A mix of plants lifts feed value from saline land

CSIRO Livestock Industries scientists David Masters, Hayley Norman and Robyn Dynes discuss the opportunities and limitations for improved animal production on land affected by salt.

Growing a combination of salt-tolerant grasses, legumes and saltbush species will improve the feeding value and maximise animal production from saline land.

The Australian Dryland Salinity Assessment 2000 report indicates 5.7 million hectares are at risk, or affected, by dryland salinity. This could increase to 17 million hectares during the next 50 years.

For many salinised areas, reclamation is not a realistic option in the short- to medium-term.

The challenge is to find a land use which provides an economic return and is environmentally sustainable.

There are opportunities to use saline land for livestock but productivity is often low with current management systems.

Although there are many salt-tolerant forage plants available, evaluation of these plants has focused on persistence and forage dry matter production, resulting in species which have poor nutritional value to sheep and cattle.

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There are opportunities for animal production from saline land but farmers need to consider the mix of salt-tolerant plant species grown to help improve nutritive value for sheep and cattle.

A new approach is needed to assess the potential of salt-tolerant plants and livestock production from saline land.

Production from salt-tolerant plants

There is a range of shrubs, grasses and some legumes which grow well under saline conditions and produce large amounts of potentially edible biomass (stems and leaves).

The amount of biomass grown will depend on a combination of climatic, soil, plant and animal factors. Biomass production alone is not a good estimate of the amount of forage

available for grazing or its feeding value. The most studied plants are chenopods, particularly saltbush (*Atriplex*) and bluebush (*Maireana* species).

Research shows sheep grazing saltbush-based pastures tend to graze the inter-row pasture species first and only consume significant amounts of shrubs when there is little other choice.

Chenopods tend to have low organic matter digestibility, high levels of non-protein nitrogen, high levels of various salts and contain significant levels of secondary compounds.

Some secondary compounds such as salt and tannins may be beneficial in low concentrations but can limit intake and reduce metabolic efficiency in excess. Other compounds such as nitrates and oxalates are toxic to livestock. These observations have slowed the adoption of saltbush for grazing.

Feed availability and use

Many salt-tolerant plants produce little edible dry matter and cannot support significant animal production.

Saltbush species have been reported to produce 5–20 tonnes of dry matter per hectare within 2–3 years of planting.

Actual dry matter production is related to soil salinity, soil fertility, establishment methods, plant spacing and plant variety. Most of the biomass produced by saltbush is woody stem and edible dry matter is only about 100–1000 kilograms/ha.

Estimates of feed intake by sheep are variable, ranging from 0.48–1.9kg DM/day.

Acacia species (wattles) are also planted widely in mild saline areas and while providing relatively significant amounts of dry matter, many have low feeding value.

At a glance

- There is a range of salt-tolerant shrubs, grasses and legumes which could be used on saline land for livestock production.
- Carefully select salt-tolerant plants as many produce little edible dry matter. The quality produced depends on a combination of climatic, soil, plant and animal factors.
- Research shows a mix of plant species will improve the nutritive value and dry matter production for sheep and cattle.

Bluebush species are comparable with saltbush species in salt tolerance but produce less biomass suitable for grazing.

High levels of dry matter production is also possible in other salt-tolerant plants.

Research has reported dry matter availabilities of 12.2t/ha, 5t/ha and 2t/ha respectively for *Puccinellia stricta*, tall wheat grass (*Thinopyrum ponticum*) and mixed balansa clover and Italian ryegrass (*Trifolium michelianum* and *Lolium multiflorum*) in moderate to severe saline areas.

Generally, the legumes currently available are not particularly salt-tolerant.

Scientists have also reported up to 10t DM/ha of sweet clover (*Melilotus alba*) grown on mildly saline alkaline soil. This annual legume grows during summer, providing feed outside the normal growing season.

Dry matter production also depends on the plant variety and environment. A plant which grows well in one saline area may not be successful in another.

For example, greenhouse trials indicate that the sweet clover species continue to grow at about 18 deci siemens per metre of salt, although growth is significantly reduced.

Measuring dry matter

Most reports on dry matter available from salt-tolerant pastures provide static estimates of feed available.

In a dynamic grazing system, feed availability will depend on dry matter at a specific time and plant growth rate.

Grazing management is likely to influence both the amount and nutritive value of feed-on-offer. For example, continuous browsing at low stocking rates of saltbush leads to the development of woody branches and decreases nutritive value and availability.

Heavy rotational grazing may result in new growth with lower salt levels in leaves and higher nutritive value.

Tall wheat grass and puccinellia can also become rank and be poorly digested if not carefully managed.

When considering the amount of dry matter available it is important not only to measure the total amount of plant material grown in a year but also the time of most rapid growth and the plant's ability to persist under grazing conditions.

Time of the year, when pastures are grazed, may be critical for determining economic returns and the viability of planting salt-tolerant pasture.

Out of season feed production has been calculated to be 4–10 times more valuable than extra pasture during the spring flush in a mediterranean environment. This is due to high grain or concentrated feed supplement costs which would be needed if pasture was unavailable.

It has been estimated the low dry matter production and nutritive value of saltbush may not provide returns to cover establishment costs. But the introduction of higher quality pasture plants in the inter-row, such as balansa clover, may provide a significant return on establishment costs.

A mix of plants is beneficial

In many grazing trials both sheep and cattle consume a range of plant species with the salt-tolerant shrubs forming a minor but perhaps important part of the diet.

A mix of grasses, legumes, shrubs and forbs is likely to maximise the feeding value of the pasture. The mix allows grazing animals the opportunity to select specific plants. For example, grasses, legumes and chenopods have different compositions of salt, fibre and nitrogen indicating a mixture of plants will provide the most balanced diet.

A mix of species may also improve the microclimate, growing conditions and dry matter production of the plants and improve the nutritive value of each plant grazed.

Salt-tolerant shrubs lower the watertable and allow the growth of shallow-rooted annual plants of higher nutritive value.

The annuals avoid the requirement for salt tolerance by growing during winter when salt in the topsoil has been diluted. The plants produce seed quickly and rely on dormancy for regeneration in the following season. But the sustainability of this complementary system could be jeopardised if the deep-rooted shrubs lead to a long-term increase in salinity in the root zone. Further paddock research is required to evaluate this.

Many farmers use salt-tolerant pastures by allowing simultaneous access to stubble paddocks. Mixing saltbush with straw results in significant increases in feed intake compared with either diet fed alone.

Feeding saltbush with low-quality hay also improves the use of the roughage and can replace grass hay in rations with equal and sometimes improved growth rates.

Further research is needed

There are significant opportunities for improvements in the traditional salt-tolerant shrubs grown on saline land, the use of these shrubs in combination with other plants or farm feedstuffs and in the identification and improvement of new salt-tolerant legumes and grasses.

Research is required to select and breed potentially useful plants and identify the best nutritional, agronomic and environmental plant mix. Strategies can then be developed to optimise production from saline land.

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