

Saltbushes for saltland – all you really need to know to get started

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1. What this book is about

Saltland pastures could be for you if:

- You want to develop a productive and profitable use for your saltland, and / or
- You want to make sure your saline land is well vegetated and looks a lot better.

The key pasture species for saltland in Australia are:

- The saltbushes (especially old man saltbush, river saltbush and wavy-leaf saltbush),
- The salt tolerant perennial grasses (puccinellia and tall wheat grass), and
- The annual legumes (balansa clover and burr medic).

This little book focuses strongly on the saltbushes as they are the most important saltland pasture species for WA, and for the agricultural areas of lower rainfall in SA, Vic and NSW. Saltbushes can be grown either as dense stands on more saline sites (Photo 1) or in alleys of shrubs alternating with annual legumes or perennial grasses on less saline sites (Photo 2).

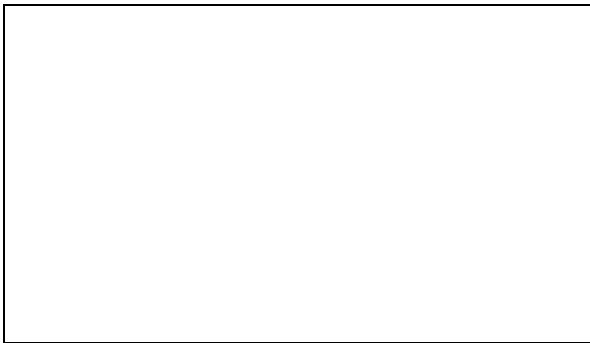


Photo 1. Dense stand of saltbush.

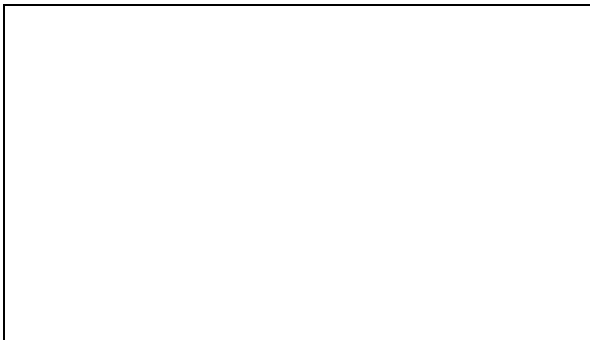


Photo 2. Alleys of saltbush alternating with bays of annual under-storey.

Establishing saltland pastures can seem complex, and different to conventional agriculture. It can be difficult to understand the categories of saltland, and the plants

and machinery used. All this can make it confusing for a farmer just starting with saltland pastures. Why can't there just be a simple recipe? Well, now there is, and this is it! The recipes and case studies given here show that productive and profitable saltland pastures are possible now.

If you are new to saltland pastures, or need a 'quick reference' guide, then this little book is for you. This book focuses only on what you need to know to get started. Our message is simple – growing a good saltland pasture is just another agricultural activity that is based on many of the skills that you already use with other crops and pastures – good site preparation, weed control, insect control, grazing management. None of this is rocket science!

In the face of confusion, often the hardest thing to do is to make a start. We hope that the information provided here will encourage you – the farmer – “to have a go” and that your success will encourage others.

2. Two recipes for saltland pasture establishment

There are two ways of establishing saltbushes: niche seeding (growing saltbush directly from seed) and the planting of nursery-raised seedlings with a tree planter.

Niche seeding should only be used on moderately affected soils with a duplex (sand over clay) profile. However, nursery-raised seedlings are more versatile and can be grown on mildly and moderately affected soils with a wider range of textures. Confused? Don't worry! All this is explained in greater detail in Section 4.2.

When choosing which establishment method to use, also remember that there can be trade-offs between cost and reliability. Niche seeding is cheaper (around \$100-150 per hectare) than planting of nursery-raised seedlings (around \$450 per hectare). However, niche seeding is inherently less reliable than the planting of nursery-raised seedlings. If good quality establishment is essential and higher costs are not a problem, then nursery-raised seedlings should be planted.

Recipe 1 – Nursery-raised seedlings

Establishment of any seed is a risky process. On non-saline land, germination and establishment success is routinely challenged by drought, frost, insect attack, and weed competition. On saltland, there are additional risks associated with salinity, waterlogging and inundation. The advantage of planting a nursery-raised seedling is that you start with a living plant. All this plant has to do is survive and grow!

Saltbush seedlings are available from a number of nurseries in WA and the Eastern States. The seedlings are usually planted with a commercial tree planter (Photo 3).

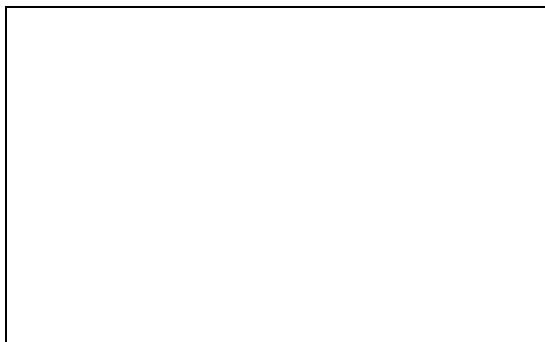


Photo 3. Commercial tree planter planting saltbush seedlings.

Ingredients

To plant nursery-raised seedlings you need:

- A suitable mildly- to moderately-affected saltland site (Table 1).
- Saltbush seedlings. A mixture of old man saltbush and river saltbush is recommended. You need about 1000 plants per hectare for dense plantings and for plantings within belts.

