Waikerie landscape forage trial – 6 years on

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Background

In regions with low annual rainfall (<350 mm annual rainfall), long summers, and poor-quality soil there are few green feed options for farmers for many months in the year when both feed quantity and quality are limiting. Consequently, supplementary feeding is often required to meet animal requirements. Forage shrubs can be particularly valuable during these times and extended periods of drought. Research to further develop the profitable use of forage shrubs, including new shrub options from the Enrich research program, was initiated under the Future Farm Industries CRC (which ran from 2007 to 2014).

In 2009 a field experiment including Old man saltbush (OMSB, *Atriplex nummularia*) and Mallee saltbush (*Rhagodia preisii*), one of the more promising alternative species, was established at Waikerie, South Australia with the aim to monitor shrub development, leaf biomass production and regrowth after grazing, and to investigate the effects of soil variability. In doing so the greater aim was to determine the potential contribution of perennial forage shrubs to modern mixed-farming systems in medium to low rainfall grain and livestock zones. The experiment ran until 2015. Here we summarise some key findings from 6 years of the field experiment.

Why was the project done?

- Very little detailed information on forage shrub performance across Mallee soil types is available to assist farmers to devise productive, profitable and sustainable grazing systems from year to year, and
- We wanted to develop a model that could be used to predict forage shrub growth across a range of seasons and soil types

Key messages

- Forage shrubs are well adapted to climates with (low) variable rainfall – therefore the lower variation in feed supply between years mean that forage shrubs are a reliable source of feed,
- In most areas, and on most soils, farmers with OMSB can expect between 1-2 kg edible dry matter per shrub from plantations in most years,
- Soil type has a large influence on the amount of biomass produced by forage shrubs –rooting depth probably being one of the most important factors,
- The nutritional quality of shrubs seems less influenced by soil type,
- For OMSB, the root system contributed (on average across the different landscape positions) 67% of the total plant biomass,
- A model now exists that can be confidently used across soil types, regions and different grazing systems in the low and medium rainfall zone,
- The interrow is widely underrated and plays a critically important role in the livestock productivity of the forage shrub system

