

Calcium & Alkalinity Management

The new 1st priority to help ensure increased and ongoing Soil & Crop productivity.

A summary guide for Farmers and Consultants

Supporting our Farmers with their pressing Challenges:

Our modern Farmers have to be even more experienced and efficient to not only ensure productive survival in bad times, but also to maximise profitability in good times. This requires absolute input cost efficiencies for every ton produced, as well as reduced risks dealing with unpredictable weather and rainfall patterns, often on sub optimal lands.

To achieve this, we also need to quickly change our 1st priority focus from traditional NPK Nutrient input costs, to always fully evaluating, understanding and managing our soil Calcium and Alkalinity position, then planning for each crops minimum Calcium, nutrient **and alkalinity requirement**, crop to crop.

Only then can a realistic planning program, using both super quick reactivity and essential Calcium provision of Agri Nutrient Granules, together with the slow reactivity and placement restrictions inherent with traditional bulk liming practices, be undertaken.

Understanding the exponential acidity risk with reducing pH:

pH is measured on a logarithmic scale from 1 to 14, with 7 being neutral. A soil with a low acidic pH of 4 would have 10 x more acidity than one with a pH of 5 and 100 x more than a soil with a pH of 6 and 1000 x more than a soil with a pH of 7. Optimum for most plant growth would typically be 5.5 to 7.5.

In practical terms, (as can be seen in Fig 1 below) even with a seemingly small pH drop from 4.8 to 4.4, acidity increases by 2.5 times. More importantly even than a reduced NPK utility, this seemingly small pH drop to 4.4 (KCL) could also quickly move a particular soil into root toxic at just 2 -5 ppm Aluminium.

Figure 1, Exponential acidity increase, with only a small pH reduction.

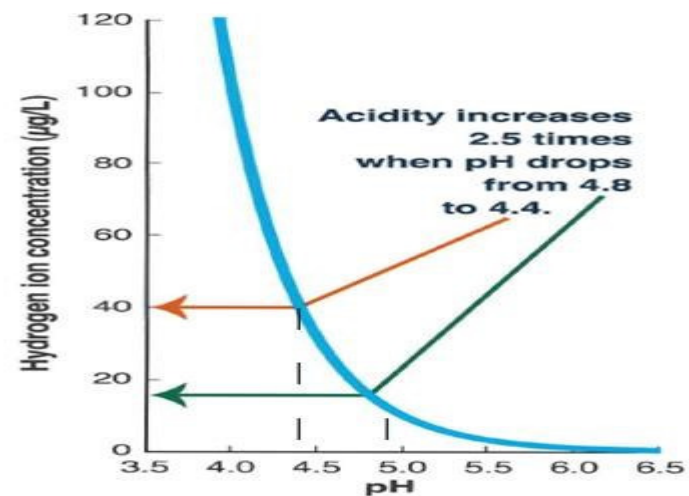


Figure 2, Not a pretty picture - Acid Subsoil profile, the universal pH indicator clearly shows in orange, the early acidic sub soil band, preventing any root access to deeper moisture and nutrient reserves below. (Ref: DAFWA).



An available Calcium shortfall together with an increasing soil acidity trap could be caused by a simple shortfall in previous years of bulk liming, together with inadequate time for the slow bulk lime conversion against an increase in land productivity with increased alkalinity also being removed off the land (in various crop and or animal production volumes being removed off the land).

In high productivity cycles or in winter rainfall production regions, the challenges of providing adequate time for traditional bulk lime applications to convert, with good moisture, to adequate available Calcium and Alkalinity reserves in the top soil and to then allow alkalinity to move through to the sub and deeper soil profile, is even greater.

(and without the traditional expensive luxury of allowing lands to lie fallow for long periods while this very slow traditional bulk liming process, is allowed to take place, during adequate rain and moisture entering the land.)

This soil acidity would also continue to increase with the use of ammonia type nutrient applications including DAP/MAP, and with Nitrate leaching. (Typically due to excessive rain periods where the crop cannot take up and utilize the available Nitrate levels provided).

Figure 3, Alkalinity removal guide as 100% Calcium Carbonate Kg equivalent per 1 ton of various farm produce removed from the lands x typical yield per Ha, to total as 90% CaCO₃/ha removed.

