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Free-enterprise farming on grasslands in central NSW, Australia

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Abstract

A pathway is described in developing and improving the pastures on family-owned sheep and beef properties at sites near Blayney in central NSW. Initially, the twin approach of sowing perennial grasses, predominantly phalaris (*Phalaris aquatica*) with subterranean clover (*Trifolium subterraneum*) plus the recommended addition of superphosphate fertiliser, was closely followed but within a decade ill-thrift in pastures and livestock occurred. Once the core problem of soil acidity was recognised, steps were taken to overcome this constraint with applications of lime. However, an additional modification involving the application of gypsum with lime had to be sorted out and applied. This approach is explained. While recent drought conditions on the Central Tablelands/Slopes have been a factor in reducing the productivity of district pastures, an important part of the problem is a consequence of many landowners not understanding the basic principles of plant and livestock nutrition, an unwillingness of some research/advisory agronomists to recognise the expertise of successful producers, and the implementation of various farmer subsidy and support schemes that appear to reward dependent producers rather than encouraging independence.

Key words: lime, gypsum, calcium, phosphorus, phalaris, subterranean clover, weed control

Introduction

In 2017, Des Green’s life amongst grasslands was summarised (Green and Wolfe 2017) for the biennial conference of Grasslands Society of NSW, which is a premier organisation in Australia for the transfer of information and technology relevant to pasture, grazing and land management. The aims of the Grasslands Society are to advance the investigation of problems affecting grassland husbandry and to encourage the adoption of results of research and industry experience. Since its inception in 1985, membership has grown to a plateau of over 500 members, most of whom are farmers and graziers. In this paper, we summarise the progress that the Green family has made as landowners, graziers, animal producers and merchants, discussing also the problems that they continue to face. We reflect on how these problems, which range beyond their own properties and management systems to ‘over-the-fence’ and district issues as well as industry, political and community issues, may be resolved.

Methods and Study Site

In a previous paper, the senior author recorded a history of his partnership with his wife Sally as a grazier and businessman (Green and Wolfe 2017). The properties they developed are located in the vicinity of Mandurama (750 m elevation, average annual rainfall 750-850 mm) on the western slopes of the Central Tablelands. The area is part of the ‘high-rainfall zone’ that extends along the tablelands and upper slopes of NSW, a zone that is too hilly and/or rocky for arable farming but it is ideally suited to ‘grazing’ (pasturing) sheep and cattle. In recent years, cattle production on the Central Tablelands has stabilised but sheep production declined during the two decades from 1990, driven by livestock prices and the ease of looking after cattle (Behrendt and Eppleston 2011). On the family properties (beef-dominant), the sequence of development is described below and shown in Table 1. The lessons learnt in coping with soil constraints, the cost-price squeeze and climatic variability are described. Then follow a series of observations and approaches that have kept the family’s grazing and business interests profitable and fulfilling.

Results

Soil, grassland and livestock improvement

In 1968, Des Green married Sally (Crofts). Over the next decade, they developed and implemented plans based on building their assets, taking over “Rhondda Villa” from Des’s parents, fertilising with superphosphate and molybdenum to overcome soil fertility constraints, sowing improved pastures based on phalaris and subterranean clover, and refining a specific timetable for farming and grazing operations. Des Green takes up the story:

“In the 1970s, the knowledge underpinning pasture ‘improvement’ with perennial grasses, subterranean clover and superphosphate was available from a range of sources, including the Department of Agriculture (DoA), leading farmers, soil-testing services, fertiliser companies and consultants. Discussions between farmers were encouraged by our local District Agronomist, Warren McDonald. For a number of troublesome issues, such as weed ingress (thistles, serrated tussock, blackberry control) and livestock health (bloat, pulpy kidney, trace element deficiencies and toxicities), work-arounds were available. For example, Barney Milne provided outstanding service as a DoA weeds officer, guiding our control of silver grass, serrated tussock and saffron

Table 1. The history of the Green family, their properties and business activities at Mandurama