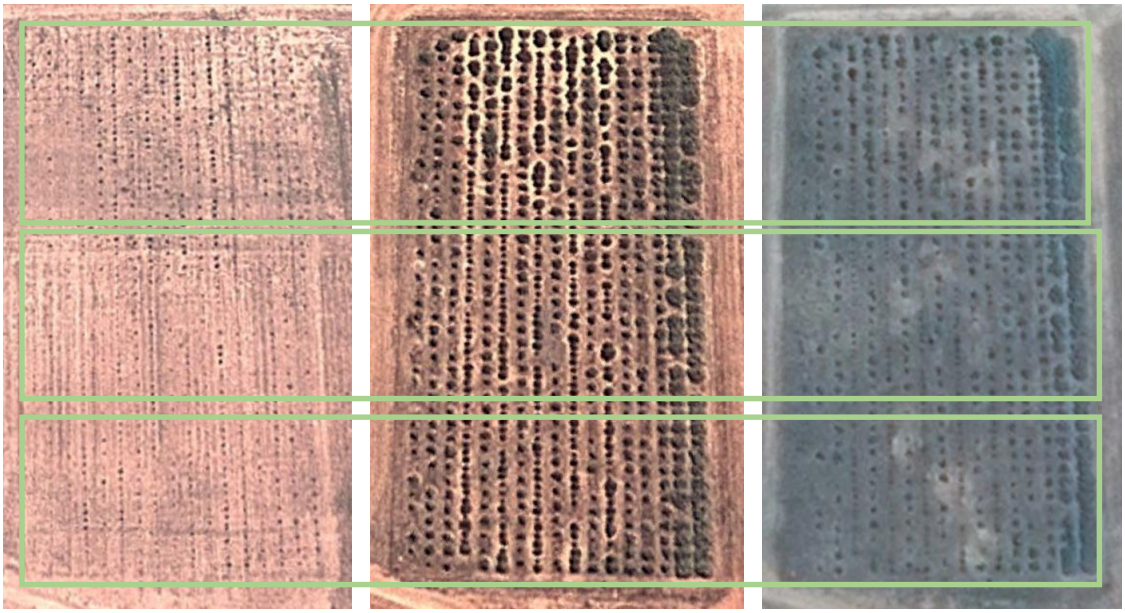

Figure 1. Aerial photographs of the landscape trial (left to right) in Feb 2010, December 2012 and December 2015 showing the rows (150 m long) of forage shrubs. The boxes indicate a nominal delineation of the dune (top), midslope and swale (bottom). (Photos copied from Google Earth).

Results and discussion

Dry matter production

The trial was established in May 2009, in what was a close-to-average rainfall year (see Figure 2).

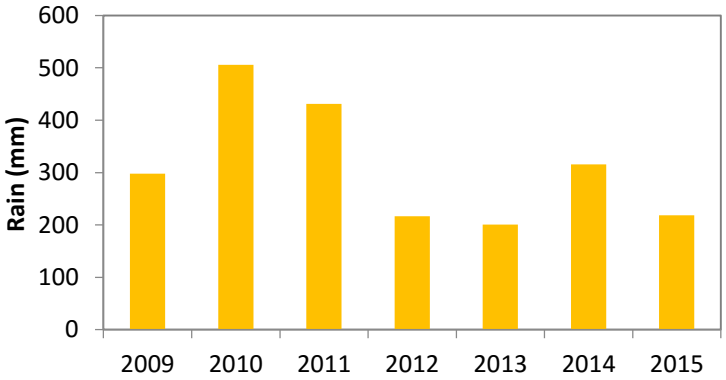

Figure 2 Annual rainfall for Waikerie (Station #24041) – the long term average from 1950 to 2015 is 273 mm.

The experimental period covered a wide range of climatic conditions: for example the summer of 2010–11 was the wettest on record, the following summer was wetter than normal, but then extremely dry conditions ensued for the next couple of years. Notably, during the 6-year period a number of significant rainfall events were recorded during the summer period.

Annual dry matter production varied with rainfall - but was influenced in particular by spring falls. There was consequently a large range in edible biomass on offer at the start of the grazing window (this usually took place in early- to mid-autumn) from about 1.0 to almost 3.0 t/ha. For the duration of the experiment, the shrubs growing in the dune soil produced around 80% more edible biomass than those in the swale or midslope (Figure 3). Over time as the shrubs matured and the years became drier, the differences between the biomass produced on the midslope and swales became less obvious.

