

From poorest of land to top pasture business A producer snapshot by Bob Freebairn

Greg and Lyn Rummery, along with son Tom, are well underway in developing their property "Athlone", located between Pilliga and Wee Waa on the NSW northwest plains, into a highly profitable grazing business. However, their property has historically been regarded as extremely poor-quality country.

Their pasture improvement program, now well underway, aims to establish tropical grasses that can persist for decades while also being highly productive with good quality. These tropical grasses, such as Premier digit, Consol lovegrass and Bambatsi panic, are combined with winter legumes such as Sub clover, Serradella, Biserrula, Rose clover and Barrel medic. Soil fertility issues are being addressed by correcting deficiencies with fertiliser. Careful grazing management is also an important part of their pasture's high productivity and high quality.

Much of the agricultural area typified by "Athlone" is loosely termed "Pilliga scrub", which is some of the harshest farmland in eastern Australia. Many people have regarded this country as impossible to develop. Greg, Lyn and Tom's progress in developing "Athlone" is testament to what courage, risk, hard work, careful planning and execution of the plan can achieve.

Most of the soils on "Athlone", and in the vast Pilliga scrub bioregion, are acidic in the top soil and overlay clays, at various depths, that are commonly highly sodic, sometimes with sodium at 85% of the cation exchange capacity (CEC). Soils with high sodium levels inhibit water absorption and root growth. Soils on "Athlone" range from pH 4.5 to 6.5 (Calcium chloride test), with the majority 4.5 to 5.5. Aluminium toxicity is also high in the lower pH soils. In addition, natural soil fertility of these soils is generally extremely low, with phosphorus typically 2–5 mg/kg (Colwell test) and sulphur 1–3 mg/kg (KCI 40 test). As a consequence of low phosphorus and sulphur, legumes are both low in productivity and persistence unless deficiencies are addressed, and therefore soil nitrogen is also very low.

Average annual rainfall for "Athlone" is 550 mm, with the summer months generally receiving more rain than the winter months. Like most areas of Australia, variability from year to year can be enormous. Not only do droughts periodically occur on "Athlone", but like the spring of 2022, the property can be flooded.



Tom and Greg Rummery, in mid-November 2023, checking a two-year-old stand of tropical grass on their Pilliga-Wee Waa property "Athlone". Following about 7 months of almost totally dry conditions, a seasonal break in November has resulted in rapid pasture recovery.

Property development

Greg, Lyn and Tom purchased "Athlone" in 2017. As it turned out, this was the start of a three-year drought that developed across much of eastern Australia. This was followed by three well-aboveaverage rainfall years, that included flooding, especially in spring 2022. 2023 has been exceptionally dry from March through to November when promising rains occurred.

"Athlone" was essentially unimproved native grass pastures on old cropping lands. So far, 300 ha has been successfully established to tropical grass pastures combined with winter legumes. The aim is to establish 1000 ha of these pastures, with the balance of the property retaining native grasses but with soil deficiencies corrected via fertiliser and the addition of winter legumes.

Winter cropping has been part of the business as a means of eliminating summer grasses and other herbage, so as to be able to reliably establish tropical grasses. Winter crops add to winter feed supply and their management in the fallow period is important for eliminating weeds that can commonly outcompete newly sown tropical grasses.

"Athlone" is managed alongside a 1100 ha heavy soil property near Walgett, of which 850 ha is utilised for grain production. Hence, stocking levels vary according to seasonal conditions as well as variable seasons between the two properties. The aim is to run a 150 cow herd plus a variable size cattle trading enterprise, with numbers depending on seasonal conditions.

As part of the property development, paddock numbers have increased from 6 to 34, with the average paddock size now between 20 to 40 ha. Laneways have also been included to allow ease of stock movement across the property. Grazing management is focused on always retaining good levels of groundcover, which is especially critical on sodic soils that are highly vulnerable to wind and water erosion. More paddocks have allowed for far better control of groundcover, as well as allowing perennials to be periodically rested to build up root reserves.

An upgraded water system, including dams with greater capture of water flowing through the property via several creeks plus upgraded bores, is part of the development that has been undertaken. Safer and efficient higher throughput stock yards have also been built.

Economics of property development program

Economics of purchasing and upgrading a property like "Athlone" have been carefully assessed by the Rummery's. There are several ways of assessing the upgrade. The first is capital improvement while the second is annual gross margin return.

Unimproved pastures that support grazing enterprises, on these soils and in this environment, are commonly assessed at below 2 dry sheep equivalents (DSE) per hectare. In contrast, the Rummery's believe the carrying capacity on their improved pasture areas is more like 6–8 DSE/ha. Until higher stored fodder reserves are incorporated into the system, plus a drought feedlot, they stress their enterprise has to be flexible to allow rapid destocking when droughts evolve. But they also emphasise their grazing business is focused on livestock weight gain, something not possible on unimproved pastures in these soils.

