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PASTURES &GRAZING NSW

SPRING NEWSLETTER

Volume 36 – Issue 1, September 2024

THRIVING WITH SHEEP IN THE MONARO REGION

The McGufficke family's expansion and consolidation of its grazing and sheep operation

SUBSURFACE ACIDITY NOT A PROBLEM!

Have you checked?

RESEARCH UPDATE

Keeping you up-to-date with the latest pasture and grassland research in Australia

IN THIS NEWSLETTER

> Pastures & Grazing NSW has a vision to bring together producers, agronomists, agribusiness firms, animal scientists and teachers of agriculture to review and exchange high-quality information of relevance to grassland farming.

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From the Chairperson

Welcome to the relaunch of our newsletter, which I trust you will enjoy and find useful for your business. The newsletters will be available on our website as they were previously. As an introductory offer, they will also be available to all this year. To receive the newsletter, you only need to ensure we have your email address, so contact our Executive Officer by email via admin@pgnsw.com.au.

At the Special Meeting of members on 20 December 2023, the meeting voted on renaming the organisation to Pastures & Grazing NSW and changing the constitution accordingly, to a more manageable and sustainable operation. These motions were carried.

Since this meeting, the Board has been busy working on a new website, revamping the newsletter and working with government departments including the Australian Securities and Investments Commission (ASIC), Fair Trading, and Australian Charities and Not-for-Profits Commission (ACNC).

Our name has changed but our vision and objectives remain the same. Our Vision is: "*Pastures & Grazing NSW has a vision to bring together producers, agronomists, agribusiness firms, animal scientists and teachers of agriculture to review and exchange high-quality information of relevance to grassland farming*". Our Objectives are: "*To be a conduit of reliable information that is science based, to initiate and coordinate action for producers and the community to manage, maintain and improve the pasture feedbase in NSW for both production and sustainability. The dissemination of accurate and timely information to facilitate an improvement in grazing systems, and to provide opportunities for discussion between researchers, advisors and producers*". We have also written a strategic plan and this will be published on our website.

I would like to introduce our new Editor of the newsletter, Jonathan McLachlan. Jonathan is a Lecturer in Pasture Science and Grazing Management in the School of Environmental and Rural Science at the University of New England.

Carol Harris, Research Scientist, NSW DPI was our last editor. Carol took over from Haydn Lloyd Davies in 2009 and was the editor up until 2021. I would like to thank and personally recognise the outstanding commitment Carol made to the Grassland Society as Editor of the Newsletter for 11 years; the longest serving Editor for the Society. A survey of members a few years ago put receiving the newsletter as a high priority for being a member. On behalf of the Board – well done, Carol!

Mick Duncan, who served as President of the Society for nine years, was presented with life membership at a small function at the Armidale Bowling Club on 29 April 2024. Margaret, Mick's wife, was also presented with a bouquet, for loaning Mick to the Society for 9 years.

Our Secretary, Janelle Witschi, who had been with the society for 16 years, was farewelled and her contribution recognised at a function in her honour, at the Parkview Hotel in Orange on 29 May 2024. I would like to introduce Anne Baker as our Executive Officer (replacing Janelle). Anne brings to the table skills in event management, social media and website management. Welcome Anne.

This year, I will be putting a motion to the new Board to consider the reintroduction of our biennial conference. This sets us apart from other organisations, where 50% of the presentations are from grassroots, practising producers.

Pastures & Grazing NSW will continue to be involved in pasture updates with NSW LLS and Agribusinesses across NSW. We anticipate the relaunch of the publication '*Pasture Varieties used in NSW*' either late this year or early in 2025. This publication was originally produced by the NSW DPI, with the last edition being 2012-2013.

Once again, welcome to the relaunch of our newsletter.

Lester McCormick
Chairperson

Editor's Note

Welcome to the first Pastures & Grazing NSW newsletter for 2024. As the new editor, I look forward to providing you with interesting and relevant information about grassland farming.

