A 'second go' at pasture improvement on "Mt Somers", Neville

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Abstract: *I describe the recovery of my grazing land, which was 'sterilised' by years of superphosphate and legumes. On treated paddocks, applications of lime + gypsum have raised the pH and reduced the levels of aluminium ions in the topsoil and, with sufficient phosphate to stimulate legumes, the treated pastures and livestock have since thrived. I plan to continue this improvement on "Mt Somers" and take advantage of other opportunities. After consultations with colleagues, I record some ideas about why producers may follow various pathways to the future. Further research and demonstration work involving producers is needed on acid soil topics such as pH stratification and lateral zonation in topsoils, ion movement from topsoils into subsoil and a proactive approach to lime use.*

Key words: superphosphate, acid soil, lime, gypsum

Introduction

I grew up on a family farm comprising 280 ha of cleared land south-east of Neville, NSW (GPS co-ordinates 33.72800, 149.18418), purchased by my father in 1957. The soil type consists of red and grey granite and some shale at an elevation of 1000 metres. Mean annual rainfall is 800 mm. The farm runs SRS Merino ewes joined to White Suffolk rams, with replacement ewes are sourced from other growers. Upon completing my schooling, I worked for the NSW Soil Conservation Service for 5 years, before joining my brother in a business that maintained tractor/earthmoving equipment. When my father died in 1999, I took over "Mount Somers".

During the next 10 years, the standard program of farm improvement continued, topdressing with superphosphate and direct drilling grasses and legumes regularly to the 'improved' pastures (180 ha, with the remaining area comprising native pastures and woodland). However, by the end of the millennium drought (2002–2009) the soil on the 'improved' portion of my land (derived from granite, and previously used for grazing with occasional crops of oats or potatoes) had become 'sterilised' by cycles of plough-sow-fertilise. At that time, the pastures had reverted to silver grass and summer grasses. This account describes how my paddocks were returned to productivity.

A new approach

I was impressed with the improvement of an adjoining property that had been acquired by Des and Sally Green, who had implemented a program (described by Green and Wolfe 2017) of applying lime and gypsum in order to raise soil pH towards a target of pH_{Ca} 5.5, to remove exchangeable aluminium (Al3+) in the topsoil and to increase the levels of calcium (Ca) and sulfur (S) in the soil profile. I began implementing a paddock-by-paddock program, about 10 ha at a time, starting with a spring 2012 topdressing of 2:1 lime:gypsum at a total rate of 2.5 t/ha, followed by additional topdressing on the worst patches. Paddocks were sprayed with roundup in spring 2013 and again prior to sowing in autumn. The first paddock was direct drilled in May 2014 with phalaris (Australian Commercial and Landmark cultivars), Victorian ryegrass and subterranean clover (*Trifolium subterraneum*). I chose Trikkala sub-clover that belongs to the sub-species yanninicum (and later balansa clover, *T michelianum*), because my country was prone to waterlogging. At sowing, phosphatic fertiliser (DAP @ 80 kg/ha) was applied and since then there have been two dressings of high analysis P fertiliser + Mo. I have no particular system of grazing management beyond being careful not to overgraze the newly-sown pastures.

Results

The early results were promising enough to extend progressively this topdressing and sowing program to the cleared areas of my farm. At Neville, the years from 2012 including the drought year of 2019 were not as severe as elsewhere, and during the favourable years of 2016 and 2020 the pastures and stock thrived. On one paddock, I missed a scheduled re-

sowing after the lime + gypsum, but sufficient phalaris was evident after treatment for me to nurse that paddock along until the phalaris and clover content recovered. Another paddock of 10 ha, which was not much better than 'beach sand' a few years ago, has in 2020 maintained 204 ewes and their 279 lambs on a three to six-week rotation, with feed to spare. Areas of paddocks that were at one time waterlogged and were a trap for vehicles have 'dried up'. Occasional soil tests on my paddocks have confirmed the worth of lime + gypsum. The lime raises soil pH and reduces the proportion of aluminium ions in the topsoil. The gypsum is adding calcium, offsetting any soil sodicity and boosting the soil sulfur content, a limiting factor in building organic matter.

The rapidity and extent of the overall turnaround on my property from sterile soil to productive pastures has boosted my confidence in the future of my land. This confidence has spilled over into other pursuits. I now work, casually but regularly, implementing a similar plan of lime-gypsum-super on a neighbouring cattle property, while also supervising the livestock.

I now have 130 ha back in full production with 50 ha to go. My current plan at "Mt Somers" is to have one paddock ready for pasture, one paddock ready for a second spreading of lime/gypsum on the poor areas and a third paddock receiving its first spreading of lime/gypsum. This plan suits my farm cash flow situation but I am considering speeding up the rehabilitation of the remaining cleared areas on the property. The other advantage is we are cutting more wool and the lambing percentage has increased.

Discussion

Like me, many graziers on the tablelands and upper slopes have become frustrated with the failure of the 'sub and super' approach to pasture improvement, steering them towards beliefs along the lines of biodynamics, holistic grazing and regenerative farming. These approaches fail to deal with the underlying causes of poor productivity in the high-rainfall zone, causes that include soil acidity, low phosphate and low legume content (Hackney *et al*. 2019). Recently, I have been discussing (and thinking) with Des Green and Ted Wolfe about why many livestock producers on the upper slopes and tablelands seem slow to recognise the potential value of lime (and lime + gypsum) in correcting the problems of acid soils. One factor on grazing lands is that the feedback loop from thinking about an issue (e.g plant nutrition) to management action (e.g soil testing, apply fertiliser) and eventual payback (adding and selling livestock) is longer than on croplands (paddock selection, fallow, crop choice, sow, harvest, sell).

In my case, I was fortunate enough to have Des Green as my neighbour. With his many years of experience in rectifying acid soil and aluminium toxicity, he educated me in the application of top dressing with a lime and gypsum mix and encouraged me to apply his programme to my property. I found the feedback pathway relatively rapid, initially in terms of soil tests (confirming progress towards targets of a soil pH of 5.5 and near-zero aluminium levels in the 0–10 cm topsoil), along with the strong visual responses of my pastures and livestock. I am now aware that the scientific evidence (pulled together for me by Ted) supports what I have done. Virgona and Daniels (2010) advocated the importance of evidence-based decision-making in agriculture. Condon et al. (2019) assessed the current response of many growers and advisors to soil acidification as 'reactive'; they recommended a more pro-active approach to management (e.g., prevention rather than mitigation, higher lime rates) needed to reduce the extent of acid zones in the topsoil layers and inter-row spaces, and to reverse or prevent subsoil acidification.

In conclusion I encourage further investment in research and demonstration work to fine-tune the knowledge bank of scientists, advisors and producers on acid soil issues targeting issues such as pH stratification, lateral zonation in topsoils, ion movement from topsoils into subsoils, the proactive approach to lime use and the suitability of various soil types to lime + gypsum mix.

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