- Seed of appropriate under-storey species as required. These could be inoculated annual legumes (like Frontier® balansa clover and Scimitar® burr medic) or grasses like puccinellia or tall wheat grass.
- A knockdown herbicide and a spray rig.
- A means of cultivating the site.
- A tree planter to plant the seedlings.

Method

1. Year before planting – Choose the site, plan the layout and control red legged earth mite. The site should be mildly- or moderately-affected (Section 4.2). On mildly-affected sites you can plant alleys of saltbush with an under-storey of annual legumes or perennial grasses (Photo 2). On moderately-affected sites you can plant dense stands of saltbush (Photo 1). Think about the layout of the pasture and your machinery widths when designing row spacings. You will need to plant the under-storey with a drill or air-seeder, so the bays between the saltbushes will need to be wide enough to take your planting gear. Make sure that your planting doesn't have mounds that hold back the drainage of surface water. In fact the layout should be planned to assist surface drainage (Section 4.3). You should consider other design issues like the location of fences and the provision of good quality drinking water for grazing stock (Sections 4.6 and 4.7). Red legged earth mites can be *partly* controlled in the spring of Year 0 by spraying as close as possible to the optimal TIMERITE® spraying date (see the TIMERITE® website at <http://www.timerite.com.au>) (Section 4.5).
2. Year 1 – Planting the saltbush. Wait until the risk from waterlogging has abated (August-October). Apply a knockdown herbicide. Cultivate. Mark out saltbush rows / alleys and bays for the growth of under-storey plants. Plant the saltbushes. Spray on your TIMERITE® day in spring to control the red legged earth mite in the under-storey to be planted in Year 2.
3. Year 2 – Planting the under-storey. Apply knockdown herbicide after the break of season, being careful not to spray the saltbushes. Sow the under-storey legumes (balansa clover and burr medic). Complete fencing and provision of stock water. Monitor and control red legged earth mite, lucerne flea, aphids and native budworm at establishment, and again in spring.
4. Grazing. For dense saltbush stands with no under-storey, light grazing can commence in the first autumn after planting (early in Year 2). Pastures with an annual legume under-storey are grazed lightly in the early spring of Year 2 (to control annual grasses) and receive their first heavy grazing in the summer of Year 2 (Section 4.7).

Note

Another variation of this method occurs when the sown under-storey is a mixture of perennial grasses (puccinellia and tall wheat grass) or "Evergreen" saltland mix. These perennial plants need at least a year and a half before they can be grazed. They are therefore planted in Year 1 immediately after the saltbush is sown, and the combined saltbush / perennial pasture is ready for heavy grazing in the summer of Year 2 (Section 4.7).

Costs

The cost of establishment using nursery-raised seedlings will depend on:

1. The price your nursery charges for plants (25-30 cents per seedling is common)
2. The costs of getting the plants to the site (could be another 5 cents per plant if you are using seedlings imported from an interstate nursery).
3. The planting density of the seedlings. (1,000 plants per hectare gives good saltbush leaf production, but some farmers use a higher planting density.)
4. Whether the site is to also include bays of under-storey species like annual legumes (burr medic and balansa clover) or perennial grasses (puccinellia and tall wheat grass).
5. The costs of spraying and cultivating the site, planting the seedlings, and providing infrastructure like surface drains, fences and sources of stock water.

Recipe 2 – Establishment from seed

Saltbush can also be established from seed using a “niche-seeder” (Photo 4).¹ The niche seeder places the seeds mixed with vermiculite at 2–3 m intervals along the top of a raised M-shaped mound. The raising of the mound reduces waterlogging and the vermiculite acts as a mulch, preventing the movement of salt to the soil surface by capillarity.

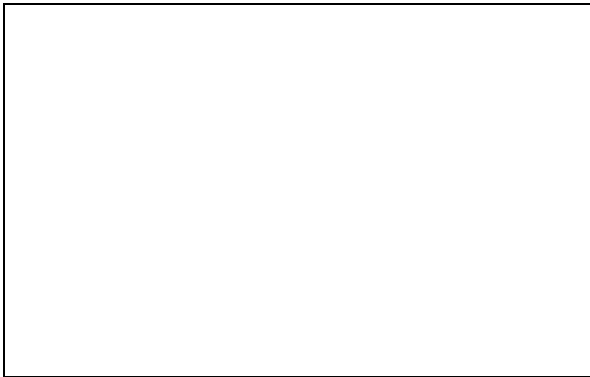


Photo 4. Typical niche seeder.

Ingredients

To establish a saltbush-based pasture from seed you will need:

- A suitable moderately-affected saltland site.
- Saltbush seed of good quality. A mixture of old man saltbush, wavy leaf saltbush and river saltbush is recommended.

¹ Commercial niche seeders include: the “Mallen” niche seeder (manufactured by W.C. Diamond and Co.), the KimSeed seeder (manufactured by Kimberley Seeds), and the mounding Chatfields’ tree planter.

- Vermiculite.
- Knockdown herbicides and a spray rig.
- A means of cultivating the site.
- A niche seeder.