The newsletter has been re-branded and re-formatted since the last issue in 2021, in line with the changes that have been undertaken to Pastures & Grazing NSW over the last year. However, the purpose of the newsletter and the content included will largely stay the same. This includes research articles and reports, interesting stories, summaries of recent events, and highlights of relevant publications (both recent and historic).

As always, we value your input. If you have something you would like to contribute to an upcoming newsletter, feel free to send me an email at editor@pgnsw.com.au. I'm happy to receive something you have already prepared, or discuss and plan future contributions.

In this issue of the newsletter, we unveil our new website (see below) and there are two interesting articles; one that describes a leading Monaro grazing enterprise (Page 5) and the other that focuses on subsurface acidity (Page 10). There is also a short article that describes how to conduct a simple field check for subsurface acidity (Page 14).

Going forward, we plan to publish the newsletter quarterly – at the start of Spring, Summer Autumn and Winter. The deadline for submission for the next newsletter is 15 November 2024.

Jonathan McLachlan
Director/Editor

Unveiling our new website

We are proud to announce the launch of Pastures & Grazing NSW's redesigned website, which is now live and located at https://www.pgnsw.com.au.

The new website was rebranded in line with our name change and designed to be faster than before, easier to navigate (with improved security), and more user-friendly. You'll find updated and detailed information about our organisation, access to the science-based grasslands information you've come to rely upon, such as past conference proceedings and newsletters, upcoming field days, and other functions via our events calendar, and some new features – 'Ask an Expert' and 'Success Stories'.

If you've got a burning question about grassland farming, use the 'Ask an Expert' contact form, and you'll hear back from one of our Board members or a suitable industry professional within our network with the answer. We'd also love to hear from you about your recent wins in grassland farming via the 'Success Stories' contact form. Perhaps you've had a brilliant season, and your proactive management has paid off. Whatever it is, please consider sharing it with a brief comment or description (and don't forget photos)!

We hope you enjoy exploring the new site, and if you have any questions or feedback, feel free to contact us.

Thriving with sheep in the Monaro region

Alan McGufficke, Michelle McGufficke, Mark McGufficke, Karen McGufficke and Ted Wolfe
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Abstract

We describe an expansion and consolidation of the grazing area and sheep flock of the McGufficke family partnership, as an example of best-practice family leadership, farm management and risk control in the challenging environment of the Monaro region. The course of this family partnership over four generations towards recent business expansion, and the management principles underpinning its success, are explained. With tertiary education a feature of the fourth generation of this family of specialist fine wool growers, members of the McGufficke clan look forward to a continuation of productive partnerships and good decisions.

Key words

pasture improvement, direct drilling, grazing, soil type, Merino sheep, Australian Sheep Breeding Values (ASBVs)

Introduction

The Monaro tableland region (including the Counties of Beresford, Wallace and Wellesley; 600-1200 m elevation) is defined by an extended winter (the coldest agricultural region in Australia), relatively treeless grasslands that are too stony for arable agriculture, and the influence of the Snowy Mountains. The mountains create an easterly 'rain shadow' area of 480-700 mm annual rainfall and a rainfall pattern that is summer-dominant but statistically variable. Hancock (1972), when describing the region's geography and social history, referred to the journey from Moss Vale in 1823 of an exploration group led by the British explorer Captain Mark Currie, whose party encountered a group of Ngarigo people, the generational occupants of the country they called 'Maneroo'. From a hill north of present-day Cooma, Currie observed the distant mountains and the distinctive landscape, noting that the 'downy country' was "tolerably well-watered, the hills stony and the soil sometimes good". Successive waves of new families and livestock soon followed. Landmarks in the economic development of sheep and cattle production in the region included the establishment of the principal towns of Cooma (surveyed in 1840) and Bombala (~1850), their connection to the NSW railway system (Cooma in 1889, Bombala in 1921), accelerated pasture improvement and livestock expansion during the 1950s based on pasture legumes and superphosphate fertiliser, and better roads that were in part built for the Snowy Mountains Scheme (1949-72). Man-made problems included rabbits, overgrazing and soil erosion (which peaked in the 1940-50s), the closure in 1967 of the high-country 'snow leases' that were used as summer pastures by Monaro graziers, and the reserve price scheme for wool that began in 1970 and collapsed in 1991 (Abbott and Merrett, 2019).

