Saltbush development narrows the field

With the help of some experienced tasters, researchers have fast-tracked the identification of elite lines of oldman saltbush, which are now being trialled on properties across Western Australia, New South Wales and South Australia.

Lead researcher, Dr Hayley Norman (CSIRO) is passionate about the potential of the elite native shrubs as a nutritious and palatable perennial option across marginal saline and non-saline soils in the low-to-medium rainfall regions of southern Australia where producers have few perennial forage options.

"This Future Farm Industries CRC-funded project is unique in that it has taken a native perennial shrub, which we know is adapted to local conditions, and delivered a range of cultivars that show significantly higher nutritive value than the average across the species," Hayley said.

key points

- Researchers, with the help of some dedicated taste-testing sheep, have narrowed a selection of promising saltbush cultivars from 80,000 to 12 elite options.
- Elite lines have substantially higher digestibility and palatability than the average of the original pool of oldman saltbush cultivars.
- The elite lines of saltbush are being sown and trialled on properties across Western Australia, New South Wales and South Australia.

"Oldman saltbush has been a part of marginal grazing systems for a long time, but this is the first time anyone has tried to improve its feeding value through a simple selection process."

Partners in palatability

According to Hayley, she has it on good authority that the elite line of saltbush cultivars is not only nutritionally superior, but one that producers can be confident sheep will find palatable.

As a source of feed for sheep, saltbush has its limitations — not only in terms of low energy and high salt levels, but also in terms of palatability.

"For me one of the most exciting aspects of this project is that we have rather unique project partners —sheep — who have helped us shortcut our plant selection process in terms of palatability, and somewhat surprisingly, nutritive value," she said.

With a base number of more than 80,000 cultivars to choose from, the selection process had the potential to be both time-consuming and costly.

"A small team of researchers were looking at three replicated plots across WA, SA and NSW, with 20,000 plants in each, which represented the collection for across Australia," Hayley said.

"At a higher level we measured nutritive value of plants from each collection site through the lab (20 plants from each of the 27 collection sites — plant samples, which represented the diversity of cultivars)."

But as Hayley explains, measuring the nutritive value of saltbush as a species using standard laboratory analysis alone was fraught with difficulties.

"The tools developed to analyse plants for nutritive content were designed for simple annual and perennial plants, such as oaten hay or lucerne — they were never designed to measure the digestibility of a plant as complex as saltbush.

"Native perennial shrubs, such as saltbush, have survival mechanisms that involve a range of compounds that impact on digestibility and play havoc with standard laboratory analyses.

"So in addition to the laboratory testing, we grazed sheep across the trial plots, looked at their grazing preferences and used animal data to identify premium families — essentially we used the sheep to narrow the field.

"What the sheep were telling us made sense when we cross referenced against laboratory data.

"We took the top material from the laboratory; checked it against animal preference and anything the animals consistently rejected; we rejected."

Narrowing the field

The research team established plots of 90 elite genotypes of the preferred material across the three new trial sites.

"For the past three years we have monitored this second series of experiments. This included grazing, further laboratory analysis and animal house feeding trials," Hayley said.

"We have now narrowed the field to 12 elite lines, which will go through further on-farm evaluation and out to commercial testing."

Within this final cut, all plants show superior digestibility, but vary in biomass production. Some produce more biomass in salty areas and others performed better on non-saline soils.

"We looked at biomass production, preference and various components of nutritive value to come up with 12 that are superior," Hayley said.

(Above from left to right): Dustin McCreery, Chatfields Tree Nursery, Hayley Norman, CSIRO and Peter Zurzolo, FFI CRC peruse 20,000 elite saltbush cuttings being grown in the nursery. (Photos: Hayley Norman, CSIRO and Jill Griffiths, FFI CRC)

"It's not going to be a case of finding a single miracle plant for all of Australia — what has the highest digestibility won't be the highest biomass producer at a given environment.

"Our final goal is to get the best options across arrange of environments.

As well as providing energy, crude protein, sulphur and vitamin E to livestock, Hayley sees these plants as having a role in drawing down the water table, providing habitat and other environmental benefits.

"Due to the salt levels in saltbush, as a fodder species the plant should form part (up to 50%) of a total diet during summer-autumn," she said.

To preserve the genetic integrity of the new genotypes, cuttings are the most reliable method of propagation and establishment in the field. (Photo: Hayley Norman, CSIRO)

How the taste test works

Before grazing, researchers estimate dry matter on each plant across the trial site. Every week during grazing the team scores the plants for defoliation.

"An untouched plant is clear," Dr Hayley Norman, CSIRO explained. "And as they get more intensively grazed, the plant gets bared back to sticks."

The trial sites are assessed weekly until everything is gone.

"During the trial, sheep also have access to high quality hay — it is important for producers to note that saltbush is not suitable as a single source of fodder; it should only form about 30-50% of the total diet on offer.

"By the time we got down to the 90 preferred lines, all the plants were grazed back to sticks, but there were still clear preferences."

"Saltbush, like many hardy perennials, isn't a single-species silver bullet — but there is plenty of variation in nutritive value and farmers should use the best material available."

