

Salt is important, but seldom understood. Correct levels are essential for soils, people and animals.

Maize silage, if not salted at making or before feeding, has caused cows to not eat the maize silage, showing how low and unpalatable it is without salt.

Sodium chloride, common salt, is essential to animal and human life. Our bodies contain up to 450 grams of salt and we need to take in a few grams each week to stay healthy. The value of salt can be seen in the way Roman soldiers used to be paid in salt, leading to the phrase "worth his salt" and to our word "salary". The growth of industry has increased the demand for salt, both for direct use and as a raw material for producing other chemicals. Please also read Salt (Na) for Humans.

The best salt is in Himalaya. www.saltnews.com/chemical-analysis-natural-himalayan-pink-salt/

It is available from some human food shops, but can be too expensive for animals. It is beneficial for your health and is known as 'white gold' and is the purest salt available, is uncontaminated and perfect for household use and cooking.

A Tauranga (not far from the sea) gardener could not get his plants to grow well even after applying more of all the common fertilisers. He then tried adding salt and was surprised at how well his plants then grew. I have added 30 to 100 kg/ha of salt to ALL LimeMagPlus mixes and ALL Phosphate Nutrient Planner mixes, unless near the sea or the analysis shows it is not needed.

Excess salt kills soil bacteria so makes saline soils, raises the pH and makes the uptake of water by plants near impossible. Too much salt in soils kills soil bacteria and plants can die.

When you have a sore throat and gargle with warm salt water, you are killing bacteria in your throat.

Salt is needed for animals to make saliva which is the first digestive juice, so is essential, and also needed for temperature control, minimising winter-cold and summer-heat stresses, and giving a smooth skin and hair, seen as gloss, which in moist animal noses, indicate sufficient sodium.

There is ample evidence that salt is essential for both soil, human and animal health. Good vets and I recommend including salt in the daily drenches if a dispenser can't be used. This is not necessary when drenching or feeding Solmin, the best soluble mineral mix and the only one with nine elements, including salt, through the drinking water. Some others contain manganese and no magnesium. Read the human salt chapter.

Maize silage, can be a major portion of diets, is low in Na. Most pastures are low, especially tropical ones, like Kikuyu which don't take much up, especially when well inland away for coastal breezes, and in high rainfall areas. Salt deficiency can occur, especially in young stock and milking cows, more so on pumice and peat soils because they are very low in it, and most minerals.

Below are sea and river analyses.

PRINCIPAL CONSTITUENTS OF SEAWATER		COMPARISON BETWEEN OCEAN WATER AND RIVER WATER		
Chemical Constituent	Content (parts per thousand)	Percentage of Total Salt Content		
		Ocean Water	River Water	
Calcium (Ca)	0.419	—	14.51	
Magnesium (Mg)	1.304	—	0.74	
Sodium (Na)	10.710	1.19	16.62	
Potassium (K)	0.390	3.72	4.54	
Bicarbonate (HCO ₃)	0.146	30.53	6.98	
Sulfate (SO ₄)	2.690	1.11	2.55	
Chloride (Cl)	19.350	0.42	31.90	
Bromide (Br)	0.070	7.67	12.41	
Total dissolved solids (salinity)	35.079	55.16	8.64	
		Nitrate (NO ₃)	—	1.11
		Bromide (Br)	0.20	—
		TOTAL	100.00	100.00

Feeding salt

When these heifers arrived from a stock sale on the 18th August 2008 on Barry Brunton's Rukuhia lifestyle farm they looked dreadful, with long shaggy hair and selenium scours indicating a lack of salt and other elements. They were so nervous that I had to use a zoom to take this photos. Read more about them in Beef Profiting.

Always have fresh clean water available. Don't put salt through the water supply until it's fully dissolved. Know the percentage needed and taste it. Solminix (80% salt) fed through the water at 0.006% of the total cattle herd weight is very beneficial, with tremendous advantages, and has not caused any problems, but has given a lot of benefits to animals and cow's milk quality with less mastitis and lower somatic cell counts (SCC).

Never feed crushed salt ad-lib in the paddock because some can eat more than is good for them. It's usually OK to feed it in the exit lane after milking, when cows are keen to go to new pasture.

