pH does not show lime requirements Version 2.4 3 January 2015

Please promote the faults of soil tests and pH measurements.

pH stands for Potential Hydrogen, which is used for measuring acidity and alkalinity because hydrogen is a very easily measured element, so some wrongly choose to use it to measure soil acidity to assess the calcium requirements of soils and plants. The more hydrogen the more acid the soil is (low pH) and the less hydrogen, the more alkaline (high pH), but pH doesn't measure only the calcium level which is what farmers need to know. Potassium (K), sodium Na in soils and dryness all increase the pH so analyses of pasture leaves is the only way to tell us what is in the soil, what the pasture is using and what the animals are eating.

The difference of 1 pH, is a tenfold change, so pH 5 is ten times more acid than pH 6.

Potassium (K), sodium (Na) and dryness all increase the pH. Fertiliser companies and sales people know this, but because they sell K, they don't tell farmers. Some consultants and even scientists getting commissions on fertiliser sales tell farmers that they need high amounts of K per hectare to increase the pH, which it does, but poisons soils, clovers - reds first then whites, followed by cows!

In inverted commas below came from a concerned agricultural consultant who, with a dozen of others attended a field day near Gordonton on 25th June 2012 to try to solve differences of opinions between practical consultants and so called scientists. Doug Edmeades was one who miss-quoted 1954 Ruakura research that was wrong then, and has lost peat farmers collectively millions of dollars. At the field day on peat, Edmeades volunteered several times that he knew nothing about peat, which was the soil type they were standing on and was being discussed. However, he wrote a leaflet on peat for Environment Waikato. I, many scientists and farmers around the world say the opposite to what Edmeades says.

One consultant wrote, "I came across a farmer on the Mamakus who so called scientist Doug Edmeades nearly caused to go bankrupt because of overuse of potash and not recommending calcium (lime) and its synergisms, magnesium, boron and deficient trace elements, known collectively as LimeMagPlus. The farmer then had to sell his Fonterra shares and supply another factory just to stay solvent. He had 120 cows out of 550 go down with milk fever, and a number never got up again. After dismissing Edmeades he applied 4,000 kg per hectare of lime and things came right.

"I think the farmer would like to sue Edmeades who will just rattle out his 'science' so it would be an exercise in futility. Pity the rural media don't do a story on how Edmeades is ruining farms. He seems to have the rural media in his pocket. I have got another client near Matamata that Edmeades was advising. He had 400 cows, 60 went down with milk fever, and a number never got up. Over two years many farmer's problems have been solved by getting the soil and pasture levels correct.

"I know I am preaching to the converted. You probably have many similar stories."

End

Edmeades wrote that no soil in New Zealand needs calcium. What a stupid, ignorant statement, no wonder Ruakura banned him from speaking to the media, but he is consulting to farmers, recommending high amounts of K to please fertiliser companies' profits. It is $800 a tonne, while lime is only $18 to $26 a tonne. His Ruakura colleague, Ants Roberts, now with Ravensdown fertiliser company recently wrote that no soils in New Zealand need trace elements or earthworms. No comments are necessary to waste my and your time about them, but beware of fertiliser companies, current and ex 'establishment' consultants, those recommending applying manganese in New Zealand and recommending K based on soil tests. K pasture tissue should be 2.2 mg/kg or ppm.

Some fertiliser companies don't like stocking and mixing in trace elements because they are costly to buy and store with little profit. One large lime company can't mix in anything. An exception is

Rorisons Lime who do so willing because being farmer owned, they know that serpentine, boron, etc., are needed to make the calcium in lime perform better.

Disaster

Relying on pH for the application of lime is disastrous, and losing New Zealand farmers millions of dollars collectively every year. It is used by the uneducated, who are not up to date with proven measuring systems to assess the soil's calcium levels and requirements. Measuring the calcium content in pasture and crops is 100% accurate. To achieve this accuracy requires knowing the exact optimum levels of plants as in the Pasture Minerals Analysis spreadsheet, and sampling only one plant because a mixture requires exact percentages, so we use the most popular grass, ryegrass.

