Optimising establishment and utilisation of saltbush-based forage systems

Dr Hayley Norman, Matt Wilmot (CSIRO), Dr Ed Barrett-Lennard (Department of Primary Industries and Regional Development), and Dustin and Lisa McCreery (Chatfields Tree Nursery)

Acknowledgements

This project was funded by Meat & Livestock Australia, Australian Wool Innovation and the CSIRO; project code L.LSM.0018 – No More Gaps With Superior Shrub Systems.

The project research team included Dr Hayley Norman, Matt Wilmot, Dr Sarah Rich, Elizabeth Hulm, Paul Young, Josh Hendry and Andrew Toovey (CSIRO), Dr Ed Barrett-Lennard (DPIRD, Murdoch University), Dr Simone Pedrini and Prof Kingsley Dixon (Curtin University) and Aslak Christensen (University of Copenhagen). Dustin and Lisa McCreery (and their team) from Chatfields Tree Nursery were key contributors. Thanks to Dr David Masters (CSIRO), Robert Harrison, Justin Hardy and Ron Master (DPIRD), Dr Bradley Nutt (Murdoch University) and staff from the Western Australian College of Agriculture Cunderdin and Muresk Institute. Our generous host producers included Tony, Simon and Oscar York (Tammin), Ian and Michael Walsh (Cranbrook), Sam and Sandy Lehmann (Cranbrook), Andrew and Debbie Gillam (Dongara), Rex Luers (Baandee), Craig Forsyth (Dongara), Simon Tighe (Kellerberrin), Alan Manton and Kelly Pearce (Yealering), Rodney Stokes (Tammin) and John Wallace (Esperance). Thanks to Freya Spencer and the Gillamii Centre, Mingenew-Irwin Group and Sian Pladdy and Glenice Batchelor from Merredin and Districts Farm Improvement Group. The project and industry engagement were enabled by the CSIRO Drought Resilience Mission and the WA Livestock Research Council.

Many thanks to Dr Joe Gebbels and Dr Melanie Smith (MLA), and Melissa McAulay, Emily King and Dr Emmah Goldsmith (AWI) for working proactively with the research team to manage COVID disruptions and optimise the outcomes for red meat and wool producers. Finally, thanks to Dr Allan Peake whose contribution regarding the improvement of quality, coherence, and content presentation is greatly appreciated.

Cover images credits
Australian Wool Innovation (top image)
Dr Hayley Norman (bottom images)

Other images
Images are attributed to Dr Hayley Norman, CSIRO, unless otherwise stated

Contents

What is saltbush? 2

Why should you grow saltbush in your production system? 4

Understanding how saltbush can benefit your production system 7

Is saltbush suited to your farm? 8

Designing a saltbush area for your production system 11

The importance of good understorey choices 13

How to ensure successful establishment 16

Additional considerations when direct seeding 18

How to optimise grazing 21

What are the animal nutrition considerations? 23

What is saltbush?

Saltbushes are perennial shrubs that provide palatable year-round feed, often in marginal environments. They belong to the chenopod family of plants and are well adapted to Australian conditions. Common types of shrubs used by producers include:

- **Old man saltbush** (*Atriplex nummularia*) is a long-lived perennial shrub (20+ years) which grows across Australia's arid interior. It is well adapted to drought and tolerates high levels of salinity. Therefore, it grows on soils not ideal for cropping. Old man saltbush is tough and well adapted to Australia's agricultural zones.
- **Anameka™** is a popular cultivar of old man saltbush that has been selected for higher energy content, greater biomass production and palatability for livestock. It is best used on better classes of 'marginal' land. It is currently only available through nursery-raised cuttings as it is a clone of one plant selected from 60,000. Work is underway to select high feeding value seed lines for nurseries or direct seeding. Though nursery availability can constrain saltbush supply, planting seedlings offers uniform establishment and reduces the need for replanting and of the paddock being out of production for more than six to nine months.
- **River saltbush** (*Atriplex amnicola*) originates from the Murchison region of Western Australia and is suited to saline and wetter areas with shallow water tables.
- **Creeping or berry saltbush** (*Atriplex semibaccata*) is a short-lived shrub which volunteers readily and is often found on dam walls and areas protected from grazing.
- **Mallee saltbush** (*Rhagodia preissii*) tolerates some salinity and is well adapted to poor sandy soils.
- **Small-leaved bluebush** (*Maireana brevifolia*) is not a saltbush but a chenopod with similar nutritional attributes to saltbush. It readily spreads across saline land if protected from grazing during flowering. If they are not on the site and you are happy to have woody plants in the inter-row, you can throw in a few seedlings when planting saltbush.

This guide aims to help inform producers of the potential benefits of these different types of saltbush in southern Australia, and how best to get them working for you.