Method

1. Year before planting – choose the site, spray-top, plan the layout and control red legged earth mites. The site should be moderately-affected with a shallow duplex soil profile (Section 4.2). In the year before planting you should spray-top with a knockdown herbicide to prevent seed-set by annual grasses. You should plan so that the mounds of saltbush will not hold back surface water and additional surface water management structures are provided for (Section 4.3). You should plan the location of fences (Section 4.6). You should consider how you will provide good quality drinking water for grazing stock (Section 4.7). Red legged earth mites can be *partly* controlled in the spring of Year 0 by spraying as close as possible to the optimal TIMERITE® spraying date (see the TIMERITE® website at <http://www.timerite.com.au>) (Section 4.5).
2. Year 1 – planting the saltbush. Wait until the soil temperatures have warmed and the risk of waterlogging has abated (August-September). Apply two knockdown herbicides – glyphosate four weeks before seeding, and SpraySeed® two days before seeding. Cultivate just before niche seeding. Do the niche seeding (Section 4.5). After seeding, look carefully for insects as saltbush seedlings are very vulnerable to attack from these insects. Spray immediately if red-legged earth mites, aphids or native budworm are present (Section 4.5). Check at weekly intervals for 10-15 weeks. More than one spray may be required.
3. Year 2 – Planting the under-storey. Use the same method as for nursery-raised seedlings (Recipe 1).
4. Grazing. Use the same method as for nursery-raised seedlings (see Recipe 1 and Section 4.7).

Costs

Your cost of establishment from niche seeding will depend mainly on:

1. The cost of vermiculite (about \$15 per 100 L bag).
2. The cost of saltbush seed. Expect to pay between \$40 and \$80 per kilogram for seed of the three major saltbush species.
3. Your costs of preparing the site, hiring a seeding machine and providing infrastructure (surface drains, fences, sources of stock water, etc.).

Contractors are available to do niche seeding. Contract rates can be about \$150 per hectare, however the price charged will depend on site conditions, and may also be affected by the availability of the farmer's tractor, fuel and labour.

3. What farmers have found – three case studies

3.1. Michael and Margaret Lloyd

Location: “Bundilla”, Pingaring (WA).

Annual average rainfall: 300 mm

Scale of salinity problem. “Bundilla” is a farm of 2,250 ha. Of this about 800 ha are salt affected and more than 600 ha have been sown to saltbush pastures.

Major soil type: Duplex (sandy loam over clay) soils with highly saline (seawater) groundwater at depths of 1.5 – 2 metres.

Preferred method of planting: Niche seeding with a Kimseed planter

Types of stands:

1. The Lloyds sow mixtures of old man saltbush and wavy leaf saltbush.
2. Dense stands are grown on moderately-affected land. They consist of multiple rows about 3 m apart with seed placements about 2 m apart within rows. Slightly wider bays every 5 saltbush rows allow for vehicular access.
3. Alleys of saltbush are grown on mildly-affected land. They consist of twin rows of saltbush 3 m apart, with bays 10 m wide. The bays are planted to a mixture (10 kg/ha) of Frontier balansa clover, Dalkeith sub-clover, Trikkala sub-clover, Santiago medic, Prima gland clover, Santorini serradella, Roper ryegrass and Dargo ryegrass.

Tips for success:

Many farmers take the attitude that land at risk of salinity should be used to grow crops until it becomes too saline. However, Michael advises that one should plant saltbush before the degradation becomes too severe. He has two criteria for choosing sites:

1. Indicator plants. Sites suited to niche seeding have a grassy cover varying from sparse (50%) barley grass to 100% barley grass with some annual ryegrass. If capeweed is present the site is not sufficiently saline. If samphire is present it is too saline.
2. Soil texture. The site must be duplex (sandy loam over clay). It must be possible to easily push a spade into the soil to a depth of 10-15 cm in winter. (If the spade can't go in to this depth, the soil is clayey, and it will come up cloddy with the niche seeder.)

3.2. Kim and Dianne Diamond

Location: “Guyscliffe”, Buntine (WA).

Annual average rainfall: 325 mm

Scale of salinity problem. “Guyscliffe” is a farm of 3,200 ha. Of this about 500 ha are saline and have been sown to saltbush-based saltland pastures.

Major soil types revegetated: Duplex soils (sandy loams over clays)

Preferred method of planting: Niche seeding with a “Mallen” niche seeder

Types of stands:

- The Diamonds sow a 50:50 mixture of wavy leaf and river saltbush.
- Kim’s planting methods have evolved over 35 years. In recent years, Kim’s saltbush stands have been sown in an alley conformation. Three mounded rows of saltbush are planted in a bay 10 m wide and the next 10 m bay is left unmounded for an under-storey of annuals, puccinellia or “Evergreen” seed mix. This layout of alternating bays of saltbush with under-storey leaves flat paths through the shrubs that will allow the passage of a truck for fertiliser application.

Tips for success:

- Plant saltbush in the same year that the rest of the paddock is being cropped. This has two advantages: Firstly, the saltland can receive exactly the same knock-down herbicide treatments as the cropland while the spraying gear is in the paddock. Secondly, if the saltbush is sown when the rest of the paddock is in crop, the area doesn’t have to be immediately fenced off.
- Maintaining moisture during germination. Kim farms in the northern wheatbelt of WA where a few dry windy days in spring can cause huge mortality to the germinating saltbush. He uses large amounts (about 200 fruits) of seed per placement and he keeps the placements moist by lightly covering them with soil. This is done by dragging a light chain over the shoulders of the M-shaped mound, which draws down a thin cover of sand; the placement is then rolled with a press wheel.
- Fertilisers. Saltland pastures need potassium and phosphorus for growth. Kim finds that his saltbush establishment is improved by spinning on muriate of potash (100 kg/ha) just after planting. On acid sites he applies lime within the saltbush row at the rate of about 3 t/ha. Subsequent fertilisation depends on seasonal conditions. Growth of saltbush and under-storey can respond strongly to subsequent applications of phosphorus and potassium.

3.3. Tony, Simon and Donna York

Location: "Anameka Farms", Tammin (WA).