It tells us what it is getting out of the soil, not what some theorist thinks they might get or might need. See Elements > Calcium.

Read what the very good pioneer Ruakura scientist Ken McNaught wrote in Analysing Tissue Versus Soils, or Google for his papers written in late 1950, yes, that long ago, and some so called scientists still haven't read them.

Before going on, earthworms are far more accurate (and cheaper) at showing calcium requirements. Soil stuck to sluggish, dry earthworms shows that lime (calcium) is needed. Moist shiny, slimy active earthworms with no soil stuck to them, indicate that calcium is adequate. Plants also show if deficient. Read and see the photos in Elements > Calcium.

A top NZ consultant left LIC because they insisted on using pH and soil analyses, rather than pasture herbage mineral analyses which are accurate.

As soils under grazing become more fertile, the humus content rises. Liming also increases humus in soils, and encourages earthworms, which mix in organic matter to a greater depth, and also convert surface organic matter called thatch and weed seeds into humus.

Paddock 地点名	pH	Humus腐食
No.1	5.0	1.3
No.1	**4.9**	**2.3**
No.2	5.0	1.8
No.2	**4.7**	**2.4**
No.3	5.2	2.3
No.3	**5.0**	**3.1**
No.4	5.9	2.8
No.4	**5.1**	**2.0**
No.5	5.2	1.8
No.5	**4.8**	**2.0**
No.6	4.7	1.9
No.6	**4.7**	**2.3**

These figures are from the Japanese Government Agricultural Department, taken on six of my Japanese GrazingInfo subscribers severely Ca deficient farms growing mostly weeds. Two years after I got them to apply 3,000 kg of agricultural lime per hectare. It was three times more than had ever been applied before because they believed the pH was OK and because 25 kg bagged lime (the only lime available) was $400 per 1,000 kg. They now have half tonne bags which still costs a lot more than bulk lime. The black figures are before liming and the red ones are two years after applying 3,000 kg per hectare.

They were surprised at the soil humus increase of up to 50% and the drop in pH. I was not. I've seen how the best NZ farmers on sandy and pumice low organic matter soils have deepened topsoils from 5 cm to 25 cm in a few decades, and good Waikato clients who have got clover nodules down to 35 cm, after applying 600 kg of lime per hectare per annum for 14 years. Another farmer got clover roots and nodules down to 35 cm after apply 8,000 kg per hectare over three years. See Elements > Calcium.

The low humus figures above were simply because they had not applied enough lime ever, so had very low fertility and weeds so didn't grow much pasture, which meant not much organic matter was produced, so not much animal manure was made.

As well as analysing pasture tissue which is a far more accurate way than pH to measure calcium requirements, is to check the soil and its contents with a spade -

1. The earthworms should be moist, slimy and active, with no soil stuck to them. See the photos in Soils > Earthworms.
2. The soil should be soft and crumbly, which shows a good structure. Soils lacking calcium are tight and hard with little or no structure. Most farmers, consultants and scientists blame the hard

pan, but the hard pan is the result of Ca deficiency.

3. The grass roots should be thick and growing downwards, not horizontally caused by aluminium from a lack of lime. See Elements > Aluminium, and see Calcium.

4. Clover roots should be strong and covered in nodules, which should be big (depending on clover variety), pink or brown inside, not white, which shows a lack of molybdenum.

5. Clover rhizomes (surface runners) should be spreading and sending down roots at each node, which they don't do as much or as strongly, when the soil surface is dead.

6. Bad pests in the soil should be almost non-existent, but a few don't matter because in the case of New Zealand grass grubs, they feed the disease that controls them alive. An example is after a few years of growing maize (Corn), grass grubs die out and so does the disease. Then later, after growing pasture, grass grubs increase to damaging numbers, until the disease returns, which can be helped by farmers gathering grass grubs from other areas. See Soils > Pests.