Above: Miranda and Alan scanning sheep

The McGufficke family have operated a fine wool business dating back to 1929, when grandfather Harry McGufficke purchased the original 350 ha sheep farm "Greendale", 9 km south of Cooma. By 1990, through a combination of hard work and astute decision-making, Harry followed by his son Greg had expanded this block to 2200 ha (including the

home base of "Willarney"), comprising naturally cleared country on a mix of soils derived from basalt (20%) and granite. A further 240 ha was purchased in 1988 at Rocky Plain, between Lake Jindabyne and Lake Eucumbene west of Cooma. Seeking to ease back at this time, Greg McGufficke progressively passed over the control of these properties to his two sons, Alan and Mark. These young men had by then acquired the work ethic, acumen, experience and skills of long-standing Monaro grazing families. In this paper, their pathway over the next 35 years is traced, their learnings and current standing recorded, and possible opportunities for the family in the years to come assessed. This is their story.

Ambition based on harmonious partnerships

After a 360º review of their situation, Alan and Mark soon realised the relatively healthy situation of Monaro specialist woolgrowers, who had endured unusually difficult times during the 1970-90 period, brought about in part by high interest rates and an over-supply of wool. Although the future of the Australian sheep industry appeared dire due to the then stockpile of 4.5 M bales of unsold wool, the future offered hope for Monaro fine wool producers once the rapid decline in total sheep numbers in the fat lamb districts (high-rainfall tableland and upper slopes), the wheat-sheep belt (non-specialist, mixed farming) and the semi-arid pastoral zone, had run its course. At that time, a similar decline was forecast to occur in bank loan rates, which peaked at 17% in early 1990. Schooled by their parents on the importance of forming harmonious partnerships to deal with 'life on the land', and inspired by several notable farm families nearby, Alan and Mark began with a conviction that they could meet most of the needed labour for the management of their land and livestock (including shearing), maintain a conservative and disciplined approach to stocking rates and the costs of production, and await better returns.

Since 1990, the partnership has proceeded in three directions. The confidence and lifestyle of the brothers improved with marriage to resilient, reliable and employed partners, Alan to Michelle (nee Schofield) in 1998, and Mark to Karen (nee Daly) in 2000 – the first direction (family). Enduring elements of the expanding McGufficke family included their ongoing enthusiasm for the Merino industry and the Monaro landscape, along with adherence to the basic principles of good teamwork (shared planning and decisions making, work and discussion), so that their 'intergenerational partnership' has included not only the second patriarch Greg but also the children of Alan/Michelle and Mark/Karen (three in each family – more on this matter later).

Expansion and consolidation of pasture resources

After more hard work over the ensuing two decades, discipline in relation to actual and projected cash flow, and support from commercial and banking relationships, opportunities emerged for further property acquisitions, the second (business) direction of the partnership. Additional land purchases occurred in 2003 ("Idaho" at Bungarby, south of Cooma, 1215 ha, basalt), in 2011 (a block at Murrumbucca, north of Cooma, 650 ha, mainly basalt), and in 2017 the important acquisition of "Murlingbung" (at Middlingbank, north-west of Cooma, 1300 ha, predominantly granite). These additions all comprised properties that represented a combination of slightly higher rainfall than at "Greendale", and they were in different directions on all-weather roads radiating out from the central location of "Willarney". Geographically, Mark McGufficke and his family spend more time on the Murrumbucca and Murlingbung properties, with Alan and his family concentrating on the central core of Greendale, Willarney, Idaho and Avon Lake. However, both brothers and their family members move quickly to where the work needs to be done. Growing up, their children learnt to observe and emulate how much food their fathers ate at breakfast, an indication of the duration/amount of work to be accomplished that day.