Table 1: Key chenopod species that are often utilised in grazing systems

Species	Origin	Lifespan	Height*	Width*	Soil preferences*	Salt tolerance	Waterlogging tolerance	Seed or seedlings?[2]
Old man saltbush (*Atriplex nummularia*)	Across Australia	20+ years	1–3m	1m	Clay, sandy loam	High[1]	Low	Seedlings easier
River saltbush (*Atriplex amnicola*)	South-West WA	20+ years	0.3–1.7m	up to 2m	White or grey sand, sandy clay	High[1]	High	Seedlings easier
Creeping or berry saltbush (*Atriplex semibaccata*)	South-West WA	2 years	0.2–0.5m	1.8m	Clay, sand, loam, laterite	Moderate	Low	Either – a good early coloniser and will self-seed
Mallee saltbush (*Rhagodia preissii*)	WA	15+ years	0.5–4m	1.5m	Sand, loam, calcareous and massive earths and yellow duplex soils	Moderate	Low	Seedlings easier but some success with direct seeding
Small-leaved bluebush (*Maireana brevifolia*)	South-West WA	<10 years	0.2–1m	0.4m	Loam, sandy clay	Moderate	Moderate	Either – a good early coloniser and will self-seed
Grey saltbush (*Atriplex cinerea*)	South-West WA	<10 years	0.2–1.5m	up to 2m	Coastal areas, limestone cliffs, salt lakes, sand dunes	High	Low	Seedlings easier
Wavy-leaf saltbush (*Atriplex undulata*)	Argentina	<10 years	<1m	<1m	Clay, sandy loam, sand	Moderate	Moderate	Either – a good early coloniser and will self-seed

*Sources https://florabase.dbca.wa.gov.au/ and Revell et al 2013

[1] Also adapted to non-saline systems

[2] Some shrubs species are most commonly established by transplanting seedlings, which are grown either as cuttings or from seed for 6–9 months, typically in a tree nursery before being transplanted.

Why should you grow saltbush in your production system?

Nutritional gaps present the largest production cost to grass-fed meat and wool producers across Mediterranean-type and dry Australian environments. These gaps lead to sub-optimal production or slower growth rates, the need for supplementary feeding and overly conservative whole-farm stocking rates.

Perennial forages, including drought-tolerant native shrubs such as saltbush, provide an opportunity to fill the summer/autumn and early winter feed gaps.

Saltbush and other shrubs can:

- be grown on soils considered marginal for crop production and provide nutrients to complement, and thereby improve the feed conversion ratio of crop and pasture residues
- offer an effective tool for managing recharge of water tables and restoring the productivity of saline land
- provide a reliable green feed source in summer and autumn, which is high in crude protein, sulphur, vitamin E and minerals.

It is important to remember that saltbush species are not a suitable feed on their own, due to the high salt content of their leaves. This means it is important to consider what other feed sources the animals will have to complement the saltbush, whether this comes from understorey plants in the same paddock or other feed sources like hay or grain.

Livestock also need a generous supply of fresh drinking water nearby.

Sheep offered Anameka™ saltbush or Mallee saltbush, while grazing cereal residues, maintained weight and had 20% greater wool growth than sheep offered cereals alone (Li et al 2018).

Old man saltbush (*Atriplex nummularia*)

River saltbush (*Atriplex amnicola*)

Creeping or berry saltbush (*Atriplex semibaccata*)

Grey saltbush (*Atriplex cinerea*)

Wavy-leaf saltbush (*Atriplex undulata*)

Mallee saltbush (*Rhagodia preissii)*

Small-leaved bluebush (*Maireana brevifolia*) in flower (left) and not in flower (right)
Credit: the Enrich Team

Why use saltbush in your production system?

Used in a grazing system, saltbush can:

- maximise production on land not suitable for cropping or other pasture types
- fill seasonal feed gaps
- lift farm stocking rates
- reduce supplementary feeding
- improve drought resilience
- restore the productivity of saline land and help manage water table recharge
- maintain sheep weights in summer while increasing wool growth
- provide health benefits through provision of vitamin E and minerals
- provide shade and shelter for livestock

Understanding how saltbush can benefit your production system

Saltbush and other shrubs can have a range of benefits to a production system, but there are many species to choose from and different ways to use them. It is important to understand your production goals, production system and the capacity of the land so that you can design the optimal system to meet your needs. Consider how they will complement the rest of your production system:

- Focus on when your feed gaps are, such as during summer grazing of crop stubbles, during early winter while resting or restoring pastures or during extended dry periods.
- Identify where on your farm shrubs can be established to manage soil challenges such as shallow water tables that contribute to dryland salinity.
- Consider which land could be improved from a production and visual amenity perspective.
- Assess the cost and resources required to invest in successful establishment.

Preparing a site for establishing Mallee saltbush (August), Cranbrook, WA

Mallee saltbush six months later in mid summer, Cranbrook WA

Is saltbush suited to your farm?