Testimonial

This is from Tania Fernyhough, dairy farmer, Walton, Waikato, a client who joined GrazingInfo in 2008, seven months before writing the following -

"Thank you so much for taking a pasture analysis and then encouraging us to apply lime and oversow. The 3,000 kg of LimeMag per hectare and then another 3,000 kg of lime and trace elements per hectare three months later, has worked wonders - after having applied very little lime for decades because the pH was between 6 and 6.2.

"I went for a walk to the back of the farm today. Where we had hardly a single clover plant, there are now LOADS of clover and Tonic Plantain plants from the oversowing you recommended. The clovers are covering the bare patches where there were weeds. It's such a fantastic sight.

"You have done more for us in 6 months than anyone else has done for this farm in at least the past 10 years I have been here, actually, more than anyone has done for at least the past 20 years.

"Since then, one paddock has had another 3,000 kg of LimeMag and trace elements based on pasture analysis, per hectare and is the best paddock with deeper roots, more clover and is growing faster." End

From Wikipedia:

pH was introduced by Danish chemist Søren Peder Lauritz Sørensen at the Carlsberg Laboratory in 1909. It is unknown what the exact definition of p is. Some references suggest the p stands for "Power", others refer to the German word "Potenz" (meaning Power in German), still others refer to "Potential". Jens Norby published a paper in 2000 arguing that P is a constant and stands for "negative logarithm"; which has also been used in other works.

H stands for Hydrogen. Sørensen suggested the notation "pH" for convenience, standing for "power of hydrogen", using the cologarithm of the concentration of hydrogen ions in solution, although this definition has since been superseded.

The pH of pure water at 25 °C (77 °F) is close to 7.0. Solutions with a pH less than 7 are said to be acidic and those greater are said to be alkaline. pH measurements are important in the body (blood 7.4, urine 6, gastric acid 0.7), medicine, biology, chemistry, food science, environmental science, oceanography and many other applications.

End

pH can be deceptive

pH is not accurate at measuring Ca in soils because it is affected by moisture, potassium, sodium and humus levels. pH levels also affect the complex interactions among soil chemicals. Phosphorus (P) for example likes a pH between 6.0 and 7.5 and becomes chemically immobile outside this range, forming insoluble compounds with iron (Fe) and aluminium (Al) in acid soils and with calcium (Ca) in calcareous soils.

Hydrogen ions are acid, but are used because they are easily measured, however, even those who use pH admit that it is erratic. In New Zealand, in the last decade, scientists have changed from saying that reactive phosphate won't become available if the pH is above 5.8, to now 6, and some 6.2. However, if the soil is dead (lacks the life of earthworms and soil microbes), reactive phosphate won't become available even at a pH as low as 5, unless the reactive phosphate is chisel ploughed in, which increases its contact with the soil and aerates the soil. At the other side of the scale, good reactive phosphate will become available at pH 6.5 if the soil is live from lime-plus and active earthworms. Reactive phosphate will work even with pH of 6.5 if elemental sulphur is mixed with the phosphate, earthworms are more than 20 per 20 cm spade spit 20 cm deep (they love good reactive phosphate and make it become available), and as long as the soil is live. The positive things above improve biology in soils which is what organic farmers aim for.

The pH of rain, usually about 5.8, depending on the carbon dioxide content from the earth's atmosphere at the time, and the rate of fall, and proximity to the sea. Sea water has a pH of between 7.3 and 8.

The depth of soil sampling is important. Depending on the consultant, laboratory and country, the recommended depth varies between 10 and 20 cm (4 & 8 inches). The pH can be lower in the first two centimetres (cm) if thatch (surface dead plant material which is naturally acid) is present. If lime has been applied over the years and been moved down by earthworms and/or chisel ploughing, the next few cm can be higher. Below the cultivation depth the pH can be lower and this is where a major problem can occur in the name of aluminium toxicity, which prevents some pasture roots (mainly ryegrass) from going into a high aluminium soil. See Elements > Calcium. Yorkshire Fog (Velvet grass) is not adversely affected by aluminium. One needs to know these things to identify what needs to be done on farms. I repeat, earthworms are the best gauge of lime requirements.