If you must feed salt in the paddock, use salt blocks. Cattle don't normally eat enough loose salt to kill themselves, but salt starved sheep and poultry have. As with all things, make changes gradually.

A farmer on pumice soils near Tokoroa had cows die from low sodium, that a vet thought was low magnesium, but deaths from low salt is rare. Tokoroa is in the middle of the North Island so far from the sea. Swizerland is very low in sodium.

Lick blocks don't work

Mineral blocks can be either unpalatable, or if with molasses, so palatable that they are gorged by some animals, so can't be used to supply the optimum amount of minerals. Supplying salt and minerals through a dispenser into the drinking water removes this problem, and ensures that all animals get their correct amount. Most animals prefer correctly mineralised water, so drink more. Farmers must remember this when supplying minerals in the water, so must adjust a metering dispenser to supply the same amount all day and night. On-line tank dispensers don't have this problem. The correct amount for all animals on the farm is poured into the tank daily or twice a day. I've seen calves wait for the minerals to be added before drinking and several farmers have told me this. Dairy farmers would not want milking cows to not drink because the minerals had run out. Farmers must remember this when supplying minerals in the water, so must adjust the dispenser to supply the same amount all day and night. Dairy farmers would not want milking cows to stop drinking because the minerals ran out.

Mineral lick blocks, while a help in the past, are not as good as minerals through the water, because some stock don't lick them, and a researcher at Cornell University, USA, tongue in cheek, said that for a high producing milking cow to get enough salt from a lick block, she would have to spend all day licking, and would wear her tongue away in the process!

Self help minerals fed individually don't work as has been proved by many farmers and Cornell University trials. Magnesium, another necessary element, is bitter, so animals avoid it.

Some eat salt and some don't, as can be seen here by the cow's lack of sheen with pot belly because of poor digestion, and cobalt and selenium deficient.

Those that eat it, have healthy moist noses, ample saliva and glossy hair, rather than long shaggy dry hair.

The Hereford bull at the top right was from a good farmer on Woodlands Road deep peat between Gordonton and Morrinsville, feeding



Solmin which the bull's good condition shows. Its tail is how all tails should be thanks to optimum minerals, especially selenium, being fertilised and fed. This herd is on a registered organic farm, which has since given up organics, because of the ridiculous USA imposed rules which don't allow, CCA treated pine posts, mastitis and milk fever fixes, feeding Solmin or Selcote Ultra fertiliser. New Zealand should have its own organic rules which the world would accept because we have an honesty record and mostly clover based pasture grazing and a good farming reputation.

Self help mineral feeding doesn't work at all as has been proved by many farmers and Cornell University trials. Magnesium, the mineral most important after salt, is bitter, so is not eaten.

This farm had loose lick available near the dairy. He had noticed that some stopped and ate it and looked better, while the one in the foreground didn't, so showed a lack of zinc (excess hair on her crown), low cobalt (long hair on top of her neck), low tail with muck on rump (low selenium). The cow in front of her was not eating enough minerals. The one at the back top left with a sheen was eating more. After showing the farmer these pointers, he installed an on line dispenser and fed Solmin with excellent results.

The farm was overstocked so some animals suffered, which is unprofitable. Selenium, is an essential element and can't be fed ad-lib unless you want dead animals. Seaweeds have more than pastures, but supplying enough Se that way is expensive, won't provide enough Se, and as with most seaweeds today, it is high in toxic elements, especially mercury. Salt supplies the minerals in a better way.

Saliva is the first digestive juice, and is high in sodium which is necessary to neutralise the rumen contents. Ample saliva is also a bloat inhibitor. If it is lacking, digestion will suffer and bloat will be more likely. See Animal Health > Bloat.

The above are reasons why supplying Solmin with its nine essential elements through an on-line dispenser like this healthy herd got. New ones have no steel to rust and no moving parts to wear out and don't need servicing as is required with some. This is far better than adding kelp with its excess iodine, high mercury and high cost. Some seaweeds added to some drinking waters make troughs dirty, block pipes and cause animal health problems, which Solmin doesn't. New Zealand soils are mostly high in manganese so Solmin has none.