In mixed farming zones, perennial shrub systems have the best economic fit on land that has lower profitability for cropping. On the flip side, there is little point establishing saltbush in areas where it will not be productive, persistent and provide a return.

To get the most out of saltbush, start with the best 'marginal' land, which offers the easiest establishment and the highest economic return potential. Don't venture into the more challenging areas until you are more experienced in establishing and managing shrubs and have a system that works.

Additionally, it is important to understand the degree of salinity and waterlogging in the paddock where saltbush is being established. If you don't want to spend a lot of money on site characterisation, the plants that have naturalised on the site are often great indicators of what else can grow there. For greater precision, piezometers (to measure water table depth), soil tests and EM38 (electromagnetic meter) surveys can assist you to better understand the distribution of salt and water in the landscape. In patchy areas, you can mix the species and plant each on the most appropriate area.

If a potential site is dominated by scalded soil (bare salty ground) and samphire plants, it's unlikely to be profitable to revegetate. A better option is to cover the soil with old hay or header chaff, keep stock off and let it rehabilitate.

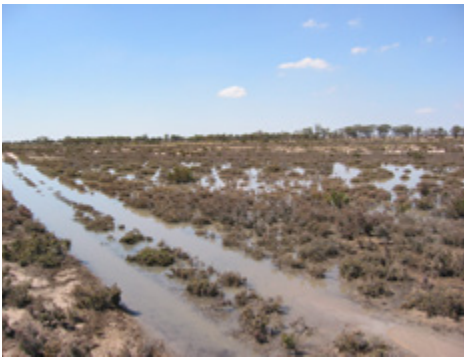
Although these shrubs are incredibly hardy once they have matured, many species can be difficult to establish through direct seeding as seeds are only 1mm in size. Planting nursery-raised seedlings reduces the risk of poor or patchy establishment.

In any shrub system, it's also important to consider what species will be sown in the understorey, as this can provide a significant source of complementary feed.






From top L to R. Sites that are suitable for saltbush-based systems include barley grass flats on valley floors (where inundation is uncommon), heavy saline and sodic red clays, midslope areas where salinity patches are breaking out, infertile sandy soils, retired irrigation country and rocky corners of paddocks that are difficult to reach with seeding machinery



Sites too waterlogged and saline for saltbush systems. Areas with regular inundation, very shallow water tables and bare salt scalds are often dominated by samphire. These areas are unsuited to saltbush systems.

Making plans

Here are four helpful resources to help you get started:

1. Saltland Genie is a website that provides a fantastic source of information about indicator species, tests and technology to understand paddock capability, and suggests solutions for a range of conditions.
   Go to: https://www.saltlandgenie.com/#/home.
2. The Enrich Guide (https://cdn.environment.sa.gov.au/environment/docs/Enrich_Booklet.pdf) offers further information about a wide range of native shrub species and using shrub mixtures for grazing.
3. Information about establishing annual legumes in the understorey is available in the *Pasture legumes information and management guide*.
   Go to: https://grdc.com.au/resources-and-publications/all-publications/publications/2023/pasture-legumes-manual.
4. Talk to producers who have already grown saltbush and contact nursery suppliers to seek their advice.

Designing a saltbush area for your production system

Consider the layout carefully, as you could have it for decades.

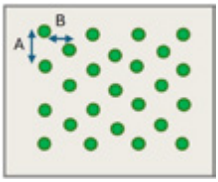
Things to consider include:

- ability to see the stock as you are driving past; consider planting rows on an angle such that you can see down them from the roadside or laneway
- how stock will be mustered, shrub row orientation in relation to the gates or yards
- leaving sufficient space in the inter-rows to allow for movement of machinery
- leaving gaps for access tracks that run across the plant rows will also make it easier to muster and for stock to access water; these gaps also need to be planned in relation to the width of farm machinery
- the direction of prevailing weather conditions and how planting can be optimised to provide shade and shelter for livestock
- strategically planting on slopes along contour and where surface water flow occurs to reduce erosion issues
- ensuring that shrub rows are far enough apart so you can manage the understory species with the necessary machinery.

When designing the site:

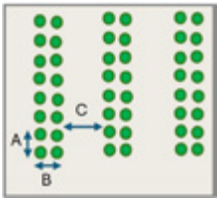
- Aim for a plant density of 700–1,200 seedlings/ha. If you have more than this, they ultimately compete for subsoil water and stock movement becomes more challenging. See the Saltland Genie website's shrub design calculator; Fig 1 below provides some of the more common layouts.
- Two to four closely spaced rows of shrubs with a wide alley gives you more management options than a uniform or 'block' planting.
- Don't forget to order your seedlings or seed well in advance of the season you are planting. Seedlings take six to nine months to produce in a nursery.
- Ensure sufficient access to clean, cool drinking water. If water is in the corner of a large paddock, stock may underutilise some shrubs and overgraze others.

