



Legumes key to the success of Boggabri beef business

A producer snapshot by Bob Freebairn

Pasture legumes, tropical grasses, dual-purpose winter crops, and fertiliser application to correct chronic phosphorus and sulfur deficiencies have been important for the success of the Avendano family's beef and cropping business at Boggabri in north-west NSW.

Especially significant is that George and Maree Avendano purchased their property 33 years ago when it was widely regarded as poor country. Much of the soil is sandy to sandy loam, generally acidic, including in the subsoil layers, and very low in natural fertility. In particular, soil phosphorus levels, according to the "industry standard" Colwell test, were generally 5 mg/kg (low) or lower, and sulphur levels (KCl40 test) were 2 mg/kg (also low) or lower. Soil pH ranged from 4.0, with 39% aluminium (as % of CEC), up to 8.0. Most of the lighter textured soils are pH 4.0 to 4.9, whereas heavy loam areas are mainly pH 6.5 to 8.0.

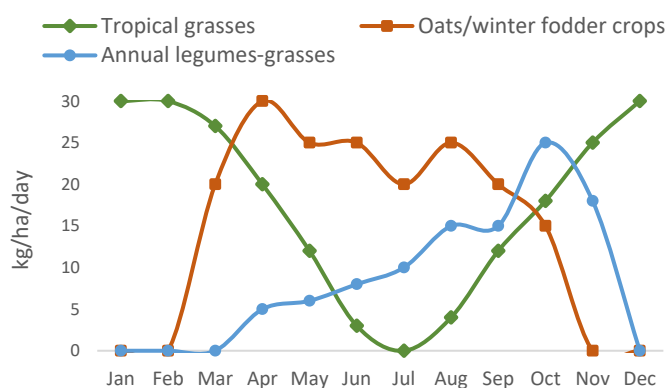
Prior to the Avendano's ownership, the country on the property was farmed using multiple cultivations per crop with little fertiliser applied to replace exported nutrients. Coming from a non-farming background, the Avendanos were expected to quickly fail. Further to their challenge was that they needed to borrow heavily for purchasing and property development.

However, George Avendano widely sought out information and was eager to embrace emerging technology to improve light textured soils. When they purchased their 2016 ha property "Towri" in 1989, with about 50 percent poorly developed timber and scrub regrowth (the property adjoins the Pilliga scrub), they struggled to run 90 cows and could not grow calves out past 300 kg.

The property has now increased in size to 4000 ha, via purchase of nearby land from five different owners, and runs a self-replacing 1000–1200 Angus cow herd with calving rates in the high 90s. Importantly for profit, progeny have been sold, mainly to feedlots, at average weights around 500 kg. Sometimes progeny reach 700 kg, such as this past winter, and are sold to an abattoir for export markets. Average time from birth to sale of offspring is mostly 14–18 months.

George Avendano says they now join part of their herd (350 heifers), using purchased bulls, to target premium Wagyu markets. They also farm 800 ha of the loamier, higher clay content soils to produce crops including wheat, barley, canola, chickpeas and sorghum. They also harvest tropical grass and serradella seed in suitable seasons.

Their beef business runs on around 2800 ha of tropical grass pastures that include winter legumes, plus around 400 ha of dual-purpose winter crops that are a vital part of supplying quality winter feed. Smaller areas of pasture also include native grass with winter legumes.



Daily dry matter production for pasture and winter fodder crops in an average season at "Towri", Boggabri.

Legumes are vital

All tropical and native grass pastures on “Towri” contain legumes for providing high quality autumn, winter and spring feed, as well as supplying nitrogen for growth of all grasses. Research indicates that legumes can supply around 20 kg of nitrogen per ha/t dry matter.

George Avendano estimates per annum legume growth in their pastures ranges from 10 to less than 1 t dry matter/ha, depending on seasonal conditions. Around 3.5 t/ha is considered average, contributing around 70 kg/ha nitrogen for the grass component of their pastures. This ensures their high quality as well as high productivity.

George Avendano with his wife Maree, and in more recent years with sons Matthew and Richard (also an independent agronomist), were early adopters of the acid tolerant legume pasture species serradella.

Of their 3200 ha of tropical and native grass pastures, around 90 percent coexist with serradella. Early maturing hard seeded varieties Elgara and King have persisted well with some stands now over 32 years old and remaining highly productive. Serradella has many features including being deep rooted, acid soil tolerant, endures dry conditions, bloat free, high quality, good aphid tolerance, low disease risk and long-term persistence if well managed.



The legume serradella growing in a “Towri” tropical grass pasture. It is important for quality winter feed and for building soil nitrogen for the pasture grass component.

Current research involving CSIRO, including on the Avendano property, shows that serradella can remain at full productivity at lower soil phosphorus levels than other legumes. For example, in the Boggabri area, Colwell phosphorus levels of 20

mg/kg are sufficient for serradella, but needs to be 30 mg/kg for most other legume species.

Other successful legumes on “Towri”, that commonly coexist with species like serradella, include Hykon rose clover (almost all areas), Sephi and naturalised burr medic (50% of area), biserrula (10%), Dalkeith sub clover (20%) and arrowleaf clover (30%). Arrowleaf clover only performs well in wet spring years.

Successful legume establishment on “Towri” includes sowing in autumn following tropical grass establishment, ensuring they are well inoculated with rhizobia bacteria, leniently grazed until a good soil seed bank has built up, and the maintenance of fertile soils. Most of the tropical legumes, such as desmanthus, butterfly pea and Wynn Cassia, have been tried on “Towri”, but with no lasting success.