Optimum levels

In the Northern Hemisphere where they monitor and control levels of all minerals in feed supplements very accurately and successfully, and get double our national average production per cow, they aim for 0.5% of salt in the feed, which is double and so impossible in pasture. New Zealand ryegrass leaves should have about 0.3% sodium, so a cow eating 18 kg of pasture dry matter per day would get only 54 g of salt, which is about half what they need.

Most pastures in medium rainfall (750 mm or 30 inches) in the middle of USA and Europe (both well away from the sea) have Na pasture levels of only 0.01% to 0.05%.

0.2% Na can only be achieved in temperate pastures near the coast or if fertilised with coarse agricultural salt at about 40 kg per ha twice a year. To replace that lost in milk, perspiration and urine, a 500 kg milking cow in full milk requires 90 g of salt a day, so if it receives 46 g from pasture it needs 44 g more salt each day.

Solmin should be fed at 0.006% or more of live weight, which is 30 grams/day for a 500 kg cow. The high producing (double NZ average with no grain) Pukeroro Friesian herd in the Waikato, averaging 550 kg live weight and on pasture, forage crops and maize silage, depending on the season, kept increasing milk production when supplied up to 55 g (0.01% of live weight) of Solmin a day. This supplies about 35 g of salt as well as optimum magnesium, sulphur, zinc, copper, cobalt, selenium and iodine, which contribute to their high milk production.

The beauty of using an on-line tank dispenser and a soluble mineral mix is that the total amount needed by all animals on the farm is added to the tank once a day for dry stock, and twice for milking cows. High producing milking cows need and drink more than dry ones, so get more minerals from

Solmin, and calves drink less, so get less, race horses in training so perspiring need and drink more, so get more. Tank systems get the correct amount to animals daily in hot and wet weather. Metered dispensers are not as accurate, and give animals less Solmin when drinking less in cool or damp weather, and more in hot weather.

If oedema (excess watery fluid) occurs in cows, feed less salt before calving. The correct amounts of High Magnesium should not cause problems.

Always start it gradually over about a week, and, if having to stop, do so over at least a week, because all bodies need to adapt.

Pastures should have leaves analysed once or twice a year for the 15 important elements, to avoid the risk of deficiencies, the ill effects of which can be costly. However, it is usually impossible to supply all animal needs through pasture, so a soluble mineral mix should be supplied through a water dispenser. As explained above, this improves animal health and production and with LimeMagPlus which increases earthworms which eat animal manure which reduces parasite breeding the frequency of internal parasite drenching in young animals.

When feeding loose salt to animals deficient in salt be careful that gorging doesn't occur. It is wasteful and can adversely affect some animals.

People arriving in New Zealand 150 years ago, especially in Canterbury, were dying until they discovered that iodine was lacking. It was then added to all table salt. Animals need it too. Goat kids die soon after birth if not supplemented with iodine. Solmin contains it, and fed in the water to goats stopped kid deaths.

Fertilising with iodine is not practical or profitable because it costs so much and is so water soluble that it leaches very quickly.

Sodium levels can be measured in urine, but what is the point? It is known that it is needed, so measure it in your pasture and add it to fertilisers as required usually at about 50 kg/ha and by adding Solmin to the drinking water. It is the only complete (nine minerals) soluble mineral mix.

When cows have mastitis their milk has extra sodium, so more is drained from the animal's already depleted system so needs replacing. Solmin fed to a Waikato herd with 10% mastitis helped decrease it to less than 1%. LimeMagPlus was also applied to the whole calcium deficient and manganese excess farm.

Optimum sodium requirements in pastures vary between animals. Lambs cope with the lowest levels of about 0.1%, then lactating ewes, then cattle, then calves. Lactating cows need the most at 0.15% minimum or 0.2% optimum. Some claim that sodium content in pasture of 0.05% is adequate for non lactating cattle and 0.1% for lactating ones, but trials on pumice soils in the Bay of Plenty show they are wrong; however, how wrong depends on the potassium levels in particular, and levels in grasses to a lesser degree.

Where the potassium level is high, extra Na helps balance it. Pasture analyses show that most New Zealand fertilised pastures have K levels much too high because it is a high profit element and Na levels too low (low profit element) for animal health (unless very near the west coast where salt is in the rain in the prevailing westerly winds).