Block planting



A. Between shrubs within rows (m)	B. Between adjacent rows (m)	Shrubs/ha
3.5	3.5	816
3.0	3.0	1111
2.5	2.5	1600
2.0	2.0	2500
2.0	4.0	1250

Alley planting



A. Between shrubs within rows (m)	B. Between adjacent rows (m)	Number of adjoining rows	C. Alley width (m)	Shrubs/ha
2.0	2.0	2	5	1111
2.0	2.0	3	5	1364
2.0	2.0	2	10	714
2.0	2.0	3	10	938
2.0	2.0	4	10	1111
2.0	2.0	3	15	714
2.0	2.0	4	15	870
2.0	2.0	4	20	714
2.0	2.0	5	20	834

Figure 1. Some of the more common planting configurations for woody shrubs; to design your own plantation based on your machinery size and preferences, see the shrub calculator on the Saltland Genie site

The importance of good understorey choices

The inclusion of understorey inter-row species can boost profitability, allow animals to optimise their diets, reduce the need for supplementary feed and help cover the soil for improved erosion control.

The optimal understorey will vary between rainfall zones and soil types, and may include volunteer plants, self-regenerating annual legumes, herbaceous perennials or sown cereals. Consider species/cultivars used in your local area on similar soil types. Fig 2 shows some of the most commonly sown understorey species for saltbush systems in saline and waterlogged areas.

Legumes tend to have the highest feeding value and fix nitrogen, however they are generally sensitive to salinity. Many will tolerate waterlogging however, and can find a niche where they can avoid salt. This avoidance can be spatial or temporal, i.e. through late germination (after rain has flushed salt down the soil profile) and/or early maturity (setting seed before salt capillary rise as temperatures increase).

Hard-seeded species self-regenerate so are useful in production systems where re-seeding is difficult. Self-regenerating legumes also have high feeding value, and shrub growth is boosted by the fixed nitrogen. If the area is not saline and waterlogged, or patchy, species such as burr medics, biserrula, bladder clover, gland cover, arrowleaf clover, rose clover, seradellas (sandy and acid soils), subclover and the new trigonella could all be considered. For more information on the use and management use of hardseeded pasture legumes go to: https://grdc.com.au/__data/assets/pdf_file/0038/595865/GRDC_Pasture-Legumes-Growers-Manual_2023_FINAL.pdf

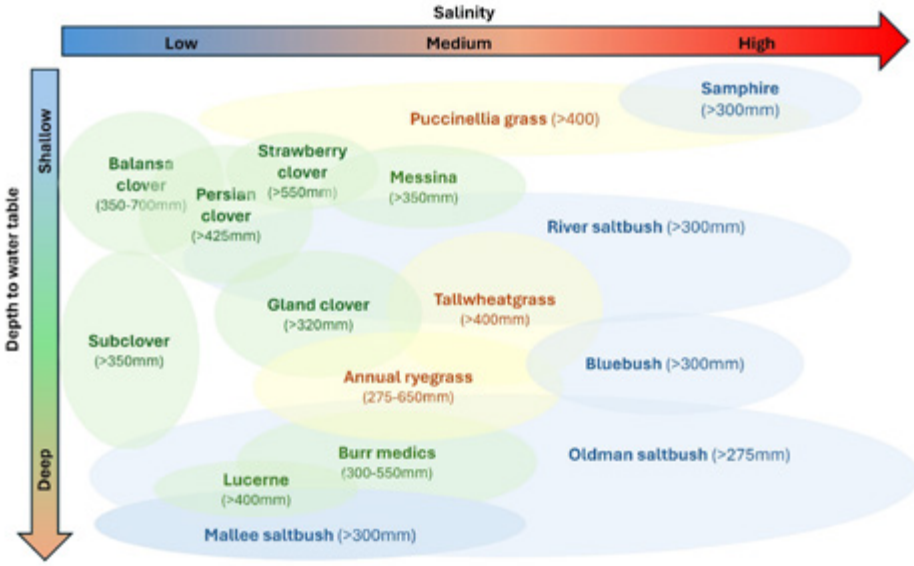


Figure 2. A graphic indicating preference among pasture species for waterlogging and salinity (rainfall in brackets). Soil type, climatic factors and weed risk all influence plant selection, this is a guide only based on outputs from Sustainable Grazing of Saline Lands. Please contact your local advisors or consult the Saltland Genie site.

If you are sowing a perennial or self-regenerating annual understorey, consider if it can be sown before the shrubs. It's much easier to do it then using large seeders and spray equipment before shrubs are planted from winter to spring.

If you want to be able to manage or re-sow an understorey after the shrubs have been planted (e.g. growing barley or managing weeds), make sure the intended shrub layout is compatible with machinery size and turning circles.