The current estimated gross margin for a beef fattening enterprise, based on NSW DPI 2023 calculations is \$40/DSE (<u>https://www.dpi.nsw.gov.</u> <u>au/agriculture/budgets/livestock</u>). A stocking rate of 6 DSE/ha is therefore estimated to return a gross margin of \$240/ha. In contrast, an "unimproved" stocking rate of 2 DSE/ha, from a non-fattening enterprise such as wool, is estimated at \$20/DSE, or \$40/ha gross margin.



Premier digit plus Bambatsi panic on "Athlone" in April 2021.

From a capital gain perspective, the value of unimproved land in the area is estimated to be around \$700-750/ha. Whilst there are no local sales of such developed land to use as a benchmark, similarly improved property in regard to fencing, paddock size, fertiliser programs etc. in nearby adjoining areas that support similar production levels is likely to be worth at least \$5000/ha. The capital cost (fencing, pasture improvement, water upgrades etc.) of improving this land is typically around \$1250/ha.

Tropical grass plus winter legume pasture

Tropical grasses plus winter legumes, and fertiliser to correct chronic phosphorus and sulphur deficiencies, are a main focus on upgrading "Athlone". All pastures species, including both tropical grasses and winter legumes, sown on "Athlone" have good to high tolerance of acid soils. Tropical perennial grasses including Premier digit and Consol lovegrass have proven to be especially acid soil tolerant.

Research in environments like "Athlone", going back as far as the 1980s at nearby Gwabegar and Boggabri, have shown that species such as Premier digit grass and Consol lovegrass, will persist indefinitely provided they are at least reasonably well managed. Bambatsi panic has also shown good long-term persistence, especially on less extremely acidic soils.

While temporary flooding has occurred over these pastures at "Athlone", both Consol and Premier digit have recovered well. Bambatsi also has a sound reputation for coping with flooding.

Winter legumes used on the property are mainly early maturing, hard seeded varieties of a range of species. These include Woolly pod vetch, Serradella, Biserrula, Rose clover, Sub clover, Gland clover, Bladder clover and Caliph barrel medic for portions with higher pH. Some legumes, such as Serradella, are highly acid soil tolerant. A later maturing species, Arrowleaf clover, has also been trialled recently. It has shown a capacity to persist over drier years and flourish when winters and spring are moist.

Slender serradella, an early maturing hard seeded acid soil tolerant species, is being sought for inclusion in the legume pasture mix. It is especially suited to areas prone to periodic waterlogging, but the seed is currently unavailable.



Franno Serradella-dominant stand at "Athlone" in early Spring, during an average season, with year-todate rainfall of ~440mm from January to September.

Inoculum

Greg, Lyn and Tom Rummery are strong believers in adding the appropriate root nodule bacteria (rhizobia) when establishing legumes. For example, group AM for most medics, group C for clovers including Sub, Balansa, Bladder, Arrowleaf, Rose and Gland, group E for Woolly pod vetch, group G for Serradella and strain WSM1497 for Biserrula. Legumes that do not have access to their appropriate rhizobia generally grow poorly, plus fail to nodulate and build soil nitrogen for the grass component of the pasture.

Applying rhizobia with new legume sowings is as important as choosing the most appropriate species and varieties. Granules, for example Alosca pellets, added to pasture seed at sowing, while a bit expensive, is a more reliable method than coating seed with peat inoculant for ensuring rhizobia survival. This is especially the case if sowing dry and if rain doesn't lead to germination and emergence for some time.

Fertiliser program

Single superphosphate is the main fertiliser used in the pasture improvement program as it is well balanced for available phosphorus and sulphur. Rates per annum of 150–200 kg/ha have been used initially with follow up applications of 100–120 kg/ha. Rates and frequency of application are projected to be lower and fewer once soil phosphorus and sulfur levels have built up, to minimum levels of 20 to 30 mg/kg phosphorus (Colwell) and 8 mg/kg sulphur (KCl 40 test).

CSIRO led research, including on Pilliga scrub country in the adjoining Boggabri district, shows that Serradella can be fully productive at lower soil phosphorus levels than other legumes. For example, a Colwell phosphorus level of 20 mg/kg is sufficient for Serradella, but needs to be 30 mg/kg for most other legume species for maximum performance.

Research and experience indicate that annual legume growth in tropical grass and native grass pastures in environments like Pilliga and Wee Waa ranges from 1 t DM/ha or less in a dry year to 10 t DM/ha in a good year. Around 3 t/ha is considered average, contributing around 60 kg/ha nitrogen for the grass component of the pastures. This ensures their high quality as well as high productivity.



A fertiliser trial on an acidic, sodic duplex soil in Boggabri showing serradella achieving its yield potential at much lower soil phosphorus levels than most other legumes.

