ew technology for the propagation and planting of bare-rooted tree and shrub seedlings is now available thanks to a former Queensland sheep grazier, Alan Lauder, and a National Landcare Program (NLP) grant. A one-pass planting machine suitable for planting both bare-rooted and plug/nursery seedlings has been successfully trialled in a variety of soil types and conditions, and the technology has been used to transplant trees as well as Old Man Saltbush (OMSB) seedlings.

Lauder says in trials using tube-stock, Greening Australia had better than 98% success using the planting machine for trees. Additionally, recent OMSB planting trials of 25,000 and 10,000 respectively using bare-rooted seedlings produced similar results.

He contends the reason for planting OMSB is to add another perennial species to the pasture mix to achieve a more complex and balanced production system.

“Ripping up the whole paddock to plant OMSB defeats the purpose of diversity and creates a monoculture. The grasses, especially the perennial grasses, need to be present when the OMSB seedlings establish so that they can complement each other. Planting an edible deep-rooted native perennial shrub enhances environmental outcomes by protecting the soil and recycling nutrients,” he says.

Lauder’s research began in 1997 when he suggested there must be a cheaper and more practical option for planting OMSB.

“Apart from the need to reduce the cost of seedlings, there was also a need to have immediate access to seedlings when suitable planting conditions presented,” he says.

While investigating different methods of establishing OMSB, NSW Agriculture inspected an early version of the bare-rooted process Lauder had developed. The three methods being investigated were direct seeding, planting nursery seedlings and planting bare-rooted seedlings. In its report released in 2000, NSW Agriculture highlighted that the bare-rooted method was “the only one that always produced a positive return on investment”. Lauder says the major breakthrough of his technology package was reducing the cost of seedlings from approximately 25 to 30 cents (depending on the area) to five cents each.

“This technology makes it possible for producers to have a large-scale nursery on their property for their own or local community use without the need for agronomic skills,” he says.

The initial focus in designing the planting equipment to transplant bare-rooted seedlings was to overcome the issue of seedlings not having potting mix around the roots, as is the case with those supplied by commercial nurseries. This focus on improving the conditions surrounding the roots of bare-rooted seedlings now provides tube stock with a better planting environment.

Recent additions to the one-pass planting machine have also extended the window of opportunity for planting trees or shrubs into marginal soil-moisture conditions. Additionally, planting in hotter conditions is now possible.
Water injection into the root zone is an important design feature as it ensures plant survival despite little or no follow-up rainfall.

The planting technology

The modular planter carries out soil preparation at the same time as planting to save time, tractor use, cost, moisture loss and labour. The rotary hoe at the front prepares a seed bed that ensures perfect soil/root contact and removes all the competition for the seedlings at the time of planting. The loosened soil then acts as a mulch to reduce moisture loss. The rotary hoe is operating in previously ripped soil so it does not leave a hard pan or suffer above-normal wear and tear.

A paddock ripper has been designed to rip the same width of soil required by the planting machine. The deepest part of the rip coincides with the position of the seedling planted. Ripping only the area of soil necessary for planting ensures maximum runoff from the undisturbed area. This also builds up soil moisture both before and after planting. The result is magnified in areas of degraded soils.

The water tank carries 2400 litres to enable planting when conditions in the surface layers are marginal. When planting conditions are perfect, it enables longer runs. The planter is balanced so a large tractor is not required. A 70-horsepower tractor is the maximum required.

The planting module can accommodate up to two people. This module, behind the water tank trailer, has a hydraulic ram and is manually adjusted up or down by those planting. It provides water both around and below the seedlings at the time of planting. This is achieved by punching a hole in the rotary-hoed soil and filling it with water. The seedling is then placed in the hole of water and dirt is brought in to refill the hole. The dirt is dissolved by the water and forms a mud ball around the roots of the seedling. There is perfect root/soil contact as the water forces out all air pockets by dissolving the soil.

More dirt than necessary to fill the hole of water is brought in. This forms a rill of soil on each side of the seedling which then directs any rain to the base of the plant.

Before the hole is punched in the rotary-hoed soil, a patented gearing mechanism activates water injection lower in the soil profile below where the hole is punched. The depth of the water injection system can be adjusted up and down as required. This allows planting in marginal conditions by forming a link with existing lower moisture in the profile.

This is efficient use of water as it places it where it is safe, which is not the case with watering after planting. Post-planting watering wastes water by wetting the top in an attempt to send moisture down to the roots. Placing the water below the plant encourages roots to go down, while watering on the surface after planting encourages the roots to stay near the surface.

The water injection system means there is already mud below when the seedling hole is punched. Depending on the depth of the water injection system, it is possible to push the seedling through the bottom of the punched hole and into this lower mud.