Annual average rainfall: 325 mm

Scale of salinity problem. "Anameka Farms" has an area of about 11,000 ha. Of this about 2,000 ha have been affected by valley floor salinity for 40-80 years, and about half of this has been planted to bluebush- and saltbush-based pastures. Much of the saltland has groundwater of more than seawater salinity at depths of less than 1 m.

Major soil types revegetated: Heavy clays and loams ('morrel' soils).

Preferred method of planting:

- Saltbush – nursery-raised seedlings planted with a 'Chatfield' tree planter.
- Bluebush – hand planted with subsequent natural recruitment across 'morrel' soils.

Types of stands:

- Small stands of bluebush were established in the 1960s at a few selected locations. With protection from grazing, bluebush naturally spread over the entire area to which it was suited (the 'morrel' soils).
- In the 1990s on the heavier valley floor soils, niche seeding was not successful. However there was 90-95% establishment with nursery-raised seedlings (old man saltbush and river saltbush) planted with a commercial tree planter. Since then the Yorks have planted more than 200,000 seedlings. Today saltbush stands are planted at about 800 plants/ha, and are about 80% old man saltbush and 20% river saltbush.

Tips for success:

- Be patient. The Yorks advise that saltland pastures have to be treated as a medium-term investment. One failure does not mean that the system won't work: success may occur the next year. The important thing is to try a little bit and learn from the experience.
- Fencing saltland is critical and leads to natural revegetation with bluebush and other species.
- Stands of saltbush without under-storey need to be fed off with hay, straw or adjacent stubble.
- Good quality water is essential. The Yorks water their stock from the Comprehensive Water Scheme.
- Motivation. The Yorks have been strongly motivated by the need to improve farm productivity and achieve environmental benefits from increased perennial plant cover. They acknowledge that the local development of the 'Chatfield' tree planter has been critical to their success. They are also keen to try new things like the recent selections of salt tolerant burr medics. "Our saltland story is not

finished yet!"

4. More technical stuff if you want to understand the principles

4.1. Do I need to grow a saltland pasture to revegetate saltland?

Surveys show that farmers grow saltland pastures for two main reasons: to improve the aesthetic value of the land, and to increase farm profitability.

If your reason for revegetation is solely to improve the “look” of your farm then you may not need to plant saltland pastures – benefits can be achieved by fencing sites, controlling grazing and allowing natural revegetation to occur using the highly salt tolerant samphire species (Photo 5). Swamp sheoak, a highly salt and waterlogging tolerant tree, can also establish naturally on saltland if it is protected from grazing (Photo 6).



Photo 5. Samphire plant growing on saline / waterlogged land near Wongan Hills (WA).



Photo 6. Swamp sheoak growing with samphire at Jillikin Lake (WA).

However, if you want to improve the look of your saline land and get some additional feed for livestock then planting saltland pastures will be an important strategy for you.

4.2. Matching plants to sites

About half of WA’s saltland is suited to the growth of saltbush-based pastures. One of the best way’s to ensure that your pasture is productive and profitable is to ensure that it is in a good location.

Saltland can be divided into three categories – mildly-, moderately- and severely-affected (Photos 7–9). Saltbushes should not be planted on severely-affected land (see Photo 10), but can be established on mildly- and moderately-affected land. The category of saltland can be identified on the basis of the ‘indicator species’ that the land grows (Table 1).

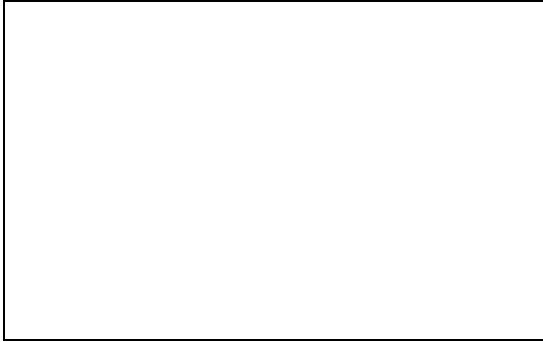


Photo 7. Examples of mildly-affected saltland.

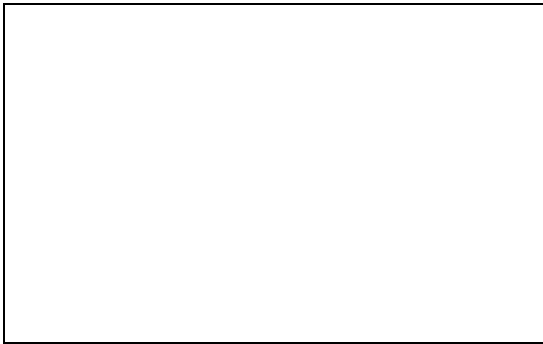


Photo 8. Examples of moderately-affected saltland

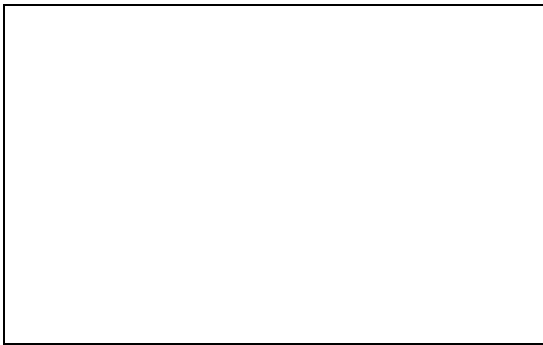


Photo 9. Examples of severely-affected saltland.