When the properties were acquired, they ranged from semi-improved to productive. On occasions, soil tests (for pH, P, S, Mo and available cations) were taken to ascertain the plant nutrient status and time-trends in the soil profile in key paddocks. These semi-improved pastures have since been successfully direct-drilled with combinations of subterranean clover, phalaris, lucerne and ryegrass (depending on the paddock and property), preferably in early-mid autumn after the application of glyphosate herbicide, an essential tool in the Monaro toolbox. No evidence has occurred yet of legume nodulation problems or pasture growth limitations due to a combination of low soil pH (pH_{Ca} < 5.0) and toxic aluminium ions on the cation exchange, which became such a problem on the southern slopes (Scott *et al.* 2000) and the central slopes of NSW (Cook 2021). These constraints are generally relieved by lime, with or without gypsum. The presence of basalt influences and the early introduction of deep-rooted perennial pasture species have possibly helped the partnership avoid this soil malady, which is induced by loss of nitrogen from the uppermost soil layers. However, from a legume nodulation survey of 225 paddocks on the Central Tablelands, Monaro, Central West and Riverina regions (Hackney *et al.* 2019a), the incidence of low soil pH on the Monaro (42%) was comparable with the values from other regions (38-47%), and high exchangeable aluminium levels (% of the cation exchange capacity - %CEC) were evident at some sites (the frequency distribution was not given for aluminium levels). Fortunately, none of the McGufficke farms apparently had areas that were as hostile to the persistence of lucerne, phalaris and subterranean clover as the exposed, drier northerly-aspect sites evaluated in a nearby paddock trial south of Berridale by Hackney *et al.* (2019b), where these sown species failed. The only survivor 12 years after seeding the trial was the harsh native, tall speargrass (*Austrostipa scabrum*), which reinvaded the site – areas dominated by this grass may be difficult to redeem.

On the McGufficke farms, fences are regularly maintained or occasionally realigned, but there is no formal pattern of rotational or continuous grazing. Vigilance is maintained to observe and control, within manageable levels, any of the primary weed threats including serrated tussock (*Nassella trichotoma*), burrs, blackberry and thistles, plus a particular watch is kept for signs of any build-up of indigestible African lovegrass (*Eragrostis curvula*).

The Greendale Stud

The third direction taken by the McGufficke family partnership entails the establishment and development of a fine wool Merino stud, Greendale Merinos (see www.greendalemerinos.com.au and Facebook). The stud provides clients with a source of rams bred primarily for wool fineness and fleece weight. For the family, the stud satisfies many requirements – diversification, cash flow, innovation and family involvement. For 35 years, Greendale Merinos have entered sheep in more than 20 production and profitability trials conducted across NSW. Over the past 13 years, the simple but effective genetic technologies (Australian Sheep Breeding Values) embraced within MerinoSelect (Australian Wool Innovation) have directly guided the mating and culling decisions made by the partnership.

The stud operates within a commercially-focused Merino flock of 15,000 sheep, all managed according to the traditional Monaro milestones of joining in April, lambing in September, weaning in December and shearing in June-July. The brothers annually join 8,500 ewes and select from this ewe base to determine the nucleus breeding flock of 1000 ewes. The sheep, both stud and commercial, are grazed on improved pastures with the only regular supplement being silage made from excess pasture growth in Spring.

The children from both families have learnt the operation of the farm and stud, and this involvement has influenced the educational pathways of the fourth generation. All three daughters of Alan and Michelle proceeded on to tertiary education at the University of New

England (UNE) – at the time of writing, Florance has completed a double degree in Agriculture/Business and is now working with Elders Dubbo as a Stud Stock Sales officer, her sister Miranda is in the final year of her degreein Animal Science (with a strong focus on genetics), while Ivy is now in the second year of a Business degree (majoring in Agriculture/Marketing). In Mark and Karen's family, James has graduated from an Arts/Business degree at the University of Wollongong majoring in Sociology and Marketing, Lach is in the second year of his Bachelor of Agribusiness at UNE, and Elle is completing year 12 at Kinross.