High potassium levels suppress sodium uptake, while low potassium levels enhance sodium uptake. Grass samples with high sodium levels (greater than 0.50%) therefore can need potassium.

Central Europe is very low except where there are salty soils pushed up out of the sea long ago. Pasture analyses I've done in NZ show that paddocks close to the Taranaki coast have ample sodium and get no bloat and ones at the back of the same farm have a lot less Na and get bloat. Clovers don't like high K. Applying no more K, but 50 kg/ha of common agricultural salt, made clovers return without oversowing them on Bryce Wilson's pastures containing 4% K from fertiliser company advise, at Te Kawa West, in South Waikato. Others have achieved the same.

Cadmium in the rubber bands of Van Heusen underpants poisoned my body causing itchy hips. See Human Health Elements > Cadmium.

John Turner, an experienced and astute consultant to Hill Laboratory, wrote, "Paul C Chiy and Clive J C Phillips found that fertilising with sodium (salt) reduced the concentrations of cadmium (Cd) in soils."

The New Zealand government is concerned about the rising Cd levels in soils.

Animal deficiencies

These Holstein heifers grazing cocksfoot and fescue in Wisconsin, USA, not fertilised with salt and not being fed salt or minerals, were lacking salt so licked each other vigorously to try to get some. A pasture tissue mineral analyses showed very low Na (0.02 ppm) which is typical in locations in the middle of continents well away from the sea.



Horses exerting themselves and perspiring can become very deficient in sodium.

Salt deficiency causes frequent drinking and urinating, less saliva, long, dry, stiff, brittle, rough colourless hair (brown hair in black animals, faded in others), diarrhoea, more milk fever, shivering, more grass staggers, more bloat, poor conception, lethargy, decreased appetite, lustreless eyes, decreased milk production, poor digestion of protein and sugars, loss of body weight, broken bones, downers and deaths. They can lick each other, eat soil and urine covered bedding, chew at salty items such as trees and treated fencing posts, and try to drink urine, although urine from low sodium animals can have almost no sodium.

When deficient, young stock grow more slowly.

Salt craving by animals is common in many countries. Deficient ones suddenly given salt may gorge on it. It is like us drinking more liquid than really necessary, after being very thirsty. Poultry deprived of it and then gaining access to it, can poison themselves. I was taught this at agricultural college in 1946/7, but it still occurs because many people are unaware of it. Feeding sufficient in drinking water eliminates the problem.

A Northland dairy farmer had two small streams his cows had to walk through to milking. The first one was fresh spring water, and the second was tidal. Even on a very hot day, the cows would not drink the first one, but would drink the second one containing salt in sea water. Now they are bridged.

Wild buffaloes in USA get sodium (and no doubt other minerals) by eating the soil around prairie dog burrows which contains sodium from urine. Wild animals will travel miles for salt, gorge then return to grazing. Elephants in Asia travel miles to eat salt in a cave and then return to their normal feeding area. If lacking, dairy cows, deer, pigs and other wild animals will eat large amounts of soil in banks which contain small amounts of salt. Once supplied with salt, they stop eating soil, unless another element is lacking.

A Waikato veterinarian frequently drenched a saline (salt) solution to 'downer' calved cows already unsuccessfully treated for milk fever and grass staggers. Within 20 minutes of receiving sodium many have got up. The same has been achieved with zinc if it is deficient. Our grandfathers when making hay added salt to it, a good practice before dispensers, but now seldom done.

Some soluble mineral mixes don't contain salt which in some cases is the most needed one.

Proofs

A survey I did of 21 Waikato dairy farmers showed that drenching with Solmin or supplying it in the drinking water caused half the herds to have less mastitis. Supplying Solmin in the drinking water through an on-line tank dispenser all year has given production, fertility and health benefits in many herds and halved the somatic cell count.

An increase in milk production from cows given a salt supplement was shown by Babcock (1905) (Aines & Smith, 1957) showed sodium rather than chloride to be the cause of the milk production response.

Direct supplementation of salt to animals is probably the most effective method of correcting a deficiency, but the use of salt as a fertiliser is an alternative method by increasing sodium in the leaves of pasture.