Table 1. General categories of saltland for the planting of saltbush

Category	Indicator species	Saltbush recommendation
1. Mildly-affected	Cereals have yields below	Double rows of saltbush

	1.5 t/ha. Site also grows capeweed, sub-clover and ryegrass	with 20 m wide alleys of annual legumes (balansa clover, burr medic) or perennial grasses (puccinellia, tall wheat grass)
2. Moderately-affected	No cereals possible. Grows continuous to patchy sea barley grass. Also woolly clover and cotula (more waterlogged areas).	Either: (a) Dense stands of saltbush with occasional tracks 10 m wide for access, or (b) Double rows of saltbush with 12 m wide alleys of annual legumes or perennial grasses
3. Severely-affected	Grows samphire or is bare. Water can pool in winter.	Not suitable for saltbush. Fence and protect from grazing. Allow natural revegetation.



Photo 10. Saltbush in the wrong place. This saltbush was planted into a severely-affected site and has grown very poorly.

One final cautionary remark needs to be made on the use of indicator species. There is one instance where the presence of bare land does not necessarily indicate land that is severely-affected. Sheep can camp on saltland in summer because it moist and cool, thereby eliminating groundcover. They can also the graze plants off and lick the soil to get salt into their diet. So, your land may be bare not because it is severely-affected but because of uncontrolled access by stock. If you are in doubt about the truth of your indicators check the effect of fences.

Photos 11(a) and 11(b) give examples of fence-line effects. In Photo 11(a), we can tell that the land on the right-hand side of the photo was probably moderately-, not severely-affected, because the land on the left hand side was growing barley grass. However, in Photo 11(b), the land on the left side of the fence was growing samphire, so the land on the right side of the fence was indeed severely-affected.

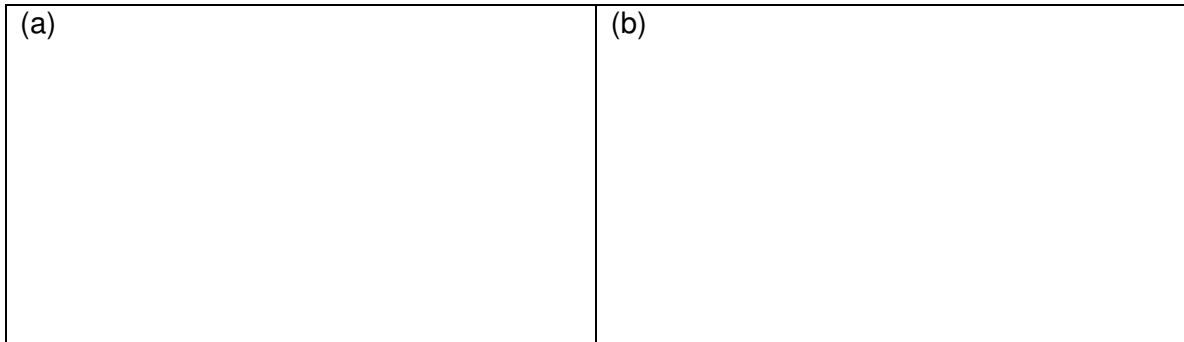


Photo 11. Fence-line effects. (A). Growth of barley grass on the protected side of fence suggests that the bare area is moderately-affected. (b) Growth of samphire on the protected side of the fence suggests that the bare area is severely-affected.

4.3. Waterlogging

Average rainfall for saltbush-based pastures. Saltbush-based saltland pastures should only be grown on sites that receive between 300 and 450 mm of average annual rainfall. Areas with higher rainfall are generally too waterlogged for saltbush, but can be suited to puccinellia and tall wheat grass.

Cause of waterlogging damage. Waterlogging causes virtually all plants to become less tolerant to salt in the soil. They have increased rates of salt uptake, accumulate higher concentrations of salt in the shoots, and this can decrease growth and survival. In saltbushes, the bleaching of leaves is a tell-tale sign of waterlogging damage (Photo 12).



Photo 12. Bleaching of leaves in waterlogged saltbush.

Time of planting. Waterlogging is a make or break issue for niche seeding. If your site is waterlogged or inundated (Photo 13) then delay planting until the waterlogging has subsided.





Photo 13. Typical waterlogging on a site after niche seeding (Cunderdin WA).

Laying out saltbush rows to avoid waterlogging. Mounds of saltbush established “on the contour” can hold back water and become waterlogged (Photo 14). It is therefore recommended that they be installed on a slight slope so that they shed water towards the major drainage line. The slope on a saltbush row can be up to 2% without causing erosion. This layout can give the appearance of a herringbone (Figure 4).

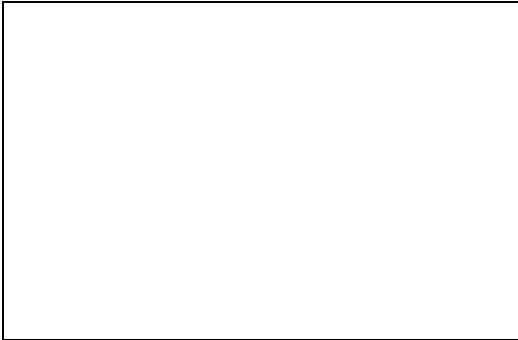


Photo 14. Example of waterlogging in saltbush rows installed “on the contour”.