Above: Ivy drenching sheep

Looking forward

The McGufficke family story is but one of several that could be told of successful Monaro grazing families. They are grateful to their trusted colleagues and business partners in the local sheep industry, who offer and share useful ideas. In return, the family participates in and contributes to their industry and the local community. For example, Alan took a turn as a Board member of Monaro Farming Systems for a four-year term around 2010 and, in 2024, Miranda is the Vice-Chairperson of the UNE Farming Futures committee. Some of the technological tools that have assisted the partnership during the past 30-35 years are the use of glyphosate, one-pass direct drilling of pasture species, quantitative sheep genetics (ASBVs) and DNA testing.

Greg McGufficke moved into Cooma over 10 years ago and sadly passed away in May, 2024. The standout feature of the success enjoyed by the McGufficke family partnership has been the harmony within the family to discuss and plan their progress, and their ability to work hard together to build their commercial woolgrowing and stud enterprises. What of the future? Alan McGufficke has reflected on the need to continue the current focus on their core sheep businesses and to keep things simple. However, the partnership will inevitably become more complicated for the fourth generation than it was for the earlier generations, but new partners may also bring new opportunities. One idea worth consideration is to improve the strength of the partnership in soil science and plant nutrition, to match the level evident in property, livestock, stud and financial management. A program of systematic soil testing on the properties, to investigate the potential constraints in the surface layer (0-10 cm, pH_{Ca} and soil nutrient status) and in the next layer (10-20 cm zone, pH_{Ca} and composition of the soil cation exchange capacity), may lift the productive capacity of their soils to sustain additional sheep.

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Below: Summer haymaking

Subsurface acidity not a problem! Have you checked?

Helen Burns[1], Jason Condon[2], Nick McGrath[3]
[1]NSW Department of Primary Industries, [2] Charles Sturt University, [3] Holbrook Landcare Network

Key messages

- The pH of soil collected from the traditional 0–10 cm sampling depth provides unreliable data and insufficient information to effectively manage acidity.
- Analysis of samples from 5 cm increments, collected to a depth of 20 cm, indicates the depth and severity of subsurface acidity and informs management programs.
- Based on the soil pH of 5 cm increment samples, 78% of sites would be prioritised for lime application, compared with 39% if the pH of 0–10 cm samples were considered.

Introduction

Accurate assessment of the depth and severity of acidic layers is essential for developing effective and targeted acid soil management strategies. This informs appropriate lime rates and application method, the role for acid tolerant species, and the timeframe to achieve objectives. Recent studies indicate that inaccurate assessment of soil acidity status, based on traditional soil sampling protocols, has led to underestimation of the seriousness and extent of the 'acid soil problem' in productive agricultural soils of southern NSW (Condon *et al.* 2021).

A survey of soils from commercial paddocks in the mixed farming zone of central and southern NSW, which examined the soil pH of samples collected in 5 cm increments, identified previously undetected subsurface acidity in layers between 5 and 15 or 20 cm (Burns *et al.* 2018a), even in paddocks with a long history of lime application. This study highlighted flaws in acid soil management programs that rely on pH and exchangeable aluminium (Al_{ex}) analyses of soil collected from the traditional 0–10 cm sampling depth.

Producer interest in revising their acid soil management programs in perennial pasture-based systems prompted Pastures & Grazing NSW to invest in a project with Holbrook Landcare Network and NSW Department of Primary Industries, under the Federal Government's National Landcare Program. This project aimed to; (i) understand the extent and severity of subsurface acidity on the Central and Southern Slopes of NSW, and (ii) update acid soil management guidelines. It involved two components:

1. A soil survey of 62 sites in commercial paddocks supporting perennial-based pasture systems.
2. Establishment of large-scale, acid soil management sites, monitoring change in soil chemical properties under differing lime rate and application options.

Soil survey – what we did

The 62 sites that were surveyed represented soils supporting productive perennial pastures and/or crops of mixed farming systems in the medium to high rainfall zone of NSW, between Albury and Cumnock. The soil pH data from these sites were combined with data from another 42 sites in the project area (Burns *et al.* 2018a).

The sites represented the regions' main soil types, with effective cation exchange capacity of ~4–14 cmol (+)/kg. Liming history varied from nil up to four applications of fine grade lime over 25 years.

