible than others, so need proportionately more prevention, and if necessary, zinc and care.

Se absorption is lowered when sporidesmin is present in pasture, and when feeding high rates of zinc for Facial Eczema control, so it should be provided through the soil and therefore the pasture, drinking water and/or drench, as should copper and other minerals in Solminix.