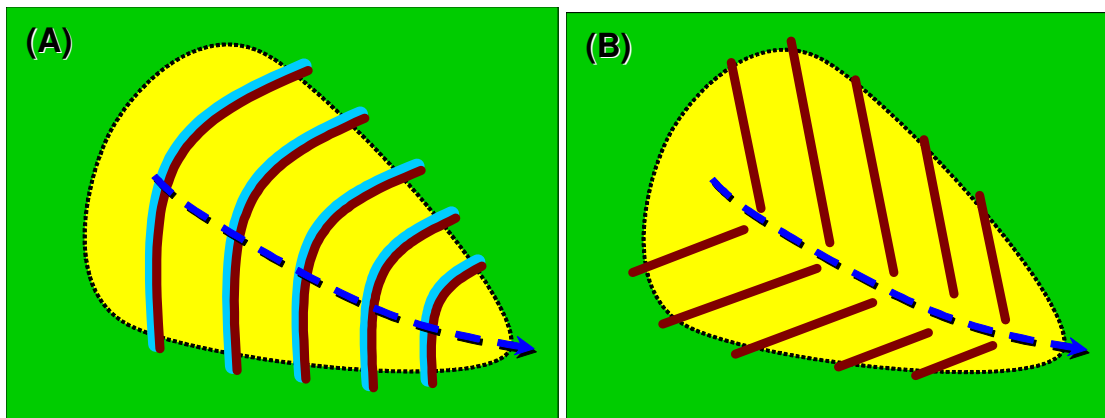


Figure 4. Use of herringbone design to alleviate waterlogging on a saline scald. (A). Saltbush rows “on the contour” hold water back and become waterlogged. (B). Saltbush rows directed towards the drainage line in a herringbone layout shed water and alleviate waterlogging.

Surface water drains. If water pools on your site in winter then additional surface water management structures (like W-drains) may be required to “get the water away” (Photo 15) To determine the ideal location for W drains, peg the centre of winter puddles that remain for more than 24 hours. These peg points can then be used align the W drain

correctly when the site dries. Failure to control waterlogging and inundation can jeopardise establishment and kill mature plants.



Photo 15. W-drain on a site subject to inundation with surface water.

Choosing under-storey species. Waterlogging can also affect your choice of under-storey species. If your site has a high risk of waterlogging, you should include balansa clover, puccinellia and tall wheat grass in the under-storey. However, if the site has little risk of waterlogging then you should use burr medic as the main under-story species.

4.4. Saltbushes and their seeds

Saltbushes have separate male and female plants with distinctly different flowers (Photos 16 and 17). We have used the term “seeds” in this book, but it is actually the entire “fruit” that is sown. “Fruits” occur on female plants (Photo 18).

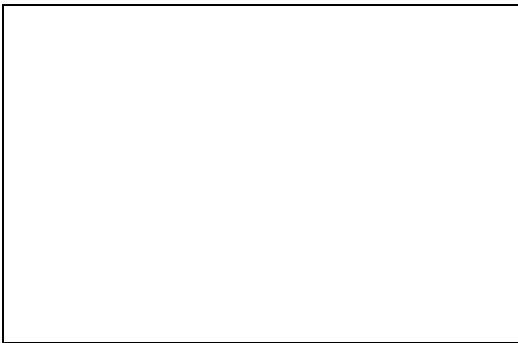


Photo 16. Typical female flowers.

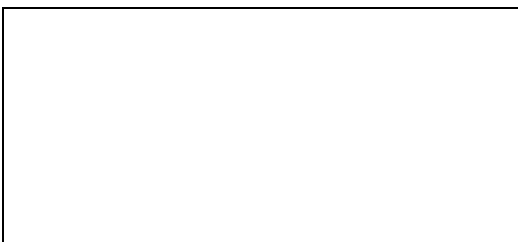




Photo 17. Typical male flowers.



Photo 18. Sample of saltbush fruits opened to show the seed inside.

Saltbush fruits will keep reasonably well for several of years if they are stored under dry conditions at room temperature.

The main reason for poor germinability of saltbush fruits is because the fruits contain no seed. Fruits can have a low percentage “seed fill” if the females are a long distance from the nearest male plant or if the plants have been subject to difficult seasonal conditions like waterlogging or drought during fruit development.

It is important to check the seed fill in your saltbush fruits – a seed fill of 50% is fairly good, whereas a fill of 5% is not! You can try opening 10 or 20 fruits with a sharp knife and see how many fruits contain a seed. Alternatively, the AGWEST Plant Laboratories (at the Department of Agriculture’s South Perth office) can determine the germinability of saltbush fruits for you for \$61 per sample.

4.5. More about niche seeding

What does the machine do? The niche seeder has two opposed discs that make a raised M-shaped mound. The seeder takes a sample of saltbush fruits and about 50 mL of vermiculite mulch and drops this as a “placement” on the top of the mound. Replicate placements are made at 2–3 m intervals.

Getting niche seeding right can save you a lot of money – it is cheap but you need to make it as reliable as possible. There are six main ways of doing this:

1. Choose a good moderately affected site (Section 4.2) without too much waterlogging (Section 4.3).
2. Apply seed at a sufficiently high rate to get a good result.
3. Plant mixtures of species.
4. Time the seeding well.
5. Control weeds.
6. Control the insects.

Calculating seeding rates. The rate to apply seed is influenced by two factors:

- (a) The number of fruits per gram – this is affected by the saltbush species, and the amount of leaf and twig in the sample,
- (b) The seed fill in those fruits – this is affected by the proximity of female plants to male plants and seasonal conditions (Section 4.4).

Saltbush establishment can be very chancy and we need a lot of room for error. You should aim to have 50 germinable seeds in each placement. The placement will be successful if one of these seeds eventually produces a plant.

What does having 50 germinable fruits per placement mean? We have made a simple calculation by way of illustration in the box below. If you would like to calculate your own seeding rate, we have installed a simple calculator on the internet (see [www.INSERT SITE](http://www.INSERTSITE) and follow the prompts).