Period	Participants	Activities and issues
Pre-1820	The Wiradjuri Aboriginal people were the original land managers	The main activities were hunting and gathering. Fire (ranging from deliberate cool burns to accidental hot burns) and grazing (kangaroos and wallabies) were the agencies that shaped the 'open woodland' nature of the vegetation (Gammage 2011).
1820-1920	Various squatters, lessees and owners. Grazing.	Sheep and cattle were introduced and the landscape was progressively cleared of unwanted timber and fenced. There were small areas of grain crops/potatoes.
1922-1956	John and Annie Green. Grazing, subsistence.	John (grandfather of Des) acquired "Rhondda Villa" (202 ha) by ballot in 1922. The land comprised native grasslands and he cleared small areas for food and fodder crops. He survived the rabbit plague, the depression and droughts of the 1930's, fenced the property, and negotiated a deal with a neighbour to access a permanent water supply to the eastern 140 ha. John ran mainly Romney Marsh sheep and a few cows. His wife Annie raised turkeys, milked cows for butter and cream which was sold along with preserved fruit off the farm. In the early 1950s, aerial agriculture aided grassland 'improvement' with subterranean clover and superphosphate.
1956-1968	George and Jessie Green, Des Green. Grazing, share farming.	George, a council worker, turned to share-farming/contracting in 1944 and agreed to purchase the farm from John in 1956. Des left school in 1958, joining George and working towards a 'free-enterprise future'. He purchased his first Hereford cows in 1959, commencing a Hereford stud. During the next 10 years, Des acquired wealth and assets by any legal means available, undertook a range of practical courses on topics that were relevant to young farmers, and travelled the world, visiting 27 countries by the time he was 21.
1968-1974	Des & Sally Green. Grazing, soil and pasture improvement.	Des married Sally Crofts and they drew up a carefully considered succession plan to take over progressively from George, who died soon after they were married. Using a network of successful farmers, advisors and mentors, the young Green's implemented a plan of pasture improvement, involving fertilising all of the property towards an initial target of 1250 kg/ha (cumulative) of superphosphate (P, S, Mo), direct seeding of improved pastures (phalaris + subterranean clover) through modified drills, and developing a specific timetable for farming operations. By 1975, they had paid off "Rhondda Villa", the death duties on George's estate, and bought 160 ha.
1974-1984	Des & Sally Green. Resolving challenges. Many discussions with DoA and private agronomists, plant scientists, a soil chemist, NZ contacts and others.	We sought answers to a problem that occurred at an increasing frequency in well-fertilised paddocks. The problem (clover ill-thrift) was soil-related and the apparent cause was soil acidity, particularly the toxicity of aluminium ions to pasture growth. By the early 1980's, after many discussions (and arguments) in order to unravel the confusion of information available, Des had nipped out a solution (liming – see text). Bought another 160 ha and leased some country to cope with clover ill-thrift and a drought.
1984-2008	Des & Sally Green. Business analysis by Rob Eccles (work placement). Diversification with business partner Richard Bloomfield. Son Stuart Green returned from university to the grazing business and daughter Joanne and her husband Mark Richardson take over the running of the rural supply centre.	Rob Eccles helped Des reorganise the farm business by concentrating on the production enterprise, including the need to understand the soil cation balance, which a UK textbook recommended should be 80% Ca and 10-15% Mg. Targets were set for soil P, pH and Al ³⁺ and the liberal use of lime to correct soil acidity. Investigated and used industrial by-products as a source of lime (slurry) and gypsum (anhydrite, plaster board), mixed together 2:1 and allowed to react before application. With inputs from Rob Eccles, Des was encouraged to develop with Richard Bloomfield side-line businesses, contract seeding and supplying other farmers with lime-gypsum. He unsuccessfully tendered for the rights to use dried sewage sludge, then purchased a local farm supply business so that the family had a financial interest in every farm input. During 1989, Stuart returned to the property after his schooling, before undertaking commerce/law studies in 1990-94, marrying Gemma, and then returning fulltime to the family properties in 1997. Mark/Jo moved from Mudgee in 2001 to manage the rural merchandise business.
2008-2020	Des and Sally Green, Stuart & Gemma Green; Mark & Joanne Richardson. A consolidation phase.	The family entered a consolidation phase, which was motivated in part by the success of the earlier (1968) 'succession plan'. The new plan included the second generation of Green's. In 2009, Mark/Joanne purchased the rural merchandise business. After acquiring and developing additional land towards a total of 2225 ha, Stuart/Gemma now manage the majority of this land, with Des/Sally retaining the home block on "Rhondda Villa" and two 200 ha blocks at Gallymont, E of Mandurama. When market conditions allow, the family exercise short-term lease agreements with adjoining landholders.
2008, 2015, 2020	Des and Sally Green. Enjoying and giving back to grasslands.	Des & Sally attended the XXI International Grassland Congress in Hohhot, China; due to illness, missed the XXII IGC in Sydney in 2013; attended the XXIII IGC in India 2015; participating in the XXIV IGC, Kenya.
The future	The third generation?	The Green family are discussing the possibilities for the next generation, who include teenagers rich in rural experience from each of the three Green sibling's families (Alison Dowling who has remained outside of the current partnership arrangements, Mark/Joanne Richardson and Stuart/Gemma Green).