Mixtures of understorey species can enable a variety of niches within variable paddocks to be colonised. If weed management is important, consider future herbicide options.

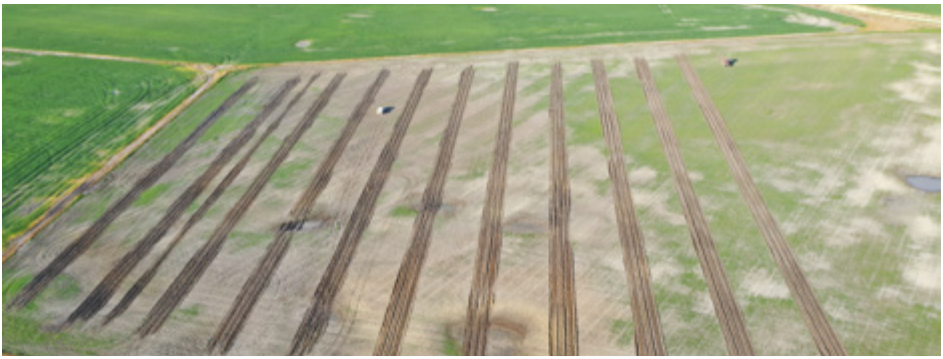
Tune in

Watch this video to see how one WA producer designed a saltbush-based system on their farm: https://www.youtube.com/watch?v=oeBDJASTaEw

Legumes in the inter-row

Tall wheat grass in the understorey

Balansa clover and burr medic



It's easier to plant the understorey before the saltbush Credit: Sam Flottmann (CSIRO)

How to ensure successful establishment

Give the establishment of a shrub system the same attention you give a crop. The paddock will need to be kept out of production for at least six months during shrub seedling establishment and longer if using seed. Take the time to get it right the first time as you don't want it out of production for 18 months while you fix a failure or a patchy strike rate.

The steps to success include:

- Creating clean paddocks before planting understorey and shrubs. It is better to reduce weed burdens before putting the shrubs in as it's harder to do later. You can plant directly into a pasture or a patch of bluebush or perennial grass if you use a tree planter which scalps the topsoil. You can even sow into an existing crop which can be harvested later, provided the crop is taller than the young shrubs.
- Fertilise to meet the needs of the understorey species. Shrubs appreciate some nitrogen but they are well adapted to infertile soils as their deep root system allows them to scavenge nitrogen from deep in the soil profile. Saltbushes also use small nitrogen compounds to osmoregulate (manage salt in the tissues). If in doubt, apply some test strips of nitrogen fertiliser and see if you get a growth response.
- Ideally, plant shrubs or seeds from June to September (but check with your local nursery). After that grazing must be deferred until the shrubs are at least six months old (if planted as seedlings) or 12 months old (if established from seed) to ensure they are not pulled out of the ground by livestock.

Harvesting wheat over saltbush that was planted four months prior to harvest
Credit: Matt Wilmot (CSIRO)

Planting saltbush into the last crop as the paddock goes into a shrub system. A crop provides good weed control, grain can be harvested over the establishing shrubs and the stubble provides a good complement to saltbush if the site is ready to graze that autumn after saltbush planting.

- Using a tree planter allows you to do multiple operations at once. The right equipment will scalp weeds to stop them competing for light and water during establishment. It will also rip soil to improve root penetration and press the root ball into the ground.
- Plant shrub seedlings deep in the soil (with less than half the plant above soil level). You want the root ball of the establishing plant as close to moisture as possible, and burying some of the stem below the soil surface does not decrease survival rates of the seedlings, per Fig 3.

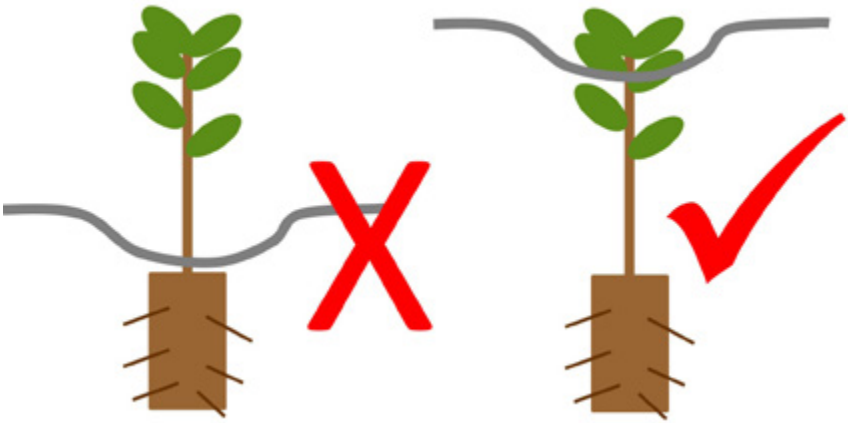


Figure 3. Shrub planting depth

Additional considerations when direct seeding

Direct seeding may be cheaper than transplanting nursery-raised seedlings, but can be a more challenging way to achieve a satisfactory plant density. Consider the risk of failure as part of the establishment cost.