At 63 geolocated sites, soils were sampled in 2.5 cm increments to a depth of 15 cm, then from 15–20 cm and 20–30 cm. At the other 41 sites, soils were sampled in 5 cm increments to a depth of 20 cm. Soil was collected at 20 random locations within an area of approximately 100 m^2 and combined into one sample for each designated depth.

Results and Discussion

The mean pH for 0–5 cm, 5–10 cm, 10–15 cm and 15–20 cm layers was calculated by averaging the pH of the 2.5 cm increment samples to combine with the pH of the 41 sites. The pH of the 0–5 and 5–10 cm layers was then averaged to give an equivalent soil pH for the 0–10 cm layer for all sites, to mimic traditional sampling depths.

The conventional approach to acid soil management is based on the false assumption that pH analysis of 0–10 cm soil samples is an indicator of the acidity status of soil experienced by plant roots. In reality, soil pH is stratified and, like many other soil properties, varies with depth.

Traditionally, paddocks are not prioritised for lime application if soil tests of 0–10 cm samples return pH_{Ca} >5.0. Lime application is usually triggered when soil pH_{Ca} values are below 4.5–4.8, with lime rates often just enough to raise pH_{Ca} in the surface 0–10 cm to ~5.2. This approach assumes that when pH_{Ca} >5.0, the concentration of toxic Al_{ex} which plant roots experience is below critical toxicity levels for most species, and by applying sufficient lime to increase a pH_{Ca} of the 0–10 cm sample to a target of 5.0–5.2, soil acidity is 'under control' and production limitations caused by soil acidity are minimised.

Soil pH of 0–10 cm samples mask a deeper issue

Based on the pH_{Ca} of the 0–10 cm sampling depth, sites were grouped to simulate the traditional approach used to develop acid soil management programs (Table 1). Sites in Groups 2 and 3 are typical of soils that support the project area's most productive farming systems.

Group 1 includes sites with 0–10 cm pH_{Ca} <4.8; the trigger to prompt a liming intervention. On this basis, 41 (39%) of the 104 sites sampled would be prioritised for lime application.

The 29 sites (28%) in Group 2 with pH_{Ca} 4.8–5.2 may receive a lime application, depending on future rotations and the managers' approach to acid soil management.

The 34 sites (33%) in Group 3 recorded pH_{Ca} >5.2. This suggests that these sites either have inherently high soil pH and no existing acid soil problems, or have had a recent lime application. The soil pH is above the critical value and acidity is being effectively managed.

TABLE 1.

The mean soil pH_{Ca} of 104 field sites from central and southern NSW, grouped according to critical pH values of 0–10 cm soil samples, assuming a uniform soil pH. Group 1 (n=41) pH_{Ca} <4.8; Group 2 (n=29) pH_{Ca} 4.8–5.2; and Group 3 (n=34) pH_{Ca} >5.2.

DEPTH (CM)	0–10
GROUP 1 (N=41) $PH_{CA} \leq 4.8$	4.5
GROUP 2 (N=29) PH_{CA} 4.8-5.2	5.0
GROUP 3 (N=34) PH_{CA} >5.2	5.6

Subsurface acidity revealed in 5 cm increment samples

Regrouping the sites according to the soil pH_{Ca} of samples collected in 5 cm increments revealed variability of soil pH with depth and acidic subsurface layers (pH_{Ca} <4.8) in 78% of the sites, and therefore these would likely be prioritised for lime application.

Figure 1 shows the breakdown of sites based on the pH of the most acidic layer that was sampled: 30% were severely acid (pH_{Ca} <4.5); 48% moderately acid (pH_{Ca} 4.5–5.0); 13% slightly acid (pH_{Ca} 5.0–5.5) in all layers; and 9% with pH in the optimal range (pH_{Ca} >5.5) in all layers. The 30% of sites (n=31) with severely acidic subsurface layers below 5 cm (pH_{Ca} <4.5) should be prioritised for lime application.