The volume of water injected can be varied depending on soil moisture conditions. In the marginal soil moisture conditions of the 23,000 planting trial, 2.5 litres per seedling were injected. This is why the seedlings suffered no setback and started to grow although there was no rain for six weeks following the planting going into summer.

The planter works perfectly in uneven soil conditions as all components have the flexibility to follow the contour of the land. Some other planters actually lift out of the ground if the front wheels of the tractor go down.

Reducing methane emissions

The use of OMSB within a grazing system also has environmental benefits in off-setting the carbon footprint of producers.

Alan Lauder says methane emissions from ruminant animals account for 80% of Australia’s agricultural emissions. These emissions can be reduced per kilogram of production by improving the digestibility of the diet in both good and bad seasons.

“One way to improve the digestibility of the diet is to rest pastures after rain and allow them to regenerate. OMSB plantations supply somewhere to place animals after rain, regardless of previous seasonal conditions. Resting pastures using OMSB plantations improves the financial as well as the environmental bottom line,” he says.

Providing animals access to OMSB as part of their diet during dry times or after frosts when the grass is also low in protein is the other time when methane emissions can be reduced. The presence of OMSB changes the carbon:nitrogen ratio of their diet – the cornerstone of achieving methane reductions.

“It is important to understand that OMSB on its own is not an efficient diet. You must manage pastures correctly following rain to ensure that OMSB has adequate grass in dry times to improve upon. There is also the environmental aspect of ensuring adequate grass cover is taken into dry times to protect the soil,” Lauder says.

Commercialisation

Lauder says the technology has been developed to facilitate the establishment of larger-scale nurseries within a district. This could include one for individual use or where one person (or group) establishes a nursery to supply the group or the wider community.

Local councils may even decide to be the catalyst for this establishment in the early stages of nursery development. The increased sustainability through introducing edible shrubs into pasture production systems would flow back into the local community with increased local spending and employment by those who are more viable.

Lauder’s preferred business model recommends a local representative be responsible for establishing nurseries and consulting on the technology.

This role would best suit a producer with some experience of OMSB. There are also additional opportunities to contract-plant or manage for others, given the cost of the new technology.

“Our intention at this stage is to hire the technology on a limited basis to selected groups or individuals and we are currently seeking expressions of interest,” he says.

Find out more:

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Alan Launder’s book Carbon Grazing is available at www.saltbushsystems.com.au
Accessing bare-rooted seedlings

Specialised equipment has been developed to allow individual producers or groups to establish their own nursery. This technology enables a million-plant nursery to be completely finalised within a few days. Before the arrival of the establishment equipment, the producer has only to erect the nursery fence and ensure there is adequate water supply. Subsequent to the initial set-up, the producer needs only water, fertilise and prune the nursery seedlings occasionally.

Lauder says a 500,000-plant nursery can be maintained by a farmer with no prior experience or knowledge of saltbush. “Such a nursery has 20 rows each of 25 metres in length, with the total nursery area being half a kilometre of seedlings one metre wide. This configuration supports the need for the six new individual pieces of equipment developed. The bare-rooted technology was developed with larger plantings in mind so to achieve substantial cost savings nurseries should include more than 300,000 seedlings,” he says.

Early competition in the nursery ensures that only the strongest seedlings survive, which is reflected in the survival rate when the seedlings are transplanted into the field. The low capital cost of the nursery and ongoing low running costs allow the production of seedlings with more wood in the stems. These woodier seedlings carry higher energy reserves and can withstand hotter conditions at the time of replanting. The attributes of thicker stems and higher energy reserves are both essential when planting into marginal conditions. Planting into marginal conditions is necessary to achieve the extensive plantings required to have a true impact on a rural operation.

Postponed planting due to dry conditions is a serious issue for commercial nurseries but not so with this bare-rooted technology. The bare-rooted seedlings can remain in the nursery for more than two years if necessary at little additional expense. During this time they develop more woody stems and become harder.

The stability supplied by growing in the soil ensures long-stem seedlings can be produced. Long stems are essential if seedlings are to be planted deeper to achieve high survival rates.

The nursery infrastructure is reusable except for the fence. This means that once the seedlings have been transplanted it can be reused or sold.

Trials were conducted during summer with bare-rooted seedlings being placed in a coldroom for 3-14 days and successfully transplanted after removal. This trial was to simulate having a nursery in any district and then transporting the seedlings to another location once a week. A mobile refrigeration unit could be used to transport the seedlings to wherever the planting machine was operating.

Further planting trials were conducted at Yelarbon on the Queensland/NSW border, using 15,000 of the bare-rooted seedlings throughout the past cold winter. The coldroom was not used during the winter trial but at times the seedlings were left in containers out of the sun for a few days.