Symptoms of a sodium deficiency may often be confused with other nutrient deficiencies or

sicknesses. Whitlock et al. (1975) reported an example of sodium deficiency in lactating Holstein cows. All salt was removed from the diet. The water contained sodium naturally, giving cows the equivalent of 10 to 15 grams of salt per day. The first signs of sodium deficiency were that cows showed excessive urination and increased water consumption to approximately 80 litres a day. During the first year the 45 cow herd dropped 40% in milk production. Reduced feed intake and loss of body condition were common. If beef cows drop the same, their calves will suffer.

Infertility is one of the common problems of heat stressed cattle grazing low-sodium pastures. In a German (not a hot country) study, researchers found that conception rates of 1,000 cows on 46 farms averaged 51%, but when supplemented with salt conception rates rose to 70%. Germans say 7 K (potassium) to 1 Na is ideal, which in pasture would be 2.8% K and 0.4% Na, but even temperate pastures can only have about 0.2% Na (unless applied every few months, depending on rainfall), so more must be fed. Na in tropical grasses is about half that.

Chiy and Phillips (1991) grazed 24 lactating dairy cows on paddocks where all, one-half, or none of the perennial ryegrass pasture was fertilised with salt at the rate of 50 kg/ha. Half of the cows received 50 grams of salt per day in their concentrate feed. Salt fertilising increased pasture growth rate, sodium pasture levels from 0.29% to 0.49% and decreased potassium. Milk yield and live weight gains were increased by salt fertilising. When given an option, cows selectively grazed the salt fertilised pastures. Ruminating time increased and digestion improved after salt fertilisation and supplementation.

Spring is best to avoid the leaching loss of New Zealand's high winter rainfall and to reduce bloat effects, but it won't eliminate severe bloat.

In experiments (Chiy et al., 1993), voluntary intake of perennial ryegrass fertilised with salt increased 12% to 18% for both sheep and cattle with sodium levels in forage up to 0.6%. Depending on rainfall, salt will have to be applied frequently to maintain this level.

Researchers have known for years that high potassium intakes decrease magnesium absorption by animals. Chiy and Phillips (1995) showed that magnesium absorption increased 23% when sodium was added to a high potassium diet, which almost all dairy farmers have before reading and applying GrazingInfo information.

1998 NZ AgResearch trials drenching salt at 38 g/cow/day on a low-sodium sandy pumice type soil near Reporoa in the middle of the North Island, gave a 12.8% increase in milk solids (MS - fat and protein) worth \$172/cow pa at a payout level of \$5/kg of MS for a cost of \$4/cow. See www.salt.co.nz

NZ peat (USA called "muck soil") is 98% raw organic matter is also very low in sodium.

Research by Lincoln University students on Mt Grand Station, Hawea near Wanaka, found that sheep were strongly attracted to areas where salt had been spread.

On a large ranch applying salt to areas at the back of large paddocks that were under-grazed encouraged sheep to go and graze them first.

Spreading salt on sodium-deficient South Island hill country pasture may be a way to help establish new pasture species (R J Aspinall et al. 2004) with trampling after oversowing.

The Imperial Chemical Industries (ICI) a British chemical company was the largest manufacturing company in the British Empire employing 29,000 people with a turnover of £4.8 billion in 2006. They added salt to their nitrogen fertiliser after trials on mineral soils produced more pasture growth and 15% more milk [because animals consumed more]. ICI is now Dutch owned and named AkzoNobel.

When first feeding salt to sheep which are low in Na, be careful that they don't rush it so much that deaths occur from smothering (sheep piling up on each other to get at salt) which has occurred. Providing many feed sources reduces this possibility. If animals gorge on it when it is supplied, there is likely to be a benefit in providing it in fertiliser and water.

Salt can be safely fed with zinc during facial eczema periods, but, if drenching, salt can close the reticular groove and cause the drench to by-pass the rumen. When drenching with bloat oils it is particularly important to avoid this. Drenching with very cold water can close the reticular groove even more so than salt, copper, etc. See Animals > Health > Drenching.

Milking shed drenching doesn't help the young stock, or the cows when they are dry, which is a time they need it as much as any, especially if on sappy grass during cold wet weather and growing a calf.