Most of these sites are acidic to depth. Effective management of such soils needs accurate assessment of the pH profile to develop long-

term, targeted strategies to address deep acidity. Such detail guides lime application rates, application method(s), the role for acid tolerant species, and likely timeframe to achieve objectives.

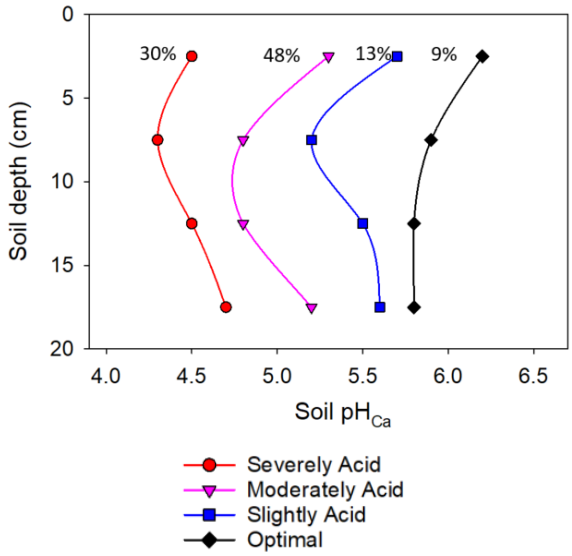

FIGURE 1.

Mean soil pH_{Ca} of 104 field sites in central and southern NSW, grouped according to the lowest pH value in layers between 5 and 20 cm. 30% severely acid (pH_{Ca} <4.5); 48% moderately acid (pH_{Ca} 4.5–5.0); 13% slightly acid (pH_{Ca} 5.0–5.5); and 9% in the optimal pH range (pH_{Ca} >5.5).

All 48% of sites (n=50) classed as moderately acidic had a pH_{Ca} of 4.5–4.8 in layers between 5–15 cm, and increasing with depth. This distinctly stratified soil pH profile is typical of the regions' productive soils with a history of traditional liming programs that targeted pH_{Ca} of around 5.2 in the 0–10 cm layer. The elevated pH in the 0–5 cm layer (Fig. 1) is common where lime is surface-applied and incorporated by sowing.

Analysis of the pH of 0–10 cm soil samples from these sites suggest that the liming programs are working. However, previous studies (Burns *et al.* 2018a) highlighted that although the 0–10 cm soil sample indicates pH is maintained within the critical range with lime rates targeting pH_{Ca} ~ 5.2, analyses of 5 cm increment soil samples reveal that the lime remains concentrated in the surface layer. Lime inputs have been inadequate and have had minimal influence on pH in subsurface layers below 5 cm. Acidification has not been checked in the subsurface layers and soil pH is likely to be declining.

Such sites are at greatest risk of poor acid soil management decisions unless the pH of 5 cm increment soil samples are considered. Based on the pH of 0–10 cm soil samples, elevated pH in the 0–5 cm layer caused inaccurate assessment of pH status in 40 moderately acid sites of the 50 allocated to Group 2 (Table 1). The pH of the subsurface was over-estimated and the acid throttle at 5-15 cm was not detected.

The 13% of sites (n=14) with slightly acid pH profiles (pH_{Ca} 5.0–5.5 in all layers) are generally considered free of acid soil issues. However, these highly productive soils can have high acidification rates. Over-time, subsurface layers will acidify and trend toward the moderately acid profile. Such soils should be included in soil test monitoring programs so that actions are initiated before the pH of subsurface layers declines to levels that reduce plant productivity and soil condition.

Updated guidelines for effective, targeted acid soil management of subsurface acidity across the range of depths and degrees of severity shown in Figure 1 is an outcome of Component 2 of this project. The influence of lime rate and application treatments on soil pH and Al_{ex} to a depth of 30 cm, 3 years after treatment application, will be reported in the next P&G NSW newsletter.

Conclusions

Our experience indicates that undetected subsurface acidity is widespread, extending well beyond the study area. Analyses of the pH of soil collected at the traditional sampling depth of 0–10 cm will not detect subsurface acidity. This sampling technique has resulted in over-estimation of soil pH and poor liming decisions, which have not prevented decline in soil pH in

layers below 5 cm. Analyses of soil samples collected in 5 cm increments provide accurate soil pH data to inform effective acid soil management strategies.