Many saltbush species have very small seed sizes (smaller than a pin head), so seeds must be planted at very shallow depths where the risk of desiccation is high, and germination rates can be very low.

Additionally, the seed of some species are enclosed in woody bracts. This also makes it harder to achieve good seed-soil contact, and sometimes no seed is contained within the bracts. It can be important to pry some of the bracts open with tweezers to check whether planting rates need to be adjusted to account for a lack of viable seed.

Anecdotal evidence suggests that direct sowing is more likely to be successful on sandy soils and in areas with summer rainfall. The establishing seed must be able to grow sufficient roots to survive their first summer. Areas with a higher likelihood of summer rainfall provide lower risk.

If direct seeding, try to use specialised shrub seeders that have been designed to scalp or mound soil to create a niche for saltbush seed (in woody bracts). There is a useful video of this on Saltland Genie interviewing farmer Ian Walsh.

Use germinable, high-quality seed. If purchasing seed, ask for a germination test. Alternatively, assess viability by putting ~50 seeds on some damp cotton wool and keep moist for two weeks. Count the number of germinated seeds to calculate viability.

Bluebush and creeping saltbush establish easily from seed, however bluebush seed must be fresh as seed quality rapidly declines.

If Mallee saltbush seed has been sourced and is still contained within the fruit, the berry needs to be macerated and washed to remove the residue before sowing.

Site at Yealering (WA) where half was planted to saltbush and annual legumes and the other half left as barley grass flats; the revegetated paddock supported four times the stocking rate in autumn

Leave a gap for sheep and vehicle movement

Align shrubs against the worst prevailing winds during lambing to improve shelter value

Anameka™ seedlings at Chatfields Tree Nursery

Old man saltbush and Mallee saltbush for shelter

Scalping for water harvesting in dry areas

Mounding with a tree planter to reduce the risk of water logging in a water-accumulating area

Tree planter demonstrating pressing root ball into the soil to reduce risk of air pockets that prevent root growth

Direct seeded saltbush; saltbush bract incorporated with vermiculite and dropped into a niche using a Mallen Niche Seeder

How to optimise grazing

Transplanted saltbush can be grazed from six months post-planting. To assess readiness for grazing look for evidence that most shrubs are actively growing and have reached at least knee height (old man or Mallee saltbush). For all species the tug test can be applied i.e. if you can pull the shrub out of the ground, so can your stock, therefore wait until the plants are well rooted.

The first graze will shape the plants. If done well it will ensure there are lots of growing tips below sheep grazing height. Try to remove only half of the leaves on the first graze as you want the shrubs to have enough energy to be growing a strong root system and maximise subsequent biomass production.

Once fully established, saltbush needs to be well grazed at least once each year. Growth slows as shrubs reach full leaf density and start flowering. Don't assume that you can 'bank' biomass for several years – it's better to give them a good graze annually. When plants switch to seed production, leaf growth slows down and they may drop some leaves when water stressed.

Heavy grazing of mature shrubs back to bare sticks is fine, as long as the shrubs have time to recover. The harder you graze, the longer they will take to recover as there is less leaf area to photosynthesise energy for growth. Heavy rotational grazing is better than long-term set stocking, as this gives a more uniform grazing pressure across the paddock.

Saltbushes do not vary in nutritional value throughout the year. That's why they tend to be grazed when there are feed gaps. The understorey is usually made up of annual species that have the greatest nutritional value in the spring, which you should endeavour to utilise. Sheep will select some saltbush at this time of year (around 13% of total intake), but mostly will eat the green understorey (Norman et al 2010).

Mixed shrub plantations are more challenging than shrub monocultures to manage, as the most palatable shrubs are overgrazed while others are left ungrazed. Grazing with a high stocking density for short duration will help even out the grazing pressure and assist the more palatable shrubs to persist (Revell et al 2013).

Keep some leaves on the saltbush in summer and autumn if you want to capture out-of-season rainfall or draw down on the water table (Barrett-Lennard et al. 2009), as the shrub water use is much reduced when leaves are removed.

In many cases, a small drop in the water table (as low as 30cm) can dramatically improve land capability. As water tables drop, additional rain will flush salt below the root zone of shallow-rooted, salt-sensitive understorey plants. These plants make a significant contribution to the feeding value of the paddock.

Saltbush can either grow from rainfall or by drawing directly from the water table if water quality is suitable. Old man saltbush can grow with salinity levels similar to sea water (35,000mg/L, 35,000ppm or ~5,500mS/m). If the water is even more saline and also acidic, the shrubs are unlikely to be drawing from the water table. In these cases, the shrubs will still use the rainfall throughout the year and reduce water table recharge over time.