LimeMagPlus speeds up decomposition of the thatch, and increases earthworm activity, which also reduces thatch because the worms consume it, but won't if Ca is lacking. See Soils > Earthworms.

Legume rhizobia, especially lucerne (alfalfa), are more active when pH is 6.3 or higher.

Earthworms are not fully active until pH gets to about 6.2. Reactive phosphate will still become available if the soil is live with earthworms and soil microbes.

Both good and intelligent organic farmers, find that the pH decreases in their soils as the organic matter increases. At the same time calcium and other elements in their pastures can increase as LimeMagPlus works. Read Elements > Calcium and see the Japanese figures from my clients.

Soil samples in 1983 from this consolidated peat soil in Hamilton that had been farmed for 100 years had similar pH levels on the right and on the left. LimeMagPlus had been applied at 5,000 kg per hectare on the left, and 10,000 kg on the right before resowing a year before.

As shown the left was weedy and dry with Yorkshire Fog, while the right was moist with 75% perennial ryegrass and 25% white clover and calcium levels were 0.7% and 0.9% respectively. It had been one paddock.

The moisture difference could be seen and felt. I've seen similar differences in other soil types, with lower application rates.

The tests were taken on the same day in late February in dry conditions.

I asked Roger Hill, the owner of Hill Laboratories that did the tests, how it was possible that the pH was virtually the same when double the lime had been applied before cultivating then resowing it a year before. He replied that this was common because of the different soil moisture levels. Note that the LimeMagPlus was the reason for the higher moisture level, and for the far superior ryegrass and clover growth and without weeds.

I measured our garden soil when wet with a pH meter, and again after the same soil dried naturally over a few weeks. The dry pH went up by 0.2.

Look at the weed-free lush grass and clover on the right of the photo, where lime was correct, and the weeds (Ragwort and Browntop) and dead facial eczema breeding material on the left, where the only difference was half as much lime. The milk and meat production from the right was about 50% higher, because the higher clover levels increased protein and digestibility, so animals ate more.

Professor Dave McKie of Waikato university has written about Olsen P being useless in many papers. Google for Dave McKie soil pH. He has a track record of academic leadership, staff mentoring, resource management, and award entrepreneurship (12 awards created and implemented including Scotland's first Communication Studies degree in the 1980s (with an information technology major), a PhD programme in Australia in the 1990s, the first university undergraduate communication studies (and honours) degree in New Zealand (with majors, honours, and masters in marketing and public relations). As chair and corporate education leader he played a key role in Waikato Management School's Triple Crown accreditation.

Reasons for an optimum pH

Most soils, pastures and crops do better when the pH is above 6. Not exceeding calcium caused pH of about 6.3 allows the use of reactive phosphate, which usually costs less and has other advantages. See both Fertilisers and Elements > Phosphorus. I've applied reactive phosphate and elemental sulphur to pH 5.2, dead peat that had no earthworms and achieved no response, while water soluble superphosphate, right next to it, gave a good response, because it leached down to the root level. Other water soluble phosphates would have done the same. Single Superphosphate as made in New Zealand (it is not made in USA) causes problems. Its high level (11% S) of water soluble sulphate leaches potassium, selenium and others. The 11% doesn't sound much, but when applied at say 500 kg per hectare, it is 55 kg.

pH just above 6 reduces the locking up of phosphorus, called P-Retention or other terms. On many NZ farms large quantities of phosphate can be released and made available to plants simply by applying enough LimeMagPlus. P-Retention levels greater that 70% indicate a requirement for lime and/or more phosphate. Top quality agricultural lime with 97% $CaCO_3$ has 39% Ca.

High soil pH levels (6.6 and above) make phosphorous, zinc, iron, manganese and aluminium less available.

