

The economic value of improving pasture production on saltland in southern Australia

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Introduction

The cause of dryland salinity and the impacts on both the environment and productivity of agricultural land is well documented (see Coram *et al.*, 2001, Keighery, 2000 and Kingwell *et al.*, 2003). A significant proportion of agricultural land in Australia is degraded as a result of dryland salinity and the land at risk of degradation from rising water tables is even greater (Anon, 2001).

Much of the area of land affected by salinity cannot be reclaimed profitably (Coles *et al.*, 1999), and may have adverse consequences for neighbouring properties, reserves and waterways. Introducing production systems that are adapted to waterlogged and saline soils is likely to be the only feasible management option for these areas. Production options include energy generation, mineral extraction, aquaculture, forestry, horticulture and salt tolerant pastures for grazing.

The Sustainable Grazing for Saline Land (SGSL) initiative was developed with a number of partner organisations throughout southern Australia to identify and promote profitable grazing systems on otherwise unproductive land. Six key issues were identified and research was conducted across five sites in the four southern mainland states of Australia. The broad issues researched were: salt and water movement, pasture performance, animal performance, biodiversity, additional pasture species and systems economics.

This paper focuses on system economics. An economic analysis of saltland pasture was conducted for four states (WA, Victoria, NSW and SA) using data collected at the research sites. The effect of changing production parameters and commodity price assumptions on the profitability of saltland pasture were estimated.

Methods

Study regions

There were four study regions as part of this project, based in the locale of research sites of the SGSL Program. These were South West Victoria, the Upper South East of South Australia, the Central Wheatbelt of Western Australia and the Central West Slopes of NSW. Characteristics of each region are shown in Table 1.

Table 1 Comparative production and climate characteristics of study regions

	Central Wheatbelt, WA	South West, Victoria	Upper South East, SA	Central West, NSW
Annual rainfall (mm)	350	700	450	600
Growing season rainfall (%)	80%	80%	70%	50%
Summer rainfall variability	extreme	moderate	moderate	mod – high
Crop area (%)	50-60%	<10%	<10%	<50%
Average stocking rate	4-5	11-13	6-7	8-10
Season break	Early May	Late March	Early May	Early April
Season finish	Early Oct	Early Dec	Early Nov	Late Nov

Farm modeling

Mathematical programming models were applied to the economic analysis of SGSL data. MIDAS (Model of Integrated Dryland Agricultural System) is a steady-state, whole-farm,

mathematical programming optimisation model that describes the physical, technical, biological and managerial aspects of typical broadacre farming systems within a defined region. The model allocates available resources in order to maximise whole-farm profit, subject to resource, environmental and managerial constraints (Bathgate and Pannell 2002). A full description of the model can be found in Kingwell and Pannell (1987).

Analysis of saltland pasture

The analysis assessed the profitability of experimental treatments imposed on salt affected land at the different research sites. A summary is shown in Table 2. For each site, the relative influence of production factors on the profitability of saltland pasture was determined. The production factors analysed were: pasture growth; pasture quality; flock type (WA and NSW only); commodity prices; pasture establishment costs; area of saltland and presence of lucerne (WA and NSW only).

Table 2 Overview of pasture production assumptions for farm models in each of the study regions

	WA	Victoria	SA	NSW
Farm size (ha)	2000	700	2000	900
Area of saltland (ha)	200	50	800	20
Salinity Stress Index	moderate	low (class 1) & moderate (class 2)	low	moderate
Production system	crop-livestock	livestock	livestock	crop-livestock
Saltland pasture	saltbush & mixed annual understorey	tall wheat grass	puccinellea & balansa	tall wheat grass, mixed annual
Other pastures	mixed annual, lucerne	perennial rye, mixed annual	tall wheat grass, lucerne	perennial rye & mixed annual, phalaris, lucerne
Establishment cost	\$300/ha	\$350/ha	\$250/ha	\$570/ha

Results and discussion

Saltland pasture was found to be profitable in all four study regions for the standard assumptions. The increase in profit resulting from better management and introducing improved plant species was highest for the Victorian and NSW sites, ranging from \$92 per hectare of saltland pasture to \$265 per hectare depending on site and treatment. The increase in profit for SA and WA sites was similar, although higher for WA, ranging from \$2 per hectare of saltland pasture to \$61 per hectare depending on site and treatment.

In most cases there was an increase in the average farm stocking rate with the improvement of saltland pasture. The exception was the NSW site where stocking rate remained constant.