There is ongoing research to investigate tolerance of these shrubs to major herbicides. Weed control is regionally specific and best discussed with your local agronomist.

Heavy grazing is okay, as long as it is given time to recover

Use it or lose it! The saltbushes that were protected from grazing has similar biomass to the heavily grazed shrubs the following year

What are the animal nutrition considerations?

Intake

Shrubs can provide between one third and half of a balanced diet and are best considered as a standing supplement of crude protein, sulphur, vitamin E and essential minerals.

Sheep and cattle cannot eat enough saltbush or bluebush to maintain liveweight if it is the sole component of the diet (Norman et al 2004). This is because saltbush and bluebush accumulate in excess of 25% salt in leaves, even in non-saline soils, and they also have relatively high concentrations of sulphur (3.9–4.6g/kg dry matter) (Bird 1972, Masters et al 2007). Both salt and sulphur limit intake after a critical threshold is reached. Equally, Mallee saltbush produces saponins, so it is not suited as a sole diet for sheep or cattle.

In a mixed diet however, these plants make a valuable contribution to animal productivity by offering a diverse nutritional profile where animals can select components to meet their needs and minimise intake of anti-nutritional factors.

Sheep offered both moderate quality hay and saltbush at the same time will eat more (around 1.5kg dry matter) than if they are offered either feed alone (< 1kg dry matter) (Warren and Casson 1992). This is due to the salt and sulphur limitation of saltbush intake and indigestible fibre limits of hay intake. Because saltbush has low levels of indigestible fibre and hay has low salt and sulphur, the two feed types are complementary and sheep can eat more if they have access to both.

Having the shrubs in the production system increases profitability as they reduce supplementary feeding costs, especially in poor seasons (Norman et al 2016).

Sheep and cattle need a low salt feed to complement saltbush

Energy supplements are needed for growing and reproducing stock

Feed value

All classes of sheep and cattle can utilise saltbush if they have sufficient fresh and cool water. The more salt in the water, the less saltbush or bluebush animals will eat. The Saltland Genie site has a section on salt intake from drinking water and saltbush.

The organic matter digestibility (OMD) of old man saltbush ranges from 50–65%, and in berry saltbush ranges from 65–72% OMD (Norman et al 2010, Norman et al 2016, Revell et al. 2013). River saltbush, grey saltbush and bluebush tend to have OMD values of 46–59%. To reiterate, while these energy values may appear high, intake is constrained so energy supplements may be required if the complementary feed is also energy deficient - especially for young, reproducing, and lactating stock.

Various sheep breeds and cattle eat the same proportion of saltbush in their diet (around 40–50% in autumn) if given a choice and plenty of fresh water. Individual animal differences are larger than species or breed differences (Fancote et al 2009; Norman et al 2010). In spring when the understorey has higher nutritional value, sheep still select around 13% saltbush in their diets (Norman et al, 2010).

Saltbush is high in crude protein and sulphur and studies show Merino sheep can grow 20–25% more wool when they have access to saltbush, compared to sheep offered moderate quality hay alone (Li et al 2018; Norman et al 2016). High salt diets may also contribute to improved wool growth (Masters et al 2005; Thomas et al 2007). Increasing the salt content of a diet leads to an increase in water intake and this can lead to more protein that bypasses degradation by microbes in the rumen and is, therefore, absorbed directly in the small intestine.

Saltbush and other salt-tolerant shrubs are a good source of vitamins E and A, as well as the minerals associated with antioxidant pathways sulphur, selenium, manganese, zinc and copper (Pearce et al. 2008; Norman et al. 2019). These are often lacking in dry feeds and thought to be important when managing heat stress.

Saltbush lamb

As well as the health benefits, vitamin E from saltbush has been shown to slow the oxidation of lipids in meat and delay the oxidative change of oxymyoglobin to brown metmyoglobin, thus increasing the shelf-life of meat (Pearce et al 2005; 2010). While saltbush flavour in meat is prized by some, consumer taste panels have been unable to conclusively pick a difference (Pearce et al 2005; 2010).

Animal health considerations

Many of these shrubs produce oxalates (Masters et al 2001; Norman et al 2016) and this can lead to induced calcium deficiency (Cheeke 1998) and reduced shrub intake (Burritt and Provenza 2000). Be aware of the risk of calcium deficiency, especially if you are supplementing with cereal grain (low in calcium) or are lambing/calving. The high sulphur from some shrubs can also induce copper deficiency in animals.

Bluebush and Mallee saltbush can have high nitrate levels which approach a toxic threshold, and these can increase if nitrogen fertiliser is applied (Norman et al 2016). However, salt limiting intake reduces risk of these toxicities as animals need to dilute the shrub diet with other feeds. Be aware of the nitrate toxicity risk particularly if you are turning hungry animals onto lush, fertilised bluebush or Mallee saltbush stands with little understorey or hay.