Good reactive phosphate powders are the cheapest form of P, have other essential elements, but only work when the pH is not above 6.3 (unless the soil is really alive with earthworms, and the reactive phosphate is very fine, like ground pepper), so it is advisable to aim for pH of about 6.2. Also, earthworms increase in numbers when pH is 6.2 and when pasture Ca is at optimum. Earthworms take reactive phosphate to lower levels where the pH is lower, so make it more available, also because it is then in the root zone.

Some trace elements tend to decrease at higher pH's, while boron, molybdenum and selenium availability increase. When Ca is low, manganese levels in pastures can become too high for animal health. Overseas literature often shows that manganese (Mn) deficiencies occur with high soil pH's, but in New Zealand the problem is more likely to be excess Mn in the low pH soils, causing high Mn uptake by pastures, at the expense of copper, and sometimes to the detriment of animal health. See Elements > Manganese.

As you can see, the pH is a confusing measurement which should not be used to decide calcium applications. Using it for this has cost farmers dearly, when legumes are lost, N has to be applied, and animal growth and health suffer.

Variations

Different laboratories can give slightly different pH levels from the same sample. Stick to one good lab, take samples at the same time of the year and with the same moisture levels, because pH varies between dry summers and wet winters, when it is usually about 0.2 lower. Allow for this, but don't worry about a decimal point or two difference.

Unfortunately most pH tests are taken to decide lime applications. This is unreliable because dry soils and high Mg, K or Na levels can show an adequate pH, even when calcium and boron levels are low. Measuring these in pasture or crop herbage is a more accurate way than in soils. If boron is low, the right amount of lime applied will not increase Ca levels to where they should be. If Mg and Zn are even slightly low they should be applied, because lime lowers both.

In mineral soils the pH should be about 6.2, while in organic (peat) soils it can be between 5.8 and 6.1, but remember that Ca and Mg levels are more important.

pH is not an exact measurement and some soils that need lime have almost no acidity, so using pH (potential Hydrogen) as a guide for lime requirements is deceptive, inaccurate, and costly when farmers don't apply lime because the pH is around 6.5. The Hydrogen ion is acidic and is easy to measure, so is used to measure the level of acidity in soils, but it has nothing to do with the Ca requirements of pastures (in particular legumes), animals, soils, earthworms and soil microbes. See Soils > pH.

The now deceased Prof Walker from Massey University in New Zealand promoted the application of lime for most of his working life. I asked him in 2009 if he thought he had succeeded in his lime mission, and he admitted that he had not. I then asked him if he knew why, and he didn't, so pointed out that it was because he recommended the use of pH to measure lime requirements, which I had not done since 1956, when I saw that it and soil analyses were useless in measuring Ca, and other elements accurately. Pasture analyses and a spade do. Sluggish earthworms with soil stuck to them mean Ca is lacking with 100% accuracy. I also pointed out that other elements such as sodium, magnesium, and especially potassium, increased the pH, so it should not be used as a guide for lime requirements, but he disagreed. How unfortunate that a civil servant didn't keep up with the times.

Apologies for so many examples (there are dozens more), but since 1960 I've been saying, writing and proving that most dairy farms need more lime, but with minimum success nationally and internationally, because of the reliance on pH, inexperienced consultants, and fertiliser companies promoting their products, rather than what their clients need. Lime companies seldom promote its use.

Lime broadcast on the surface in the normal way and not cultivated into the soil will raise a laboratory soil pH test taken to a depth of 7.5 cm (3 inches) which is the NZ standard, but does not show the true pH of the soil used by plant roots, which is a lot deeper, where aluminium can stop ryegrass roots penetrating. Users of NZ Nutrient Budgeting which uses 7.5 cm soil tests, often comment on this anomaly, as well as it ignoring trace element details. My Fertiliser Nutrient Planner spreadsheet and Lime Nutrient Planner spreadsheet are much more accurate for many reasons. See > Pastures.