This increase in the intensity of livestock production may be an impediment to adoption for some farmers. Analysis of labour demand undertaken in WA indicates that livestock production requires relatively more labour (per hectare), and in the current economic climate the supply of labour in rural areas is limited (Doole *et al.*, In Progress). Doole *et al.* show that limited labour supply is likely to constrain farmers' ability to increase stocking rate. The extent to which stocking rate can be increased may hinge on the unused labour capacity on farm.

Pasture growth rate

The growth rate of saltland pasture, and hence the availability of feed for livestock, is a major influence on the profitability of establishing pasture on salt affected land. Reductions in the growth rate of improved saltland pasture led to proportionally greater reductions in benefits on all sites except Victoria.

Rules of thumb applied by farm management consultants indicate that rates of return on capital of around 15% are required to provide sufficient economic incentive for widespread adoption. At the establishment costs assumed in this study, this equates to \$30 per hectare for all sites. Below this level of economic benefit the incentive for farmers to establish pasture on saltland will be significantly diminished and widespread adoption less likely.

For NSW and SA a reduction of only 10% in assumed growth rate of pasture reduces the benefits of improving saltland pasture to less than \$30 per hectare. For the WA site benefits are decreased to \$30 when relative production is reduced by 20%.

Reductions in pasture growth have much less effect on the benefits of tall wheat grass pasture on the Victorian model farm, at least in terms of the proportional change in profit. A 60% reduction in pasture growth rate would be required on Class 2 land and an 80% reduction on Class 1 land to reduce profits to \$30 per hectare.

Pasture quality

The quality of the pasture on saltland had a major influence on its profitability. In South Australia a reduction in digestibility (%DMD) of only 1.5 percentage points is sufficient to render improved pastures economically unviable. In NSW this occurs when digestibility is reduced by 5 percentage points and in Victoria when digestibility is reduced by 6-7 percentage points (depending on soil class).

The impact of quality on the profitability of saltland pasture has implications for management, as the quality of perennial species is greatly influenced by grazing management. Long periods of deferment will lead to a decline in quality, thus affecting the feed value to sheep when grazed. However the quality assumed in this analysis implies short deferment periods during the growing season and no deferment over the drier months.

On some farms it may be practically difficult to undertake the level of management required to maintain pasture quality at the levels assumed in this analysis. Where this is the case the profitability of saltland pasture will be much lower compared to the results of this study.

Flock type

For both WA and NSW the economic benefit of saltland pasture is highest with specialist cross-bred lamb production, compared to self-replacing cross-bred lamb and wool production. However, a specialist cross-bred lamb enterprise requires increasing the intensity of production, which as mentioned previously, may not be possible or desirable.

Wool and lamb prices

Wool and lamb prices have a significant impact on the profitability of improved pastures on saltland. This demonstrates that product prices may influence farmers' incentive to improve the management of saltland. The economic viability of improved pasture was adversely affected on only one site. Wool prices below a market indicator of 600 cents per kilogram reduced the profitability of puccinellea/balansa pasture on the SA site to less than \$30 per hectare. On all other sites the wool price would need to drop well below 500 cents per kilogram to threaten the viability of improving saltland pasture. The only exception to this is where low wool prices are accompanied by very low prime lamb prices in the WA analysis.

Establishment cost

The benefits of improving saltland pasture were relatively insensitive to establishment costs. However large initial outlays to establish improved pasture may in itself be an impediment to broad scale adoption. This is especially pertinent in recent times where cashflow of farm businesses have been very low.

Conclusions

Introducing improved pasture species to salt affected land to increase the feed value for livestock is profitable across a broad range of environments, production conditions and commodity price assumptions.

The extent to which farmers can achieve the increases in profit suggested by this study will depend critically on their ability to manage the livestock enterprise to achieve the pasture production levels assumed. Pasture quality and growth were shown to have a major effect on the profitability of improved pastures. Maintaining pasture quality of perennial species requires good grazing management, as long periods of deferment will lead to substantial reductions in feed value. The models used in this study typically selected high stocking rates

to increase farm profit when improved pastures on saltland were introduced. This was accompanied by increases in the amount of supplementary feeding in some cases.

Increasing the intensity of production has potential implications for adoption of improved saltland pastures and consequently for extension; namely that factors that may limit the ability of farmers to increase intensity of production need to be understood and addressed if widespread adoption is likely to occur.

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