Understanding the pH profile of the subsurface layers allows customisation of acid soil management strategies at the paddock and zone level, including paddock prioritisation, and decisions on lime rates, application method, the role for incorporation and species selection.

Analyses from a single sampling event provide point-in-time measures. A monitoring program that tracks changes in pH of soil samples collected in 5 cm increments, every 2 to 5 years, will inform the effectiveness of acid soil management efforts, prompt necessary adjustments to application rates or application methods, and guide re-liming events. ✾

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Simple field checks for subsurface acidity

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There is pushback from producers and advisors about the time and cost of collecting and analysing soil samples in 5 cm increments. Armed with a spade or soil probe and soil pH kit (available from most rural or garden supply centres), it is easy to quickly check for the presence of acidic subsurface layers in underperforming paddocks or zones. The video 'A rapid check for subsurface acidity in the field' (with soil pH kit): https://www.youtube.com/watch?v=01BQbHhEh8o&t=3s provides tips on confirming the presence of subsurface acidity within minutes.

Winter and early spring is the ideal time to link poor plant performance and subsurface acidity by digging up plants with intact roots and aligning roots to pH profiles, as shown in Figure 1.

This means the time to act is now!

If subsurface acidity is detected, follow-up analyses through an accredited laboratory is recommended for accurate assessment of the soil pH profile. Soil testing costs can be minimised by limiting analyses to pH and exchangeable cations (including aluminium) for 5 cm increment samples to a depth of 20 cm. Adding Colwell P analysis for 0–5 cm and 5–10 cm increments is also advisable.

The video 'Accurate soil sampling to 20cm in 5cm intervals' (using soil corers): https://youtu.be/3KiS2P09KuY presents the pros and cons of various sampling methods when collecting samples for analysis.

FIGURE 1.
A check with a soil probe and soil pH field kit shows the pH profile of soil from areas of good (left) and poor (right) lucerne growth. The results indicate subsurface acidity as a likely cause of stunted roots and lack of nodulation. Purple to green colour in the left core indicates soil pH_{Ca} >5.0 to a depth of ~10 cm where lime was incorporated, whereas topdressed lime did not increase pH_{Ca} above ~4.0 (yellow) below 5 cm in the core from the poor area.

Research Update

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Forage brassicas can enhance the feed base and mitigate feed gaps across diverse environments

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Abstract

Context

Spring-sown forage brassicas are commonly used to fill feed gaps in high-rainfall temperate livestock systems, but they have wider potential as an autumn-sown forage in drier environments within Australia's crop–livestock zone.

Aims

We modelled the production potential of autumn-sown forage brassicas grown in diverse environments and tested their ability to alter the frequency and magnitude of feed gaps.

Methods

Long-term production potential was simulated in APSIM for four forage brassica genotypes, compared with forage wheat and dual-purpose canola across 22 diverse agro-climatic locations. For seven regions, the change in frequency and magnitude of forage deficits from adding forage brassicas to representative forage–livestock systems was predicted.

Key results

Across locations, median yields of forage brassicas ranged from 7 to 19 t DM/ha, and their annual metabolisable-energy yield was higher than that of forage wheat at most sites and nearly always exceeded dual-purpose canola. Forage brassicas performed better than forage wheat in later-sowing events (late April to early May) and maintained growth and quality later into spring. At five of the seven regions, adding 15% of farm forage area to forage brassicas reduced the frequency and magnitude of feed deficits by 35–50% and 20–40%, respectively. However, they were less beneficial where winter–spring feed gaps are uncommon.

Conclusions

We demonstrated that autumn-sown forage brassicas can be reliable and productive contributors to the feed base in drier environments and are a suitable alternative to forage cereals.

Implications

Forage brassicas can help reduce feed gaps and improve livestock production in a range of production systems spanning Australia's crop–livestock zone.

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Next Newsletter

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