Other countries measure more deeply. A good pH probe from a garden store can be more accurate if soil to 20 cm is mixed, moistened with rain water and measured, but, if not used correctly, might not be as accurate, although a few decimals either way doesn't matter because lab ones vary depending on soil moisture, recently applied lime and other element levels. There are also liquid and paper pH measurers. Use rain water to moisten the soil. As I've written many times, the Ca, Na and K levels shown in pasture tissue are more important and more useful, because they all affect the pH. Soil stuck to earthworms is a more accurate indicator of calcium deficiency.

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earthworms is a more accurate indicator of calcium deficiency.

When to apply lime

The requirement for Ca is best gauged by annual pasture tissue testing aiming for 0.8% Ca, by visual assessment of soils and pastures, especially legumes, and by application history and pasture Ca measured every few years. See Elements > Calcium.

Confusion can arise after applying lime and the pH goes from say 6.2 to 6.4, so pastures, especially legume based ones, improve and claims are then made that pH 6.4 is better than 6.2. In many cases it is the calcium doing the good, not the pH change made by the calcium carbonate. An example of this is that clovers, then grasses, can improve dramatically within months of applying agricultural lime, before the pH has increased, and even if the pH is already 6 or even 6.3.

Applying agricultural lime can increase cations, and so release nitrogen, which can show up as greener grasses within a few weeks of applying lime. Ca is essential in all soils growing most vegetables, all legumes, and for grasses, making them softer and with more earthworms. Ca is a food for soil microbes, earthworms, plants and animals, so must be supplied regularly if optimum soil conditions, pasture growth and animal health are required. See Elements > Calcium.

To reinforce the necessity for liming on a regular basis, it must be remembered that earthworms, “the great soil builders” to quote Darwin, thrive where lime is applied regularly, and can double their numbers within a few months of lime being applied, following a lapse in liming. Also, legumes, essential for profitable pasture production, with growing animals and milking cows, have a high requirement for calcium. Well-fed clover has about 1.3% Ca, while grasses have only half this level.

Within months of liming pastures, dairy cow milkfat tests have gone up 12 hours after grazing the limed paddocks, then gone down again after grazing non-limed paddocks. Animals graze limed paddocks more evenly, and are often more content than when grazing unlimed paddocks. In lime trials near Matamata in the Waikato, on a fertile soil with a pH of 6.1, calves selected lime trial areas and grazed them short before eating the non-limed areas.

Regular small annual applications of lime are best because they feed the earthworms and don’t raise the pH or molybdenum levels excessively or lower zinc levels, which can occur after large less frequent applications. The application of lime every spring is best, but annual spreading becomes a higher cost. Every second year is second best and every third year is a minimum on soils needing Ca.

Where calcium levels in pasture analyses are low because insufficient or none has been applied for many years, a capital dressing will usually give noticeable and profitable results. See Elements > Calcium. The amount necessary in some cases has been 6,000 kg per hectare, despite the pH being as high as 6.2.

Visual assessments

While farmers like to know the **approximate** pH (it is not an accurate measurement), a spade, hand and eye assessment can do a lot more than a pH and soil test to assess it and the soil condition.

Take a spade and assess the top centimetre which should have no thatch on it, have earthworm casts, clover stolons (runners) spreading and sending down roots, dead material decomposing, not sitting on top to cause facial eczema. Look at your soils in good and bad places and in chisel ploughed and not chisel ploughed soils, where more lime was applied, less applied (corners), sacrifice paddocks, pugged paddocks and non-pugged ones, etc. Count the earthworms, nodules, structure, drainage, smell the soil, etc., in each.

Then decide what you will do. It will be to avoid pugging (it kills earthworms and causes gases to be sealed in soils), and to take earthworms to the pugged and sacrifice paddocks which may benefit from chisel ploughing once, as soon a possible, to let the gases out and aerate the soil. Check the soil’s humus content, compactness, structure, friability, water holding capacity, pasture root depth, legume nodulation, weed content and earthworm numbers. Earthworms with soil stuck to them indicate low Ca levels. Earthworms will be slimy and moist when Ca levels are adequate.

