

Plant Solutions for Drought-Prone Saline Soils at Bonavaree



Objectives and outcomes

A primary objective of this project was to determine how best to rejuvenate badly eroded and depleted sunny slopes in an increasingly drought-prone environment. Local landowners were highly conscious of the poor impression these hill faces presented to the public. Trials with saltbush and tagasaste conducted near Seddon in the 1980's indicated both plants had the potential to assist with revegetating the area. Our aim was to extend this work to larger blocks, then to integrate these into successful farm management systems.

Shrubby land conservation/production blocks have been effectively and economically integrated with traditional crops like lucerne at Bonavaree. A significant challenge remains, in moving proven outputs into the general farming arena and gaining wider acceptance for altered land management methods. However, ongoing drought may force a rethink on this.



Mediterranean saltbush on 'Vietnam' block, Bonavaree.

Saline and sodic soils; some solutions

Management options are restricted. You can either try to deal with bulk amelioration of the soil by expensive chemical means (eg application of gypsum; only possible on flat, high producing sites) **OR** you try to grow plants that tolerate the site conditions, the approach adopted at Bonavaree.

Here, drought, salinity, steep aspect and lack of organic content are the main constraints. Tunnel gullied sites will invariably consist of sodic soils and therefore benefit most from the use of halophytic (salt-loving) plants like saltbush (*Atriplex* spp) and bluebush (*Kochia* spp). Other hill sites may be better suited to plants with slightly lower sodium tolerance like tagasaste (*Chamaecytisus*), *Dorycnium*, wheatgrass (*Thinopyron*), chicory (*Cichorium*) or plantain (*Plantago*), and possibly some native species.

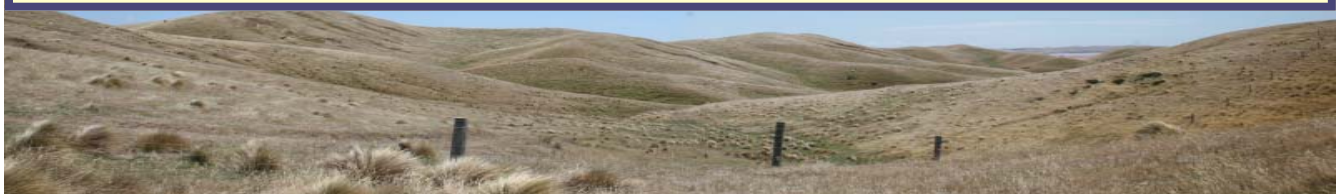
Saltbush and other species

Experience in Central Otago and observation of earlier plantings in Marlborough, suggested that saltbush had the most relevant attributes for large-scale planting of exposed salty soils on Bonavaree.

Shrub forage blocks are an excellent method for protecting otherwise fragile soils and steeper slopes. Establishment is difficult and costly, but once achieved the life-span for most shrubby species is measured in decades. Many existing saltbush blocks are already 20 years old and some surviving trial plantings date back to the early 1970's. With well-managed, intermittent grazing, pasture vegetation will quickly re-seed and re-establish, further protecting fragile soil surfaces.

Saltbush (particularly the recommended ***A. halimus*** or Mediterranean saltbush);

- is very salt and drought tolerant
 - grows reasonably fast. It provides good ground cover and can be browsed hard so is a productive as well as a conservation plant
 - grows well under good fertility regimes, but also survives under lower nutrient levels
 - will self-propagate, albeit slowly, but is not weedy.
- Saltbush was not the only plant solution trialed. Other plant species were investigated, some shrubby like tagasaste and red-stem wattle on the 'Afghanistan' block; others herbaceous like dorycnium, wheatgrass, sulla, birdsfoot trefoil and sheeps burnet. Several established well from oversown or drilled seed and show good growth potential as shrub undercover, further protecting erosion-prone soil surfaces.



Planting; steps to success

Isolating sites via fencing is an important first step, to ensure stock control and plant establishment. Ideally this cost should be offset by normal farm production profits, as at Bonavaree. The most economic option is to fence larger areas as soil/forage conservation banks, even though this may sacrifice some better land. Utilising existing fences and placing new fences along natural contours/ridges will keep costs down and better integrate the site into the surrounding landscape. Larger blocks can be further subdivided by electric fencing where required.

Planting sites were contour-ripped by 4WD tractor where accessible, or planted by grubber on steeper slopes. Establishment costs primarily occur in the first year – raising seedlings/cuttings, ripping, fencing and planting.

Cost of establishing saltbush per hectare, 1000 stems/ha (Doug Avery)		
Ripping	\$ 100	Tractor@\$100/hour
Spot spraying	\$ 60	Including chemical
Fertiliser – long-life	\$ 20	
Plants	\$1000	1000/ha@\$1/plant
Planting	\$ 500	20 hours @ \$25/hour
Fencing*	Will vary from site to site	Doug paid \$9/metre*
Total	\$1680, <i>excluding fencing*</i>	

The upper limit for plant spacing is probably 1200 stems/ha (just under 3x3m apart) and the optimum around 1000/ha, as these shrubs can spread to more than two metres diameter, effectively closing the canopy and making stock access difficult, plus increasing the risk of wool-pull.

The year two cost of establishing saltbush calculates out at 0.53 cents per kilogram of dry matter produced for a medium cost/medium yield planting, 0.35 cents in year three and 0.30 cents in years four and five.

The latest saltbush site to be developed at Bonavaree used locally collected, hand-spread seed. Costs are minimal, but establishment takes longer.

**A Farm Systems economic evaluation for Bonavaree estimated fencing costs at \$3844, \$760 and \$598/ha, for high, medium and low cost strategies. This cost could theoretically be halved, where there are benefits on both sides of the fence.*

Results and recommendations

Grazing; Saltbush (and tagasaste) was planted in August, 2005 and established rapidly. The blocks were first grazed in May 2006, and again in February and August, 2007. Stock will be allowed to graze the bushes hard after seed is harvested in late May. Plants have reached a height (± 2.0 m) that may require the occasional use of cattle to crop them to a level that sheep can graze easily, and to force them to spread thus protecting a greater soil surface area.

Once established, shrubs are quite resilient. Blocks are best rotationally grazed for short periods (2-3 days), depending on species (eg. tagasaste is prone to bark damage, so must be treated with care). Set stocking is not recommended. Suitable times to graze will depend on factors such as weather, farm management, pastoral production and stock type. Generally, it is best to utilise shrub forage in lieu of supplemental fodder when other sources of feed are scarce, e.g. late winter/early spring.

As pasture/crop production peaks in spring/summer, shrub blocks should be progressively rested allowing foliage to recover prior to winter. Plants may re-seed during this period, allowing for some recruitment of new seedlings. Hard grazing just prior to winter is not recommended for areas prone to severe frosts, like Central Otago. Plants should go into winter with a good coverage of leaves, most of which should be retained for browsing in spring.

Production; Current estimates put individual saltbush plant production at about 3-4kg DM/year; equivalent to 2700-3600kg DM/ha/yr@900 stems/ha or 3300-4400kg DM/ha/yr@1100 stems/ha. Underlying pasture may add to this.

Costs and returns; Economic evaluation of saltbush plantings by Graeme Ogle, has shown that the cost of establishing saltbush compared favorably with the cost of purchased feed by year three, except in a high fencing cost/low yield scenario. Early yields at Bonavaree were better than at the Hakataramea Valley trial that this evaluation was based on. Given their longevity, with good management the long-term internal rate of return for saltbush should be very favourable.

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