Animal excesses

Supplementation must relate to sodium and potassium levels in pasture and other feeds. Over

consumption of salt can cause frothing at the mouth, nervous animals, thirst, swollen tissues, oedema in cows (especially if pasture K levels are high), loose droppings and deficiencies of other elements, especially magnesium and, if continued, calcium, to the extent where bones will lose calcium. Some in-line metering dispenser systems can cause over-dosing, whereas tank on-line dispensers supply only the day's requirements, as added each day.

Feeding salt

See > Feeding Minerals.

Cows grazing correctly fertilised pastures getting 50 kg per hectare and the recommended 30 grams of Solminix per 500 kg cow per day get this amount of sodium. Don't feed dry or springing (freshening) cows too much salt or sodium bicarbonate without other minerals such as magnesium, because excess sodium can cause oedema and/or milk fever at calving. Solmin at the recommended rate avoids this problem. Good soluble mineral mixes based on salt usually have magnesium as the second highest element, so are not a problem when fed through the drinking water at 0.006% of the animals' live weight which is 30 grams per 500 kg animal per day. Feeding salt on its own is not advisable, but, do so at 0.004% to 0.005% of live weight, depending the pasture sodium level.

If sufficient salt is fed, especially with maize or millet silage, sodium bicarbonate should not be needed, but maize has only about 0.03% so needs salt to be added when making silage so as to mix it in thoroughly to reduce waste when feeding in paddocks through rejection. Bad mixing increases waste because some has too much salt that cattle like, and some gets none, so cattle don't eat it. See Silage.

The older, drier and finer the salt the better, but coarser salt is cheaper, so if it dissolves quickly enough, use it. Warm water dissolves salt more quickly. Some farm waters take longer. Some coppers take longer to dissolve. Oxides won't, so don't use them for adding to drinking water.

Soil & plant requirements

Dr Max Turner, a scientist at Massey University, conducted pasture trials in the early 80's using salt as fertiliser in the lower North Island where most sodium levels are not what many would consider to be critically low. He recorded dry matter responses to salt and found them to be similar to those from potassium, and found that salt could be substituted for potash. At least one honest fertiliser representative has told farmers that they can use salt as a substitute for some of the potash fertiliser. Some of those selling potash at NZ\$800 a tonne will not do so.

If needed, fertilising with coarse agricultural salt at about 50 kg/ha is the ideal way of correcting soil and animal imbalances, and helps increase most temperate pasture sodium levels, makes ryegrasses (and possibly others) softer, and increases the DM yields of crops such as turnips, which need salt for optimum yields.

Common coarse agricultural salt at about 50 kg/ha (36 lb/a) also makes pastures more attractive to animals, especially if artificial N has been applied. ICI in UK proved this with cows eating and producing more milk when salt was applied with the N. They market an N and salt fertiliser mix. Salt also counteracts high K levels which many farms suffer from and which animals don't like, especially where animal effluent is applied.

This photo of Broadbeans shows the tallest metre that has Gafsa like all our garden gets and got a 50 kg/ha of Dominion Coarse salt. Sick Camelias and other plants also gave responses. We then spread 8 kg on the whole 1/8 acre section of lawn and garden and got good results.



Levels in pasture and crops vary depending on their type, proximity to sea, soil levels and rainfall, with tall fescues at 0.6% the highest, followed by phalaris at 0.4%, downwards through oats, chou-moellier, velvet grass, kale, subterranean clover, cocksfoot, white clover, winter ryegrasses, perennial ryegrasses, prairie grass, barley, lotuses, to fescues and rape at 0.2%. These plants are natrophiles, because they take up sodium, but seldom enough for

animals, and certainly not enough for exercising horses. Fertilising natrophiles with salt helps balance pasture cation levels, which reduces the incidence of metabolic problems.

Most tropical grasses are natrophobes, which don't take up much sodium in to their leaves irrespective of soil levels, so, when grazing these, or hay or silage from them, more salt is necessary to be fed for optimum health and growth. Japanese millet, paspalum, kikuyu (pennisetum clandestinum), Bermuda or Couch (cynodon dactylon L.), Timothy, lucerne, alsike clover, lupins, sorghums and maize have about 0.01%, while soyabeans have none. Some natrophobes are less palatable to livestock so they eat less, especially if mature. Some tropical forages when they are young and green contain only enough sodium for dry cows. Animals grazing mature natrophobes can crave salt so much that they can gorge on it, if they are allowed to. Sodium is not an essential nutrient for all plants, chlorine is. Both are essential for farm animals. If you need to fertilise grass pastures with sodium you can use sodium nitrate (saltpetre). It has 27% sodium and 16% nitrogen. Apply it to give the amount of N required.