Calculating saltbush seeding rates

Approximate numbers of fruits per gram

Wavy leaf saltbush	400–1000 clean fruits per gram
River saltbush	200 clean fruits per gram
Old man saltbush	150 clean fruits per gram

Example. At what rate should I apply river saltbush fruits with a 25% seed fill to get 50 germinable seeds per placement?

- With a seed fill of 25%, I will need to apply 200 fruits to get 50 germinable fruits per placement.
- For river saltbush, 200 fruits weighs about 1 gram. Therefore I need 1 gram of fruits per placement.
- If my placements are 2 m apart then I will need 500 grams of fruits per kilometre of row.
- If river saltbush fruits cost \$80/kg then I will spend \$40/km of row on seed.

Timing of niche seeding. If you seed saltbushes in winter, you will have delayed germination and establishment because of the cold, and because of possible waterlogging. If you plant the saltbushes in the late Spring then they may not grow sufficiently to survive their first summer. Timing is therefore critical. Sow your stand from July (in drier northern regions) to mid-September (in southern wetter regions).

Planting mixtures. Saltland is variable and predicting which plant will grow where is difficult. Successful saltland farmers nearly always plant mixtures of saltbush species, sometimes with an under-storey of annual legumes or perennial grasses, and let the plants sort out “what grows where” for themselves. The three most widely planted saltbush species are old man saltbush, river saltbush and wavy-leaf saltbush, and these species are often sown in mixtures of equal parts by volume.

Controlling weeds. Good weed control is essential with niche seeding. Sites should be spray-topped in the year before planting if barley grass, brome grass or iceplant are present. A double knockdown should be used in the year of planting. Do not apply

nitrogen fertilisers at seeding as this will promote the growth of competing grasses and almost certainly decrease your saltbush establishment.

Controlling insects. Insects can substantially decrease saltland pasture establishment, especially in areas with a high biomass of annual plants. They must be controlled. Check especially for red-legged earth mite (Photo 19), aphids (Photo 20), lucerne flea (Photo 21), and native bud worm (Photo 22). Saltbushes and annual legumes are highly susceptible to red legged earth mites. Red legged earth mites can be *partly* controlled in the spring of the year before pasture establishment (Year 0) by spraying as close as possible to the optimal TIMERITE® spraying date. To determine this date, you can type the Latitude and Longitude of your paddock (in degrees and minutes) into the TIMERITE® website at: http://www.timerite.com.au/spray_tool/. Red legged earth mite and other insects should also be regularly checked in the year of pasture establishment (Year 1) and controlled as necessary.



Photo 19. Red legged earth mite.

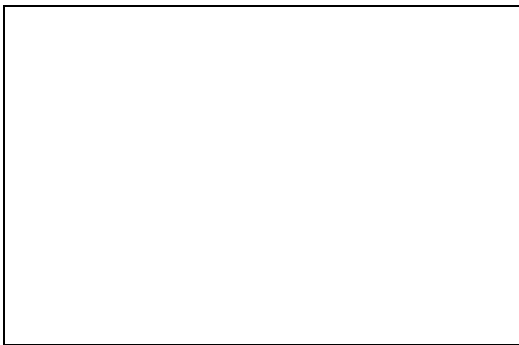


Photo 20. Aphid.





Photo 21. Lucerne flea.

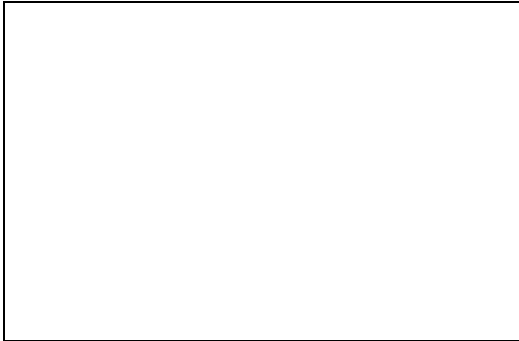


Photo 22. Native bud worm.

4.6 Layout and design

Laying out rows and bays. The layout of saltland pastures is important and should be planned. Dense saltbush stands should have occasional 10 m wide tracks through them to allow vehicular access. This helps with fertilising and fire-fighting. There should be room at the end of these tracks for a truck to turn round. In alleyed stands, the width of the bay for under-storey will depend on the severity of the site. Mildly affected sites could have under-storey bays up to 20 m wide, whereas in moderately affected sites the bays should be narrower (about 12 m wide – see Table 1). Remember that “herringboning” saltbush rows towards surface drainage lines may be necessary to avoid waterlogging (Section 4.3).

Planting density. Saltbush stands only need about 1,000 plants per hectare for maximum production of leaf. Thus if rows of saltbushes are 5 m apart, there will be maximum leaf growth if the shrubs are 2 m apart within rows.

Fencing. Saltbushes must be protected from indiscriminate grazing. Easily fenced sites are preferable to sites on which fencing would be complex and expensive.

4.7. Value to animals and grazing management

Saltbushes produce a fodder rich in protein (concentrations comparable to lucerne) but they also contain high salt (ash) concentrations (20-30% dry weight). Because animals can only consume a limited amount of salt per day, the high salt concentration in saltbush leaves forces grazing stock to limit their intake – they therefore lose weight. The key to animal utilisation is to mix saltbush with other low salt feeds. There are two main strategies:

1. Grow widely spaced alleys of saltbush with a sown under-storey of annual legumes (balansa clover and burr medic) or perennial grasses (tall wheat grass and puccinellia). Intensify the grazing (larger numbers of animals on smaller areas) so that animals eat all the components of the feed simultaneously. This

option is suited to land that is mildly-affected – i.e. the land that will grow cereal crops of uneconomic value (Photo 7).