thistle in the 1980's. We soon learnt that the application of too much molybdenum (a needed trace element) could cause copper deficiency in sheep. However, the number one problem, clover ill-thrift that is caused by an insidious soil pH decline following the introduction of superphosphate and subterranean clover (Donald and Williams 1954), created disappointment and consternation amongst farmers. At the time (early 1980s), the DoA was delivering 'mixed messages.' I was frustrated and sought information from a range of sources including local farmers and agronomists, a NZ agronomist who practiced in the border region of NSW and Victoria, and business contacts in NZ where liming was a routine practice. New Zealand agriculture was more 'switched on' to the importance of ensuring pH_{Ca} remained above 4.0-5.2. A strategy of substituting lime-super for superphosphate was initially put into place on "Rhondda Villa", with immediate benefits. Not long after, a DoA soil scientist mentioned the use of gypsum to drive calcium deeper into the soil profile in the banana areas around Coffs Harbour and this was, to me, a 'light bulb' moment'. I enthusiastically set about sourcing lime and gypsum from industrial by-products such as lime slurry (50% moisture), which was produced from the process that removed excess ammonia through quicklime when producing ammonia gas for refrigeration, and gypsum anhydrite (a by-product from soap and detergent manufacture). When the source of gypsum anhydrite eventually closed because of new standards to limit the disposal of waste products, waste gyprock (a plaster board) became a new source of gypsum. On-farm, the technique was to mix the lime slurry with gypsum at a ratio of 2:1 and let the material react, dry and settle before spreading three tonnes of the reacted material per hectare, with a re-application every four years or more depending on the Ca levels in the cation exchange. The target was to increase soil Ca to 80%, increase the soil pH_{Ca} to 5.5, and reduce the proportion of aluminium ions in the root zone (toxic to root growth), from 60% of the cation exchange capacity to nearly zero. The response to lime + gypsum on the Green farms was soon evident in these key soil parameters, followed by strong pasture growth and progressive increases in the productivity of the beef cattle and sheep that grazed the treated pastures. Selenium was also added following discussions with an innovative farmer, due to the evidence of white muscle disease in sheep and the incidence of still-born calves on highly productive pastures."

Discussion

The above pattern of progress has continued on the Green family farms and on the properties of farmers who have taken advice from Des Green. There are several specific issues that warrant further discussion:

Explaining and validating the theory and practice of 'calcium at depth'.

The conventional wisdom is that, after liming, the carbonate effect is slow in moving down the soil profile and the calcium component moves even more slowly. However, Des was impressed with how quickly the lime + gypsum treatment transformed pasture growth and livestock production, and he had some evidence from soil testing that the mobility of calcium in the soil may be enhanced by the addition of gypsum. This mobility is supported by scientific work undertaken in the latter half of the 1980s and early 1990s by Drs TS Abbott and DC McKenzie of NSW Agriculture on lime + gypsum, as outlined in Abbott and McKenzie (1996). From the conclusions of Abbott & McKenzie, the most likely explanation for the excellent results from lime + gypsum obtained on the Green family properties is that these soils were in a favourable range of pH_{Ca} 4.8-6.0, a range where gypsum provides almost immediate benefits to soil structure, especially so in soils with sodicity in the profile. The lime produces a slow release source of electrolyte and calcium for long-term benefits to soil structure, in addition to improving soil nutrition as a result of increasing the pH towards a target of pH_{Ca} 5.5-6.0. According to Abbott and McKenzie (1996), if the soil pH_{Ca} is less than 4.8 it is better to use lime alone, which improves both structure and soil pH; if over pH 6.0, lime is only very slowly soluble and some trace element deficiencies may be induced. Further scientific studies are warranted to confirm these predictions and monitor Ca^{2+} and CO_3^- mobility in tableland environments, where it is often stated by some advisers that "liming on top doesn't work". This belief must be questioned, because it seems to be constraining further progress in the adoption rate of lime, particularly on the tablelands.