Tropical grasses

The first sowings of the Avendano’s 2800 ha of tropical grass pasture are now 30 years old and remain in excellent condition. A number of species are used across the various soil types, with Premier Digit (on lighter, medium as even heavier textured soils), Consol lovegrass (on lighter soils) and Bambatsi Panic (on medium and heavy soils) being the predominant grasses. All their tropical grass pastures contain Premier digit, approximately 50 percent of very sandy to sandy loam soils contain Consol lovegrass, and 20 percent of heavier soils contain Bambatsi panic.



Tropical grass pasture on the Avendano property that is high quality, productive feed.

Most marketed tropical grass species have been tried on “Towri”, such as purple pigeon, Bahia, creeping blue grass, various Rhodes grass varieties, Floren bluegrass, Buffel grasses, Gatton and Green panics, and Sabi grass. As has been found in NSW DPI

trials in similar environments, these have not persisted or performed well on “Towri”.

Key to the success of tropical grass establishment has been preceding sowing with two to three winter crops combined with absolute control of summer weeds in fallows. Cropping is via zero till with glyphosate based treatments applied when weeds are young to kill summer fallow weeds. Depending on summer rain events, five treatments per season is common.

Sowing starts when soil temperature reaches 16°C (around early October), regardless of surface soil moisture. Either their disc or tyne John Deere seeder is used, depending on soil type and clearance conditions. Seed is placed at a depth of 0-5 mm via disc and on the soil surface via tyne seeder, followed by press wheels. George Avendano emphasises that the furrow created by the press wheel, with very little pressure, is sufficient to ensure seed is close to the surface, especially important if germinating rains wash soil over the furrow. Otherwise seed can be too deep to successfully germinate.

Seed is sown at 4 kg clean seed/ha. Germination generally commences after the first post sowing rain events of around 10 mm or more.

Over 30 years of new establishments, with new sowings of 50 to 200 ha almost every year, only one failure has occurred, and that was because of poor seed quality from purchased seed. Starter fertilisers that contain phosphorus, sulphur and nitrogen are added at sowing. Follow up applications of urea occur if soil tests and nitrogen deficiency symptoms are observed.

Winter forage crops

Dual purpose crops are grown on “Towri” for increasing the reliability of winter feed, and for preparing areas for new tropical grass sowings, especially to eliminate summer weeds that are able to outcompete new pasture sowings. Normally they are grown consecutively for two to three years to drive down the weed seed bank to low levels. Around 15 percent of the grazing area is sown to dual-purpose winter crops.

Other important aspects of the dual-purpose cropping program include conserved fallow moisture, which helps ensure high reliability of

winter feed, early sowing (late February onwards), and high soil fertility.



A mid-winter view of dual purpose crops on “Towri”, despite a dry 2023 autumn and winter. Important for winter feed and preparation prior to sowing pastures.

Soil fertility correction

All of “Towri” was low in soil fertility, either naturally or via previous owner’s exploitive cropping. Phosphorus, sulphur and nitrogen are the main elements needing correction. George Avendano stresses *“If we don’t correct these deficiencies, legumes fail to thrive and if legumes don’t thrive, soil nitrogen for grasses will always be low”*.

For pastures, correcting phosphorus and sulphur deficiency via superphosphate or poultry manure drives legumes, which then correct nitrogen deficiency. For cropping, nitrogen and phosphorus deficiency is the main emphasis. Sometimes they also add nitrogen to tropical grasses if autumns and springs have been dry and have restricted pasture legume growth.

Soil testing is used to determine fertiliser requirements. The Avendano’s have noted a gradual buildup in soil fertility across the property, even though fertiliser is not used annually on pastures.

Organic carbon

Major findings from a PhD study undertaken on “Towri” by Dr Robert Banks documented that soil organic carbon (SOC) almost doubled when comparing improved versus unimproved pastures. SOC increased from 58 t/ha under unimproved native pasture to 84 t/ha under improved tropical grass plus winter legume (Premier digit and serradella, predominately), in the 0-90 cm soil layer.



Improved pasture (left) versus unimproved (right). Has dramatically improved soil carbon levels.

This research, on an acidic sodic-duplex soil, assessed identical soil profiles comparing 14-year-old tropical grass plus winter legumes with unimproved native grass. Dr Banks notes this site is typical of one of the poorer soil groups in NSW.

Grazing management

New tropical grass stands are not grazed until plants are well rooted and fully flowering. In some years, they are ready to graze three months after sowing. In drier years it can be several months post sowing before grazing starts.

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

An overriding grazing management principal on “Towri” is to always retain close to 100 percent groundcover, despite what seasonal conditions might be. Perennials are allowed to flower periodically and a flexible rotation grazing system is practiced. This can mean a given paddock may be grazed for a week to several weeks, with timing depending on herd numbers and feed availability.

Once a good soil seed bank of winter legumes has been developed, grazing is more related to feed availability and can be over extended periods per graze, as long as good groundcover is retained. Allowing good seed set once every three years is sufficient for long term persistence.

In good seasons, the Avendanos aim to ensure high levels of plant material are reasonably grazed down

at the beginning of winter legume growth (autumn) and summer grass growth (spring). Maximum levels of dry matter for both respective periods is around 3 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. Harvesting some paddocks for hay or silage is an option commonly used on “Towri” in such situations, to better manage groundcover levels.

Concluding comment

George Avendano and family have been leading advocates of successful livestock businesses needing to be based on good science, common sense, and not overly complicated. Integrating appropriate winter legumes for a given climate and soil type, establishing and managing appropriate tropical grasses, addressing soil fertility deficiencies and a proportion of the property sown each year to winter dual purpose crops are to them key aspects for success. And especially noteworthy for their success is that it has been on country not long ago considered “pretty poor and difficult”.

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Richard (left), George (centre) and Matt (right) Avendano.



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