Product	CaCo3 as 100% (kg/t)	Crop Production (t/ha)	Total as 100% (kg/ha)	Total replacement ass 90% CaCo3 /ha
Wheat	9	3	27	30kg
Barley	8	3	24	26.7kg
Lucerne hay	60	20	1200	1080kg
Maize	43	7	301	334kg
Hay (mixed grasses)	30	10	300	333kg

If we do not have a reasonable Calcium and Alkalinity balance, with a reserve for the planned crop, we are more likely to find we are about to fall into a rapid soil acidity trap, even accelerated by our higher short-term productivity success and directly related Calcium and Alkalinity removal.

particle size of more than 50% of the particles are less than 32µm (<0.032mm), in an easy to measure and spread granule form, the speed and level of performance in providing **Alkalinity reactivity and Calcium availability of these super fine and Ultrafine particles are substantially more effective, dependable and predictable.**

To help understand this, we must compare the available particle within a single cm³ of a traditional bulk lime of being anywhere from possibly 30,000 to even 1,000,000 particles and the relative surface area of these particles compared to the Super Ultrafine particles of Agri Cal being more than 15,000,000 (15 million) and the tremendous increase in relative reactive surface area of these particles. As a simple analogy, the difference in the surface area of a room full of beach balls and tractor tyres, compared to massively increased surface area of a similar volume room full of golf balls and dried peas.

Not only can these dust-free Agri Cal Granule options be easily and accurately broad spread or placed above and within the planting zone, they can also be easily and accurately included and blended into the NPK nutrient mix to be broad spread.

While these 2 - 4mm Agri Granules are designed to be a dependably strong granule while dry, importantly they are also formulated to completely de-granulate within three (3) minutes of being fully exposed to water.

Where additional Magnesium is required, Agri Cal-Mag would be recommended, or Agri Mag-Sil where only Magnesium is required to re balance Calcium-Magnesium ratios.

Various Agri Cal-Sul Granules are also available where “over” Alkaline soils require additional Calcium and or Sulphur.

With the accurate placement and substantially faster reactivity options offered with Agri Nutrient Granules, **a quicker, optimised soil productivity can be achieved in weeks rather than years.** This then can help ensure the production of a cost effective current crop and also that a targeted Calcium and Alkalinity reserve can be built up between production cycles.

While the limited production of certain crops can still be made in soils with increasing acidity, the risks of failure will also increase unless Calcium Carbonate can quickly be made available for reasonable early root growth and alkalinity replacement.

Figure 5, as a rule of thumb, with a starting pH of 4.5, an expected pH adjustment, relative to soil types, with 1000kg of 100% Calcium Carbonate would be:

Soil Type	pH increase	pH Change from 4.5
Clay	0.2 – 0.3	4.7 – 4.8
Loam	0.3 – 0.5	4.8 – 5.0
Sand	0.5 -0.7	5.0 – 5.2

Remembering that while a clay type soil profile will have a higher buffering capacity and can be expected to hold a pH profile longer, it will also take longer, with more alkalinity to increase it up. Sandy soils will be more vulnerable to a rapid pH change, but will also be easier and quicker to bring back to higher levels.

Understanding the super productivity advantages available with the easy incorporation of Agri Nutrient Granules:

Establishing your current soil profiles:

If not already recently taken, establish and log a composite sample profile of your lands, between the three key soil bands:

- Top-soil (0 - 10cm)
- Sub-soil (10 - 20cm)
- Deeper-Soil (20 – 30/50cm)

Depending on your soil type and current profile/condition, minimum alkalinity targets can be set to achieve within the soil profile, within a reasonable time period, while still ensuring profitable cropping can continue.

Within a typical minimum pH target of 5.5pH (KCL) or greater in the top-soil and 4.8pH (KCL) in the sub-soil zone, the target must be to always ensure a higher Alkalinity reserve in the topsoil to enable excess alkalinity to continue to work down through the soil profile with available rain and moisture, to the Sub-Soil zone and deeper.

As the pH profile can be increased with substantially reduced soil Acidity levels, a more virtuous and sustainable loop of production can take place in the soil: Allowing more Calcium availability for good initial root growth, deeper root growth to access additional moisture and nutrient reserves reducing the risk of crop stress and even failure, during periods of moisture stress. With better NPK nutrient conversion availability and a reduced risk of unutilised nitrate leaching.

Figure 6, Targeting and Managing for a positive soil Calcium & Alkalinity loop.