Soil carbon and other soil features

Especially relevant to the successful development of "Athlone" is research conducted at Boggabri, on similar duplex soils, by Dr Robert Banks. Tropical grasses such as Consol lovegrass and Premier digit penetrated and developed into the highly sodic subsoil far more successfully than native grasses. This has been a major reason for the successful establishment of tropical grasses in these soils.

In the Bank's study, the tropical grasses had greater soil penetration and access to water in the B horizons compared to poor penetrating native grasses. Greater access to water was a consequence of deeper root penetration, allowing a more porous subsoil as well as a greater moisture collecting area. Soil water content, even at 90 cm, under tropical grass was almost double that of native pasture. Root abundance was far greater in the tropical pastures as well. Roots foraged deeper into the normally impenetrable B clay horizon. The average density for tropical grasses was 8.4 km roots per cubic metre of soil (to 1.5 m depth) compared to 4.6 km for native grasses.

Soil organic carbon (SOC) almost doubled when comparing improved verses unimproved pastures. A 14-year-old tropical grass plus winter legume pasture, with soil phosphorus and sulphur deficiencies corrected, resulted in SOC increasing from 58 t/ha on unimproved native pasture to 84 t/ha on improved pasture in the 0–90 cm soil layer.

Pasture establishment

A flexible approach to tropical grass establishment occurs on "Athlone", with sowings mainly occurring from December to January. In paddocks where native annual and perennial summer grass populations are high, sowing is preceded by two years of winter crop combined with summer herbicide fallowing to lower the soil weed seed bank.

In some areas, generally with poorer soils, and a previous history of overgrazing, there is commonly a limited grass component. However, these areas commonly have high levels of broadleaf weeds, especially Galvanised burr. A successful sowing of tropical grasses has occurred following a single application of glyphosate-based herbicide. Post emergent broadleaf herbicide treatments, not detrimental to young tropical grass plants, are being successfully used to largely reduce broadleaf weed competition to establishing tropical grass plants.

Winter legumes are added to a new pasture in the autumn following tropical grass establishment. They are generally added ahead of the autumn break.

Tropical grasses are generally sown at around 4 kg/ha (Premier digit 3 kg/ha, Consol 0.3 kg/ha, and Bambatsi panic 0.7 kg/ha). Winter legumes are generally sown at around 5 kg/ha, with the mixture of species depending on paddock soil type. All sowing is shallow, from the soil surface to 1 cm.

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Successful tropical grass establishment (at 4 plants sq/m) when sown into the poorest, often highly sodic, soils following a glyphosate treatment but no previous grass removal strategy.

Grazing management

New tropical grass stands on "Athlone" are not grazed until plants are well rooted and are at full flowering stage. In some years, they are ready for full grazing three months after sowing. In drier years there can be no grazing for the first 12 months post sowing.

Once tropical grasses are fully established, perennials are allowed to flower periodically, and a flexible rotational grazing system is practised. This can mean a given paddock may be grazed for a week to several weeks, with timing depending on herd numbers and feed availability.

An overriding grazing management principal on "Athlone" is to aim for 100 percent groundcover in established pastures, despite what seasonal conditions might be. On sodic soils, high retention of groundcover is especially critical for holding water after a rain event.

Grazing of winter legumes after first being added to established tropical grasses is also seasonally related. The aim is to build a high soil seed bank. Grazing is very limited, and sometimes excluded, in their first winter-spring after sowing. The aim is for maximum plant development and maximum seed set in the first two years.

Once a good soil seedbank of winter legumes has occurred, grazing is more related to feed availability and can occur over extended periods per graze, as long as adequate groundcover is retained. Allowing good seed set around once every three years is sufficient for long term persistence once a good soil seed bank has been developed for species with a high hard seed content.

In good seasons, the Rummery's aim to ensure large amounts of pasture biomass are reasonably grazed down at the beginning of winter legume emergence (autumn), to encourage legume recruitment from the seedbank, and summer grasses growth (spring). Maximum levels of dry matter for both respective periods is around 2 t/ha. This can be especially challenging after a wet spring going into summer, as well as autumn after a wet mid to late summer.

Concluding comment

Greg, Lyn and Tom Rummery are inspirational developers of some of the state's most difficult soils. Their program is based on good science, common sense, not overly complicated, but very well undertaken. Integrating appropriate winter legumes for a given climate and soil type, establishing and managing appropriate tropical grasses, addressing soil fertility deficiencies, and sound grazing management, are key aspects to their success.

For more information

Banks study: Banks R, Wendling L, Basford K, Ringrose-Voase A, Banks V (2019) Beneficial soil profile differences associated with tropical grass pastures on sodic texture contrast soils in Northern New South Wales. *Soil Research* **58**, 207-218. https://www.publish.csiro.au/SR/SR19140

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