The next step

Researchers are already working with a commercial nursery in WA to propagate the 20,000 shrubs needed to run the project.

"The new saltbush genotypes will be most reliably established through cuttings," Hayley explained.

"We do hope to develop seed lines, but because of the breeding process of saltbush the cuttings are much faster and will deliver a pure result — you know exactly what you are going to get.

"When you plant an oldman saltbush seed it is a product of four sets of chromosomes from each of the parent plants.

"Stable seed lines of saltbush are therefore much harder to achieve than seed lines of many of the traditional pasture plants."

In addition to her excitement at the many unique aspects of this project, Hayley believes this project has provided a good model for domestication of other native shrubs.

"The CRC FFI *Enrich* project has identified at least four other well-adapted shrub species that we could improve."

Acknowledgements: The research team also includes Peter Jessop, NSW DPI and Dr Greg Sweeney, SARDI.

Saltbush yields vitamin E benefits

Readers of the CRC's *Focus on Perennial* publication may well remember the investigations of PhD student, Chelsea Fancote into vitamin E levels.

Chelsea's PhD is nearing completion and her findings make for interesting reading.

"It only takes a couple of weeks of exposure to saltbush to boost the vitamin E levels of sheep and these levels will carry through a subsequent feedlotting phase of about six-weeks," Chelsea said.

Low vitamin E is common to sheep coming out of poor seasons and feedlots, where there are low levels of available green feed. According to Chelsea, the issue is exacerbated when lambs are born during a dry period and go straight into a feedlot after weaning.

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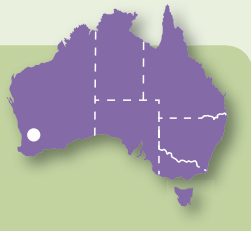
Weed risk note: FFI CRC weed risk assessment gives a low risk score for oldman saltbush for WA, SA, NSW and Victoria

Saltbush supports system flexibility and productivity

Tony York, *Anameka Farms* Tammin, Western Australia is eagerly awaiting the final results of the Future Farm Industries CRC saltbush project. He anticipates the elite lines could treble the impressive benefits he already gains from his traditional saltbush stands.

farm info.



Case study: Tony and Simon York

Location: *Anameka Farms*, Tammin, Western Australia

Property size: 12,000 ha

Mean annual rainfall: 325 mm

Soils: Heavy clays on the valley floors, with lighter hill country

Enterprises: Cropping and sheep

"Rehabilitating our 2000 ha salt-affected land has been a 30-year project and the 1000 ha we now have under saltbush is proving both productive and sustainable.

Through their oldman saltbush trials, Dr Hayley Norman and her team from CSIRO have demonstrated to us that saltbush could boost returns even on our saltiest, most marginal land.

These woody perennial forage shrubs are using summer rainfall — reducing the recharge of the water table — so you could argue they're also reducing salinity.

When we started the trial about 11 years ago, underground water on the site was 1.5 times saltier than sea water and returns from the site were a mere one-fifth of those from more arable land.

The saltbush we now have established provides feed during that critical autumn feed gap, allowing us to boost stocking rates across the farm by 20%.

We've about exhausted our ability to incorporate perennials into this landscape, but with the outcomes from Hayley's recent varietal work we will work towards improving the varieties.

Mind the gap

We farm in a typical Mediterranean climate of long hot summers and short, mild winters.

Cropping across our arable country dictates a system of annual pastures, which provide feed from late winter through to late summer.

key points

- Saltbush provides autumn grazing, reducing supplementary feeding and delaying grazing winter pastures.
- Previously unproductive saltland has become an integral part of the York's farming system.
- New saltbush lines could double or even treble productivity.

Tony York and CSIRO researcher Dr Hayley Norman (Photo: FFI CRC)

Grazing our sheep on saltbush during autumn when there is little, if any, other green feed available means we can delay turning them on to winter pastures.

Depending on the season, we graze our salt country during autumn for 4–6 weeks. If it still hasn't rained we will keep them there up till the end of June with plenty of supplementary feed.

For this two-month period we run anywhere between 10 DSE/ha up to 30 DSE/ha (although feed doesn't last long at the higher end of the stocking rates).

When the sheep first go onto the woody perennials there is a bit of grass between the bushes and we only provide a minimum of supplementary feed (mainly lupins and hay) for the first month. As the grazing period extends, we increase the supplement ration.

Diversity breeds flexibility

Saltbush has kept us in livestock. The fact that we have 10% of the farm committed to grazing has made us much more open to retaining a substantial livestock component to our enterprise, which offers flexibility and diversity.

At the moment cropping is running into trouble and those that haven't been salt affected have been disadvantaged as they are totally reliant on a single source of income — from crops.