Other considerations

Sheep offered novel forages do not inherently know they are safe to eat, and it will take time for them to learn to incorporate shrubs into a balanced diet. Lambs exposed to novel foods while with their mother, or even in utero, are more likely to rapidly incorporate them into a diet.

Learning to eat saltbush with Mum

References

Ben Salem H, Norman HC, Nefzaoui A, Mayberry DE, Pearce KL, Revell DK (2010) Potential use of oldman saltbush (Atriplex nummularia Lindl.) in sheep and goat feeding. *Small Ruminant Researc*h, 91, 13–28.

Bennett Sarita Jane, Barrett-Lennard EG, Colmer TD (2009) Salinity and waterlogging as constraints to saltland pasture production: A review, Agriculture, Ecosystems & Environment,129, 4, 349–360.

Burritt EA, Provenza, FD (2000) Role of Toxins in Intake of Varied Diets by Sheep. *Journal of Chem Ecology*, 26, 1991–2005.

Fancote CR, Vercoe PE, Pearce KL, Williams IH, Norman HC (2013) Backgrounding lambs on saltbush provides an effective source of Vitamin E that can prevent Vitamin E deficiency and reduce the incidence of subclinical nutritional myopathy during summer and autumn. *Animal Production Science*, 53, 247–255.

Fancote CR, Norman HC, Williams IH, Masters DG (2009) Cattle performed as well as sheep when grazing a river saltbush (Atriplex amnicola)-based pasture. *Animal Production Science,* 49, 998–1006.

Li X, Norman HC, Hendry JK, Hulm E, Young P, Speijers J, Wilmot MG (2018). The impact of supplementation with *Rhagodia preissii* and *Atriplex nummularia* on wool production, mineral balance and enteric methane emissions of Merino sheep. *Grass and Forage Science*, 73, 381–391.

Masters DG, Norman HC, Dynes RA (2001). Opportunities and limitations for animal production from saline land. *Asian-Australasian Journal of Animal Sciences*, 14 199–211.

Masters DG, Rintoul AJ, Dynes RA, Pearce KL, Norman HC (2005). Feed intake and production in sheep fed diets high in sodium and potassium Australian. *Journal of Agricultural Research*, 56, 427–34.

Masters DG, Benes SE, Norman HC (2007). Biosaline agriculture for forage and livestock production. *Agriculture Ecosystems & Environment*, 119, 234–248.

Norman HC, Friend C, Masters DG, Rintoul AJ, Dynes RA, Williams IH (2004) Variation within and between two saltbush species in plant competition and subsequent selection by sheep. *Australian Journal of Agricultural Research,* 55, 999–1007.

Norman HC, Masters DG, Wilmot MG, Rintoul AJ (2008) Effect of supplementation with grain, hay or straw on the performance of weaner Merino sheep grazing old man (*Atriplex nummularia*) or river (*Atriplex amnicola*) saltbush. *Grass and Forage Science*, 63, 179–192.

Norman HC, Wilmot MG, Thomas DT, Barrett-Lennard EG, Masters DG (2010) Sheep production, plant growth and nutritive value of a saltbush-based pasture system subject to rotational grazing or set stocking. *Small Ruminant Research*, 91, 103–109.

Norman HC, Hulm E, Wilmot MG (2016). Improving the feeding value of old man saltbush for saline production systems in Australia. In: Halophytic and Salt tolerant Feedstuffs: Impacts on Nutrition, Physiology and Reproduction of Livestock (Eds. El Shaer HM; Squires VR) pp 79–86.

Norman HC, Duncan EG and Masters DG (2019). Halophytic shrubs accumulate minerals associated with antioxidant pathways. *Grass and Forage Science*, 74, 345–355.

Pearce KL, Norman HC, Wilmot M, Rintoul A, Pethick DW, Masters DG (2008) The effect of grazing saltbush with a barley supplement on the carcass and eating quality of sheepmeat. *Meat Science*, 79, 344–354.

Revell DK, Norman HC, Vercoe PE, Phillips N, Toovey A, Bickell S, Hulm E, Hughes S, Emms J (2013) Australian perennial shrub species add value to the feed base of grazing livestock in low- to medium-rainfall zones. *Animal Production Science*, 53, 1221–1230.

Two-year-old Anameka™ saltbush on sandy, non-saline soil in Dongara, Western Australia

Notes

GPO Box 1700
Canberra ACT 2601
P: 1300 363 400

csiro.au

GPO Box 4177,
Sydney NSW 2001
P: 02 8295 3100
E: feedback@wool.com

wool.com

PO Box 1961
North Sydney NSW 2059
P: 02 9463 9333
E: info@mla.com.au

mla.com.au