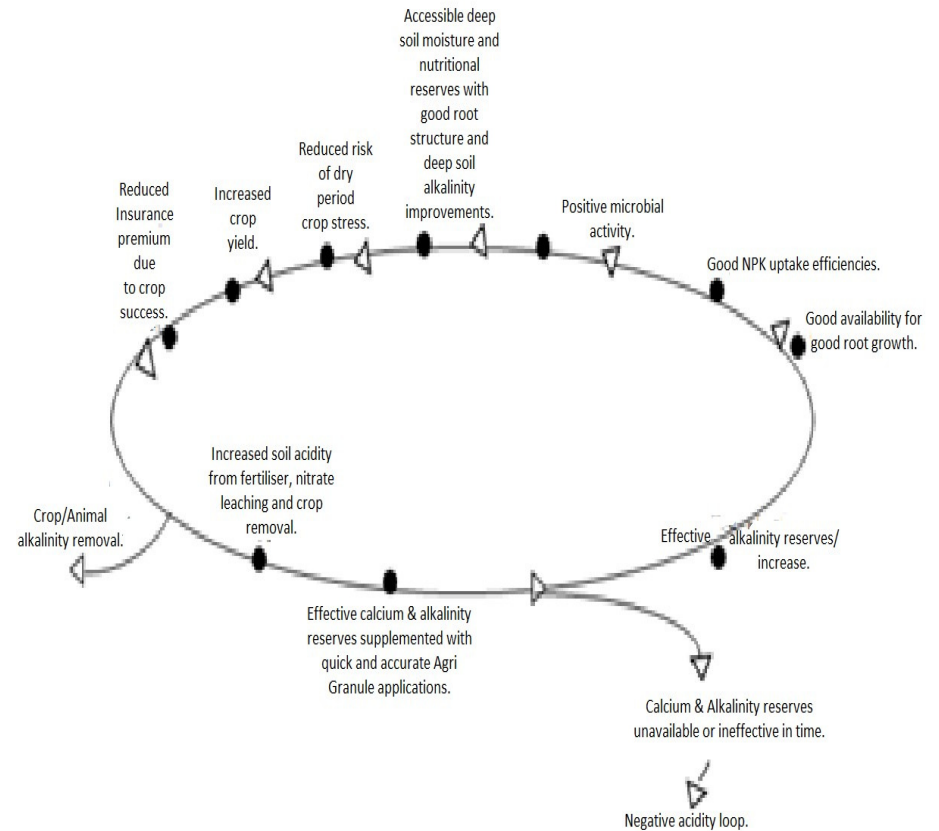
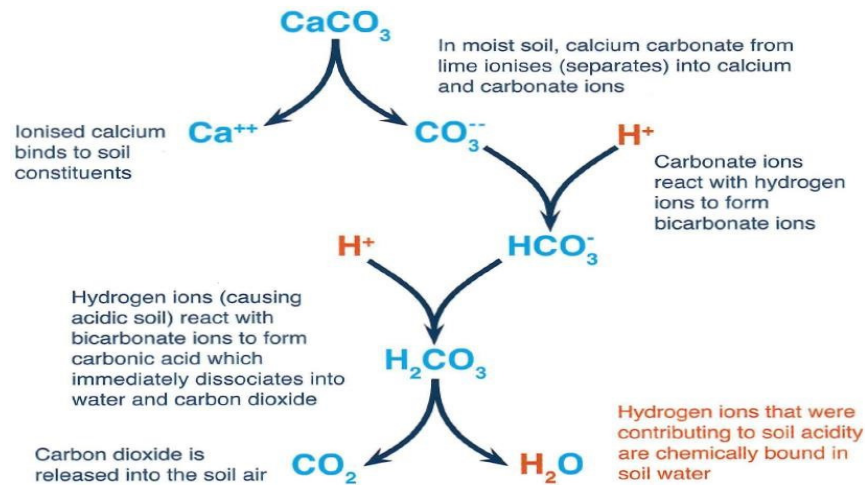


Figure 7, understanding the alkalinity, Acid balance as CaCO₃ is available with moisture in the soil to treat acidity (courtesy of DAFWA).



Alkalinity Management Realities, Evaluation tools and Recommendations:

Cost of Calcium & Alkalinity Management vs. cost of lost production efficiencies and Acidity risks over time:

Calculate both the high Interest cost and Capital cost of non productive or fallow land per ha, in time and lost crop contribution.

- e.g. @ a Land cost of R30000/ha and an interest rate of 12%pa, the annual carrying cost on Interest alone would be R7200/ha.
- The lost contribution would be the equivalent productive profit of other lands in the area.

Calculate the cost and difficulty and inaccuracy of deeper soil, bulk lime remediation and incorporation for quicker subsoil alkalinity recovery.

- An expensive time, diesel and equipment operation, but with measurable granule placing this could be justified if the land is also heavily compacted and would benefit from a deep ripping, or prior to establishing a “No till” cycle.

Calculate the full cost of lost productive crop volumes and or the NPK inefficiency values lost over the time required, with the cost and time factor of only using traditional bulk liming applications, before achieving more productive pH and reserve Calcium and Alkalinity:

- Taking into account, capital cost recovery of land and interest charge (or rental cost), plus comparable area production and profitability of optimised soils vs. actual NPK and input costs.

Calculate increased NPK input cost per ton of produce produced, until targeted 90-100% NPK conversion utility can be achieved:

- Using full crop input costs, including NPK % efficiency availability for the crop.