Salt is water soluble so leaches in high rainfall areas. To reduce leaching use coarse salt at 50 to 100 kg/ha annually, depending on the pasture analysis and the other fertiliser being used; for example Gafsa RP has 1.2% salt. Applying more than 50 kg/ha can be wasteful because more will be lost by leaching before all can be used. High potassium levels and using artificial nitrogen increase the need for applying salt. Animals don't die from insufficient salt, even over many years, but do better with it.

A major benefit of fertilising with salt is the fact that it, with calcium, it reduces potassium leaching (India, Australia, Massey University, NZ and my findings).

When soils are deficient, fertilising with salt aids earthworms. In deficient soils I've seen dozens of earthworms gather closely where water with Solmin (80% salt) was running over from a water trough.

I spread a level tea spoon of Solmin per square metre of 10 cm deep lawn clippings to make compost because trials I did showed that earthworms went to the areas where I spread it at this rate. Vermicast earthworm cast fertiliser producers apply a lot of lime and a mineral mix.

Salt slows the uptake of moisture by roots, so reduces the sappy, fast growing, moist, spring pasture problem. Don't exceed 100 kg per hectare per application, and not more than twice a year.

There are sodium-loving plants such as brassicas (turnips, swedes, sugar beet, mangolds) and barley. They are able to withstand droughts better when sodium is adequate. Brassicas yield more when salt is adequate. Tropical grasses don't take up much sodium, even if applied.

Salt used as a fertiliser increases the succulence of some plants, encouraging higher animal consumption, so higher production.

It has been known since 1943 (Mineral Deficiencies in Plants by T. Wallace, CBE, MC, D Sc, FRIC, VMH, FRS) that fertilising with salt can be beneficial and sometimes save having to use so much potash, to the benefit of soils, pastures, some crops, animals, and the bank balance, because salt is usually a quarter the price of potash. Despite this, very few use it, but many pour on potash in the mistaken belief that, because a little yields more, a lot will grow even more. Salt can be used to replace much of the potash required, provided lime is also applied to help reduce potassium leaching.



Soil & plant deficiencies

Bryce Wilson's pastures shown here were so high in potassium (3.9%) that most clovers had died. Applying 50 kg per hectare of coarse agricultural salt costing \$9 with 3 tonnes per hectare of agricultural lime and trace elements costing \$180/ha, got clovers growing again within months. No more expensive K was applied for years, saving money. The soils, pastures (shown below) and animal health improved. Pasture low in Na (especially if high in potassium) is harder (so pulls out more as shown above) and is less palatable, so animals eat less and young stock grow slower.

Turnips leaves low in Na grow more horizontally from the crown and wilt more quickly in heat. Brown scorch on leaf margins can also occur. Applying artificial nitrogen, especially urea, increases Na depletion and leaching.



Soil & plant excesses

An excess of Na displaces potassium, creates saline soils and can reduce the amount of moisture some plants take up, so that when rain stops they wilt sooner. Too much sodium can be toxic to some plants. These conditions are highly unlikely to occur where sodium levels are so low that salt has to be applied, because these are almost always high rainfall areas which leach some of it. Problems of salt toxicity can occur in low rainfall areas, or where slightly salty irrigation water is used in hot climates over a long period on cropping soils which evaporate more moisture, so continued evaporation leaves salt behind.

The removal of trees and growing crops in hot windy conditions can cause saline soils to develop, because rain falls and soaks in, then, as the top of the soil dries out, moisture moves back up carrying salt, and evaporates leaving it nearer the surface. Trees keep winds higher, give shade and create cool breezes under them, all reducing evaporation.

Ryegrass, strawberry clover and Kikuyu are relatively tolerant to saline soils, whereas red and white clover are not. Irrigation waters high in sodium, calcium and or magnesium can create saline soils.