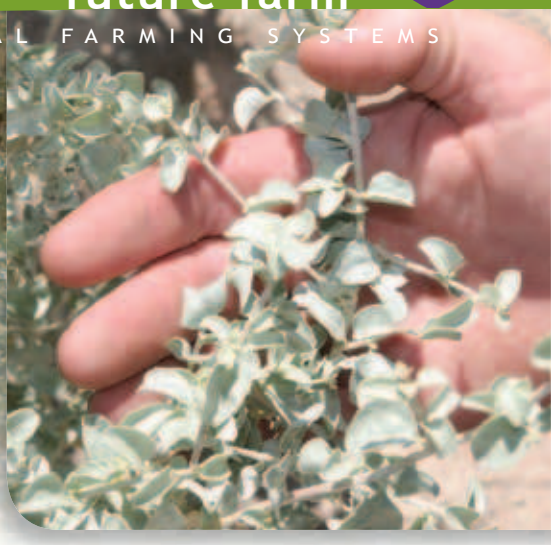
We run about 6000 Merino ewe mothers and turn off 2000 Awassi lambs into the live sheep market each year.

We think the way the Awassi contract has been marketed, providing a contracted price before joining, is great as we can assure a market 12 months in advance — it's all about price security.

Saltbush is a secure feed base that supports this livestock system — intensively graze during autumn, spelled when you graze the annual pastures. They key is to give saltbush plenty of time to recover.

Broad-scale plantings

We have planted about 500 hectares of our total farm to saltbush and another 500 hectares is mostly self-sown perennial



With some local funding Tony and Simon York are helping Hayley Norman's project team establish 10 ha of new saltbush plants to assess their commercial value. (Photos: Jill Griffiths, FFI CRC and Hayley Norman, CSIRO)

bluebush. I'm told it's one of the most significant farm revegetation projects in Australia, with up to 60,000 saltbush seedlings planted annually.

Planting is a fairly straightforward process using seedlings or cuttings — we use commercial tree planters and mechanically plant, with two people planting about 10,000 (10 ha) a day.

We plant at the start of winter on a full soil profile — this is essential for success — and usually achieve between 90-100% survival.

Depending on the season (summer rain) the cuttings will be well established and ready to graze as early as the following autumn; if the season is dry then they will still be ready by the following autumn.

We can get a whole lot more growth with a bigger, more established, robust plant before you turn the sheep onto them and you end up with more feed.

Bright future

Although we are thrilled with our current system, the point about Hayley's research is that we've not been using the best varieties.

Hayley's team has been coming up with plants that have twice the production and much higher nutrition and palatability than our varieties.

For us, that means we can turn 1000 hectares of saltland from being marginally useful (the biggest being the whole-farm benefit of destocking the rest of the farm) into being truly productive in its own right.

The capacity of our saltland could be doubled or trebled.

In the trial plots, we can already see the difference, but haven't been able to commercially graze with meaningful animal results.

These elite varieties will really give a shot in the arm to the efficiency of our saltland — we are really looking forward to paddock-scale plots of the new plants.

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science behind the story

By Dr Hayley Norman, CSIRO

- **Old man saltbush is an Australian native shrub found across the arid interior. It is understandably well adapted to drought and tolerates high soil salinity. From a commercial livestock production perspective its benefits also include summer activity and the ability to quickly respond to out-of-season rainfall.**

Livestock scientists, agronomists, ecologists and hydrologists from the Future Farm Industries CRC have investigated the value of saltbush within farming systems such as Tony's for many years. The outcome of this work is to conclude that incorporation of saltbush leads to a range of moderate benefits that, when combined, can lead to a significant increase in farm profitability and sustainability. Tony has identified these benefits within his own whole-farm system and understands how to manage the plant's limitations through strategic supplementation.

Salt accumulation in saltbush leaves can account for as much as 20% to 30% of the dry matter. Sheep grazing saltbush alone would potentially consume 1.4 to 2 kg of salt per week! Mature wethers or steers could not maintain weight on saltbush alone as salt limits the intake of biomass, even when the saltbush is growing on non-saline land.

Tony manages the nutritional constraints of saltbush by feeding his ewes hay and lupin supplements to ensure a balanced diet. The hay provides energy and fibre, the saltbush provides some energy, crude protein, sulphur, minerals and vitamin E while the lupins provide energy for pregnant ewes.

Equally, saltbush can be used to complement crop stubbles as long as energy is sufficient for the class of stock.

Although saltbush does not provide a balanced diet on its own, it has the advantage of growing marginal soils where there are few options, tolerates drought and offers a highly predictable quantity of biomass of known nutritive value every autumn.

The major economic benefit saltbush offers Tony is the ability to run 20% more animals through autumn with less risk. The saltbush also provides Tony a place to feedlot stock so annual pastures can get away at the break of season.

CRC research also shows that saltbush helps to manage salinity by reducing the amount of summer-autumn rainfall that reaches the water table. Tony's annual program of saltbush planting is likely to be maintaining and possibly improving the productive capacity of his saline land.

The CRC saltbush improvement project has been identifying genotypes of old man saltbush with higher energy values, better biomass production and improved palatability to livestock. Tony and Simon York have been enthusiastic hosts of the WA component of the research and we are currently establishing a 10 ha plot of the new shrubs on their farm to provide grazing data. The knowledge, enthusiasm and support of York family has been critical to the project.

- *Dr Hayley Norman is a Research Scientist with CSIRO Livestock Industries who is developing strategies for the profitable use of saline plant communities for livestock production.*

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