Maintaining the right species in the farm landscape. Des and Stuart maintain that their greatest ally in the continual war on weeds on their properties has been phalaris, a drought-tolerant perennial grass that, once well-established with a suitable legume companion (usually subterranean clover), is an aggressive competitor with weeds, the seeds of which blow in from surrounding properties, or are introduced by vehicles, livestock and birds. These weeds include black thistle (*Cirsium vulgare*), Bathurst burr (*Xanthium spinosum*), serrated tussock (*Nassella trichotoma*), blackberry (*Rubus fruticosus*), blue heliotrope (*Heliotropium amplexicaule*) and yellow vine weed (*Tribulus terrestris*). Des and Stuart avoid overstocking, ploughing, clearing and other practices that 'create a vacant space' for weeds to fill. Each quarter, they vigilantly inspect every paddock by motorbike to sight, remove and spot-spray perennial weeds (serrated tussock, blackberry) in pastures and mistletoe on eucalyptus trees. For blackberry and serrated tussock, Des adheres to the recommendations for the use of metsulfuron ('Brush-off'). However, he has another theory that needs, like the gypsum theory above,

to be tested by science and commercialised before it can be generally recommended. This theory is a discovery he has made on herbicide synergy, involving the use of a double-action approach to spraying blackberry, serrated tussock and mistletoe. This approach is more effective than the use of metsulfuron alone. Des has a current agreement with an agricultural innovation company to test his theories on herbicide synergy and register novel approaches with the appropriate weed authorities.

Complementary side-line businesses. During the development of the Green properties, the family have created enterprise diversity by setting up a range of side-line businesses to take control of farm inputs and generate cash for further development. One of the Green's first business partners was Richard Bloomfield, who joined them to focus initially on contract direct-drilling of pasture seed, extending later to advisory and supply services embracing pasture establishment, soil testing to define the need for applications of superphosphate to correct deficiencies of soil P, S and Mo, and contract spreading of lime + gypsum to overcome the pH decline effects that are evident on many farms. In 1992, Des/Sally bought the Mandurama Auto Port, which has an excellent location on the Mid-Western Highway, an interstate highway that passes through central and southern NSW. This purchase lessened their dependence on the production side of agriculture, and it also provided a means by which they could capture and sell their expertise as a successful farming family. Des and Richard Bloomfield made this expertise available to a loyal group of clients, stimulating fertiliser and seed sales. The Green's also supplied a full range of rural merchandise such as pasture seed, legume inoculum, fertilisers, agricultural chemicals, wire, steel, silos, sheds, fuel, lubricants, equipment, contract spreading and hire of specialised seed drills – in short, all the products that are supplied through the Ruralco group, of which they are a member. In 2003, the partnership purchased the Blayney Tyre Service and joined the Tyrepower buying group; the tyre business was sold in 2007 but the building was retained. Earlier, Des and Sally were joined by son Stuart Green in 1995 to run the family grazing business. Then, with Richard Bloomfield's retirement in 2001, daughter Joanne moved to Mandurama with her husband Mark Richardson to assist with and then purchase (2009) the operations at Green's Mandurama Rural Service Centre. In summary, the Green family members actively work with fellow farmers and business people who have an opinion but are willing to change. 'Good luck in farming starts with landowners getting up early and working hard until late' is a credo that has served the family well. They avoid the 'single solution syndrome' and seek a set of integrated tactics to initiate and sustain change within agricultural enterprises. The family are strong believers in the free-enterprise system. Banks will lend money to farmers who go to them with a value proposition.

The role of Government. While the farm environment is a challenging one, and climate change appears to be increasing business risk, the Green family seeks little help from government other than maintaining the free enterprise platform. The family believes that agricultural production systems and the markets for land and livestock will sort themselves out efficiently with a minimum of intervention from government. They recognise the role of government in basic services (market reports, meteorological services), supporting targeted agricultural R&D, ensuring that professional graziers maintain their right to operate amongst small-scale landholders, resisting the politicisation of the public service, favouring independent producers, and offering assistance to farm families only in extreme conditions (fire, flood and long-term drought).

Conclusions. Currently, the Green farms support two beef-breeding herds and one sheep flock on their 2225 ha, plus a year-round opportunistic buy-fatten-sell operation. Each year, their target return on assets managed is 7% and their farms are continuing to appreciate in value. Members of the Green family are proud of and grateful for the agricultural, environmental and personal successes they have achieved. With their staff and business partners, they look forward to the future with confidence and happiness, intending to smooth the pathway for younger family members, male and female, into their businesses.

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