Saline soils lose their structure and become lifeless and resistant to water permeability, causing plants to exhibit signs of drought. Gypsum can be used to lower soil salinity to a degree, but the cause must be removed.

Salt and bloat

Dr Max Turner of Massey University in the early 1980's achieved bloat control with salt on trial plots, and later, on farms in the Manawatu, Southern Hawkes Bay and Taranaki.

In the 1990s a farmer who substituted salt for potash in his spring fertiliser reported less perennial ryegrass pulling, more even grazing of pastures and less bloat. Another farmer had a new grass paddock the cows wouldn't graze. "The grass was as hard as wire and the stock would stand at the gate and bawl at me if I went near them. I would have to move them by midday or they wouldn't eat anything."

Within five weeks of applying Vaughan's recommended coarse agricultural salt at 40 kg per hectare the cows loved the pasture.

Another client applied salt instead potash and said, "In spring the grass had been so hard it was sticking between the cows' teeth. Some were getting so bad that the roots of the teeth were starting to show on the gum. He would pull grass out of their teeth when drenching them for bloat. This no longer occurs, and the grass is much softer now. Bloat has reduced and pastures are now being grazed more evenly."

Despite these and many others, at the Ruakura No 2 Dairy field day in March 1992, a stand on autumn fertilising manned by MAF soil scientists displayed a board listing useful and useless fertilisers. Included in the useless list for pasture was salt, magnesium, zinc and boron! They have since learned a little, but not all. For 20 years lime has been of their list, and LimeMagPlus is not understood, both costing 90% of NZ farmers billions collectively.

If severely deficient, salt can be sprayed onto sheep pasture, because sheep don't drink much water, but do need salt, especially if potassium is above 2.5% in pasture leaves. See Sheep > Bearings.

In New Zealand, depending on quantity, the salt from deserts which has not been leached by rain is about four times dearer than NZ salt from Blenheim which has just gone up by \$50 a tonne to NZ\$270 in the Waikato.

Low sodium levels in soils increase the leaching of potassium (K) which, at \$850 per 1,000 kg of potassium chloride is costly.

High K levels in New Zealand soils are common because of the inaccuracy of 75 mm deep soil tests that then cause unpalatable, hard ryegrasses which pull out.

High K also reduces animal appetite and causes poor digestion and lower production. Salt at 50 kg per hectare and LimeMagPlus at between 4,000 and 5,000 kg per hectare, reduce the pulling and other ill effects of high K. Analyse pastures and then use LimeMagPlus Nutrient Planner to get exact amounts from its columns Y and Z.

Fertilising with 30 to 50 kg kg per hectare (depending on the pasture mineral analysis) of coarse (to reduce leaching, which salt does) agricultural salt twice a year mixed with fertilisers or in LimeMagPlus, and feeding Solminix or fine salt to animals, preferably in the drinking water, provides a

lot more minerals than fertilising with fish or seaweed and a lot more completely because salt has everything from the sea. Fish and seaweed are about 90% moisture, so of much lower mineral value than salt as a fertiliser and/or feed. Salt is also much cheaper to feed dissolved through a dispenser and with fertiliser or lime, and costs nothing to spread with other products.

The best and cheapest dispenser I know of is from Cook & Galloway, Hamilton, NZ.

<http://www.cookandgalloway.co.nz/>

Uses of salt

Although table salt is the most familiar form of common salt, it is responsible for only a small proportion of Dominion Salt's output. The largest user of salt in New Zealand is the meat industry, which uses salt in the treatment of hides and skins, and there are many other uses listed below.

Industrial applications

Metal recovery

Paper manufacture

Rubber processing

Road de-icing

Dyes & textiles

Ceramic glazing

Refrigerant brines

Water pollution control

Water Softeners

In Agriculture

Hide & skin

Stockfeed

Fertiliser

Farm drenching

Water troughs

Medical, cleansing

Soap & cleaners

Dental, medical

Bath salts

Dairy products

Cheese salting

Butter making

Aquaculture

Fish brines

Fish processing

'Dry' salt fish processing

Fish canning

Chill fish (Fish slaughter)

Food preparation

Snackfoods

Breakfast Cereal

Bread

Cakes, biscuits

Confectionery

Industrial flavour

Catering

Margarine, fats

Dry seasonings

Frozen foods