2. Grow dense stands of saltbush and graze with supplements of hay, small amounts of grain or adjacent crop residues (stubbles). This option is suited to WA's moderately-affected saltland (Photo 8).

Saltbushes have one other clearly defined nutritional benefit to sheep – they can help overcome Vitamin E deficiency. Low vitamin E concentrations in dry feed can lead to a muscle wasting condition in sheep known as nutritional myopathy. Farmers currently use costly vitamin E supplements to protect sheep against this disease. However, grazing of saltbush in summer can cause 3-fold increases in Vitamin E concentrations in meat. Increased Vitamin E in the meat will also increase the storage life of the meat on the supermarket shelf.

Grazing. Saltland pastures are generally most profitable if the feed can be used to fill an existing feed gap (and therefore save on supplementary feed) or allow an increase in farm stocking rates. In southern Australia, late summer and autumn are typically the times when additional feed (eg. that from saltland pastures) has the highest value. The key to maintaining a good saltbush stand is to graze the plants briefly and hard, and then allow them to recover.

Saltbushes can grow especially quickly in summer if they have moisture. After thunderstorms in summer, take all stock off the saltbush for 2–3 weeks. There will be a huge burst of fresh edible growth that can then be utilised.

Drinking water. Saltbushes produce a salty fodder. Animals wash the salt through their bodies by drinking a lot of water. This drinking water needs to be as fresh (non-saline) as possible. We do not have good information about the limits to the salinity of the drinking water for sheep grazing saltbush. However, we do know that water with an electrical conductivity of 15 dS/m is far too saline: sheep grazing saltbush will reduce feed intake and lose weight. We suggest that you provide drinking water with an electrical conductivity of less than 5 dS/m.

Timing of establishment and grazing. For dense saltbush stands with no under-storey, establishment occurs in the spring of Year 1, and the first heavy grazing occurs in the summer of Year 2 (after about 16 months).

For alleys stands of saltbush, timing issues will be affected by the nature of the under-storey. Perennial grasses (like puccinellia and tall wheat grass) need two years to establish properly, so an under-storey of these plants needs to be planted immediately after the saltbushes in the spring of Year 1, and the first heavy grazing will not be possible until the summer of Year 2 (after a further 16 months). In contrast, annual legumes (like balansa clover and burr medic) need only a few months to establish. They are therefore planted nearly a year after the saltbush in the winter of Year 2. Annual legumes may benefit from some light grazing to suppress grasses after a few months growth (in the early Spring of Year 2). However, once the legumes come into flower, the sheep should be removed until the summer. Heavy grazing of the combined annual legume saltbush pasture should not occur until the summer of Year 2.

Control of grasses in saltbush stands. Saltbush stands can develop a substantial understorey of annual grasses, including annual ryegrass. It may be necessary to control this grass if sheep develop symptoms of annual ryegrass toxicity. If necessary, grasses can be controlled in saltbush stands that are at least 18 months old using applications of roundup (500 mL/ha) or gramoxone (350-400 mL/ha). However, herbicides should not be applied when the shrubs are flowering.

4.8. Production, profitability and water use

Production. Saltland pastures will respond to good agronomic practice. Huge productivity gains have been achieved over the last decade using combinations of plant species and better grazing management. Un-revegetated saltland growing barley-grass typically produces plant yields of about 0.3 tonnes of dry matter per hectare per year. In contrast:

- dense saltbush-based pastures can yield about 1 t/ha on land too saline for cereal crops.
- alleys of saltbush with balansa clover and burr medic under-storey can yield many tonnes of fodder per hectare on land capable of growing low yielding cereal crops.

If the site has a deep duplex soil profile with a traffic pan at 10–30 cm depth, there may be some benefit from deep ripping the soil.

Fertilising. Little information is yet available on the best fertilising strategies for saltbush-based saltland pastures. It is reasonable to assume that the productivity of annual legume under-storey will be highly dependent on the availability of phosphorus and potassium. Nitrogen encourages the growth of competing grassy weeds and should not be applied until after saltbushes are fully established.

Profitability. Saltland pastures can improve farm profitability because additional green feed in summer / autumn has a premium economic value. The establishment of 50 hectares of dense saltbush plantation on a 2,000 hectare farm in the Great Southern of WA has been estimated to increase farm profitability by 5% (\$4,000). The economic benefits of saltbush alleys with annual under-storey have not yet been determined but are almost certainly going to be higher.

Water use. Like all summer-green perennial plants, saltbushes can use stored soil moisture. Depending on its salinity, saltbushes may also use groundwater, thereby lowering water-tables, decreasing the need for drainage, and decreasing the run-off of salt and nutrients into streams. Single rows of saltbush can use 30-100 mm of stored soil moisture by their second summer, and commercially managed saltbush pasture has used 220 mm after 7 years. However, saltbushes use little soil moisture in winter. They may therefore need to be combined with other solutions for the control of surface water (interceptor drains on hillsides, “W”-drains on affected land).

5. Other information sources

Further information about issues raised in this book can be found in “Saltland Pastures in Australia – a Practical Guide” second edition, by Ed Barrett-Lennard, Clive Malcolm

and Andrew Bathgate. Copies can be ordered calling CanPrint Communications (phone 02 6293 8383).

The Saltland Pastures Association of WA (Inc.) maintains an excellent website which has good information about salt tolerant plants, and copies of the SPA Newsletter. The website can be accessed at: <http://www1.crcsalinity.com/spa/index.htm>

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