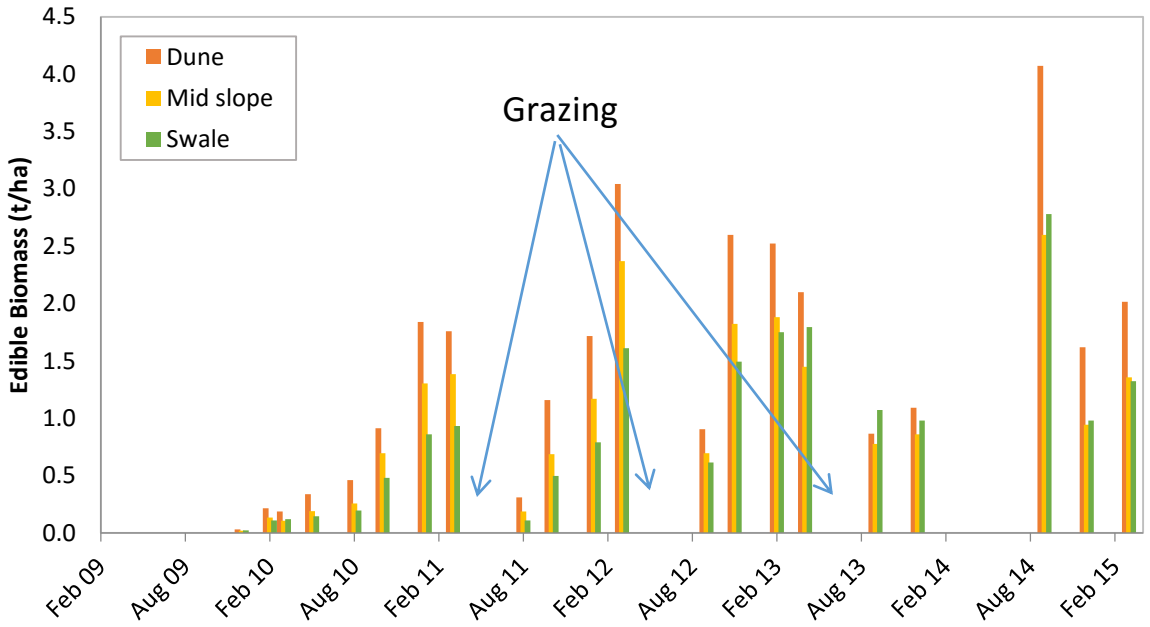

Figure 3 Dry matter on offer for an old man saltbush plantation (634 shrubs/ha) at different landscape positions at Waikerie. Note manual trimming was carried out in Sept 2014 to reduce the shrub height.

Modelling

Using the data gathered from the monitoring program, we were able to develop a model that allows us to predict edible biomass across a greater range of climatic conditions, locations and soil types beyond those which we were able to investigate through the field experiment. For example, over a 60 year period at Lameroo, at the start of March the predicted average edible OMSB biomass production was 2.2 kg/shrub with the range being from 0.7 to 3.7 kg/shrub; and low variability between years.

The model has been used to inform Meat and Livestock Australia's Feed Demand Calculator which allows growers to assess the pattern of feed supply and demand over a twelve-month period on their farm. The addition of forage shrubs to the calculator enables farmers to assess whether adding shrubs to the farm feed base, or modifying the livestock enterprise, might help to close "feed gaps". The model has also been used to investigate the productivity of saltbush plantations under different farming systems scenarios, such as: different plant species growing in the interrow, plantation densities, soil types, grazing strategies and shrub types.

Feed quality

In July 2014 a random selection of OMSB shrubs across the site were sampled to gather information on the possible effects of landscape position on feed quality. Overall the median digestibility was around 50% which translated to a calculated energy density of 6.5 MJ of metabolisible energy/kg dry matter. The median calculated crude protein was 16.9%. Importantly there were no differences in the nutritional profile of the plant material due to landscape position or soil type (although there was a large amount of variation). This result supported the hypothesis that, within the one shrub variety the greatest variability for shrubs in their overall feed potential lies in their biomass production rather than chemical composition. The soil fertility was not tested at the site during the experimental period, and so it is not determined if nutritional management though the application of fertilisers will improve feed quantity and/or quality. Farmers should note, however, that dry matter digestibility can vary between forage shrub species and even varieties.

Carbon sequestration

In 2015, 6 years after the start of the trial, sampling was conducted to assess how much carbon is stored by forage shrubs. A large unknown was to do with the below ground biomass and so OMSB shrubs were excavated (3 shrubs at each landscape position) to a 1 m depth. There were less roots in the swale soils (7.7 kg/shrub), and more than double in the dune soil (16.7 kg/shrub) - the midslope (10.6 kg/shrub). Most of the roots were confined to the top 50 cm (see Figure 4) and all within the top 1.0 m, and did not appear to extend much past the canopy line of the shrubs indicating that the plants are heavily dependent on annual rainfall. On average for OMSB, the belowground biomass (roots) contributed about 67% of the total plant biomass across the different landscape positions.

Figure 4. Old man saltbush roots growing in the sandy loam swale soil at Waikerie, SA.

The landscape forage trial at Waikerie has provided valuable information that can assist in the development of sustainable management options for forage shrubs in the low rainfall zone.

Acknowledgements

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