Calculate increased productivity and asset Value of both the land value per Ha and farming enterprise as a productive business.

- Important Bank evaluation year on year, for increased costeffective funding increasing operations and growth.

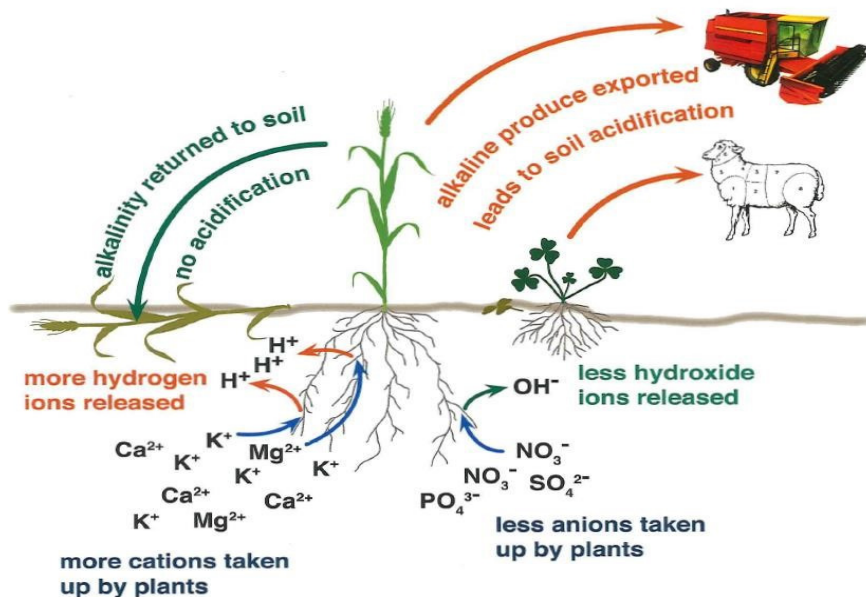
Reduced risk of future Crop moisture stress failure and reduced Cost of Crop Insurance premium, per ha.

- **Reputational and proven benefits of reduced risk to area for insurers.**

Calculate the cost benefits of utilizing super reactive Agri Cal and Cal-Mag Granules to ensure quicker Calcium and versatile Alkalinity options to meet minimum targets during Alkalinity remediation and for high productivity operations.

- **Accounting for the full profitability return and a better ability to reduce dry weather risk and to optimize the productive soil profile quicker between high productivity production and cover crops.**

Figures 9, Hydrogen ions added in the carbon cycle contribute to soil acidification (not the removal of base cations) (Ref: DAFWA).



Using traditional Bulk Agric Lime for Calcium provision & Alkalinity Remediation:

Provided Farmers have a reasonable access to quality sources of Bulk Agric Lime (with a CEE of +80% and with a particle size distribution of more than 50% being less than 0.250mm), that is regularly applied, at least every three years, this should continue to be incorporated as a long-term general remediation treatment.

However, for High Productivity operations, the effective conversion time factor will inhibit adequate Calcium provision or Alkalinity replacement through the soil profile with traditional Bulk Agric Lime and will require additional Alkalinity management interventions.

N.B. 1mt of Bulk Agric lime applied five years ago will typically be more valuable to the crop and soil profile than 5mt applied today!

Fig 10, Various 2- 4mm and 5mm Agri Nutrient Granules.



Cost-Effective Calcium & Alkalinity remediation options offering:

Quick, Easy and Accurate spreading & placement solutions using Agri Cal, Cal-Mag & Cal-Sul Granules:

- Pre-blended with the planned crop's NPK nutrient mix as an important Calcium or Calcium and Magnesium nutrient source in the Carbonate form to also help optimize the soil Alkalinity balance against continuous productive Alkalinity removal and acidic increases.

Broad spread to enhance and speed up the availability of top soil alkalinity reserves, to be available to move through to the sub soil and deeper levels during rain and good moisture.

- Placed above and within the root zone to help ensure a viable crop production, even while the general land pH and acidity levels are rectified over a few years, as can be afforded.
- Placed dust free and accurately over mature long-term crops. i.e. in pastures, sugarcane & Lucerne lands, sports fields, golf courses, forests, etc. for fast Alkalinity, Calcium and Magnesium replacement.
- Blended together and spread/placed with other Agri Granules for the inclusion of combined and differing Calcium / Sulphur /Magnesium ratios as may be beneficial to the productive root zone and particular Crop in production.
- Placed easily and accurately over no till and low till lands as well as sports fields, golf courses and winter wheat fields.

Please contact Amserve for any further details or on your closest Area Blender or Wholesaler.

“High Performance Agri-Nutrients & Soil Conditioners for High Performance Producers”

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