Evaluate the subsoil as to requirements for subsoiling, drainage and structure. Liming should improve these. Finely ground lime moves down in healthy soils by earthworms, and natural movement. To do this lime should be nearly as fine as cement (most should go through a 0.5 mm sieve and all through 1 mm).

One problem with soil testing is that people then frequently ignore observing the above factors, which are much more important than a pH figure. Fertiliser and lime history records are also important.

When giving a seminar with slides in a mid-west USA State a farmer questioned my ability to assess pH. I walked to the window and from it estimated the pH in the adjacent paddock to be 6.6 and the county agent said that was about right. Once experienced in the area, some can tell Ca requirements, pH and fertility on farms while driving along a highway. In New Zealand I can tell from roads the need for lime by the number of dandelions, buttercups, pennyroyal, rushes, clovers, unevenness of pasture, size of dung pat affected grasses. With a spade more can be assessed.

Calcium deficiency symptoms

See Elements > Minerals > Calcium.

Comparative trials

As with fertilisers, lime trials on your farm and on the various soils types you may have, are the best way of assessing whether lime is required. Visual or a PastureGauge measured trial can give an answer within months and continue to do so over years. The belief that lime takes a year to give a response comes from using hard, coarse lime, instead of softer finely ground lime, and from applying it to "dead" soils, sometimes dead because of insufficient lime in the past. Also, apply fertilisers and trace elements based on a pasture tissue test and bring in some Caliginosa earthworms, but only after lime has been applied.

Lowering the pH

Firstly, make sure that it is actually high. It is not easy to lower the pH in soils that naturally have a high pH, and high Mg or Na content. One way is to apply elemental sulphur and/or Calcined Sulphate of Iron at 7 grams per m2 (0.25 ounces or 0.7 of a level teaspoon per square yard) or 70 kg per ha or 72 lb per acre, but not if iron levels are high.

Chlorides and sulphates also lower pH levels a little. If calcium is required, but the pH is high, apply gypsum (calcium sulphate) which has 23% Ca and 18% S, but it is usually more costly.

Laboratory Measuring of pH

Measuring the pH is done by laboratories drying the soil slowly at about 40° C, then grinding and sieving it. For pH, they slurry say 10 ml of the soil sample with 20 ml of water, allow it to stand overnight, then measure the pH.

Paper pH measuring and portable pH meters will not be as accurate as good accurate laboratory tests, although a few decimals either way doesn't matter. I've found the Westminster pH probe reliable, but check the meter every year in soils where you know the pH, and again whenever you suspect an inaccuracy.

When using paper or pH measuring meters, soil has to be moist or moistened with neutral water. Rain water pH depends on the carbon dioxide and sulphur contents, and is usually about neutral, but remember how acid rain killed trees in Europe.

Laboratory tests can be distorted if the soil sample is collected or treated wrongly, such as by taking insufficient plugs or leaving the sample in a hot car for a day.

Use a TELARC (official body) approved pasture analysing laboratory to calculate requirements, such as Hill Laboratories Ltd, 1 Clyde St, PB 3205, Hamilton, New Zealand. asl@rjhill.co.nz Ph

+64-7-858-2000.

If you've read all of GrazingInfo, you'll know that I think using pH is inaccurate for assessing lime requirements. I've written the above for doubters, consultants and students who have to answer questions in exams.

Rather than measuring pH, I again suggest putting your time into taking a spade and looking at your soils in the good and bad places, in chisel ploughed and not chisel ploughed soils, where more lime was applied, and less applied (corners), in sacrifice paddocks, pugged paddocks and non-pugged ones, under large clovers to check nodules and colours, etc. Count the earthworms, nodules, structure, drainage, smell the soil, etc., in each, and decide what to do to improve your soils. This is without using the flowery words organic theorists like, such as biology, ecology, bioag, etc., which without specifics are empty words.

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