Invited article

Perennial shrubs: production, grazing and recovery in the Mallee

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Take home messages

- ***Atriplex* and *Rhagodia* species fared best in these experiments, producing the highest biomass on offer to sheep, plant survival rate and health scores. However, the *Rhagodia* species consistently demonstrated low stock grazing preference and of the *Atriplex* species, only *A. vesicaria* and *A. cinerea* were shown some preference by sheep**
- **four species showed poor adaptation to the environment at Walpeup and produced little edible biomass, namely *Atriplex semibaccata, Convolvulus remotus, Cullen australasicum* and *Medicago strasseri*. Grazers often exhibited greatest preference for these species, which is likely to have contributed to their swift exit from the experiment**
- **results from this experiment and others across the nation have led to establishment of a new site at Manangatang to demonstrate the most promising species for the Mallee region's poorer soils**

Background

In 2008, the Mallee Catchment Management Authority (CMA) funded the establishment of an Enrich shrub evaluation experiment at Walpeup Research Station, with the support of the Department of Primary Industries. Native shrubs have potential for biomass production and grazing in these areas where alternative perennial options are limited. Deep rooted perennials have also been identified as having the most impact on improvement of ecological stability by reduction of groundwater recharge and salinity.

Aim

This shrub experiment is an initiative of the Future Farming Industries CRC and aims to explore use of perennial shrubs as a feed source for profitable and sustainable grazing systems in low-to-medium rainfall areas of the Mallee. In 2011, the Walpeup-based research moved into its fifth and final stage which focused on a second round of grazing to evaluate shrub performance and grazing preference. Previous work from the site was published in BCG's *2010 Season Research Results* (pp 188).

Method

For detailed experimental design, consult Rob Harris *et al* (2010) *BCG 2010 Season Research Results* article.

Briefly, 36 plants of sixteen species (Table 1) were planted in each of four replicates in July 2008. Mixed aged merino sheep (77 sheep/ha) grazed each replicate for 3-4 weeks in turn, in autumn 2010 and winter 2011. Sheep preference and shrub recovery were measured after each grazing. The edible biomass on offer to a grazing sheep was measured in June 2011 by taking leaves and soft shoot tips from a number of plants per replicate for each species. Using this data, an index was used to estimate total biomass.

This report includes data from 2011 only. Data from 2010 and a summary of the establishment seasons were published earlier in the *Mallee Farmer* (Harris et al. 2010).

Location:	Mallee Research Station (Walpeup, NW Victoria)
Replicates:	4
Planting date:	14 July 2008
Row spacing:	3 x 1.5m

Results

How much biomass was produced by each species?

From the end of grazing in late August 2010, *Atriplex nummularia* produced 2.5kg edible biomass/plant (Table 1). Based on a planting density of 2222 plants/ha, theoretical production from *A. nummularia* could be in the order of ~5.5t edible biomass/ha. Comparable annual yields from *R. parabolica*, *A. rhagodiodes* and *A. amnicola* were on average 3.4 t/ha while the five species with the lowest production were projected to yield only 0.36t/ha.

Table 1. Mean edible biomass on offer (leaf and soft shoot material) from perennial shrubs at Walpeup Research Station produced between August 2010 and August 2011 as measured the day before grazing began

Species	biomass/plant (g)[1]
Atriplex nummularia	2501[a]
Rhagodia parabolica	1721[b]
Atriplex rhagodioides	1472[b]
Atriplex amnicola	1374[bc]
Rhagodia crassifolia	1128[cd]
Atriplex vesicaria	863[cd]
Rhagodia spinescens	812[de]
Rhagodia preissii	737[de]
Atriplex cinerea	707[de]
Eremophila glabra	694[de]
Enchylaena tomentosa	410[ef]
Atriplex semibaccata	343[ef]
Chameacytisis prolifer	37[f]
Medicago strasseri	17[f]
Cullen australasicum	11[f]
Convolvulus remotus	-
Mean	**855**
Sig. diff.	**<0.001**

Note: [1]Same letters indicate no difference in means (LSD (5%)).
Convolvulus remotus not measured.

What preference did the animals show?

Animal preference for a species can be gauged from the rate at which they eat the plant. The middle bars in Figure 1 show the proportion of biomass consumed in the first two days of grazing in winter 2011. Of the species that produced >500g biomass/plant, *A. cinerea, A. vesicaria, R. spinescens, A. amnicola, R. preissii* and *E. glabra* had more than 30% of biomass (leaves & young shoots) removed in the first two days. Animals eventually ate >80% of most species, but that is not surprising since they were left in the plots to encourage them to eat the lesser preferred species. In the cases of *A. nummularia, A. rhagodioides, R. crassifolia* and *R. parabolica*, even extended exposure did not encourage the animals to eat all the available biomass.

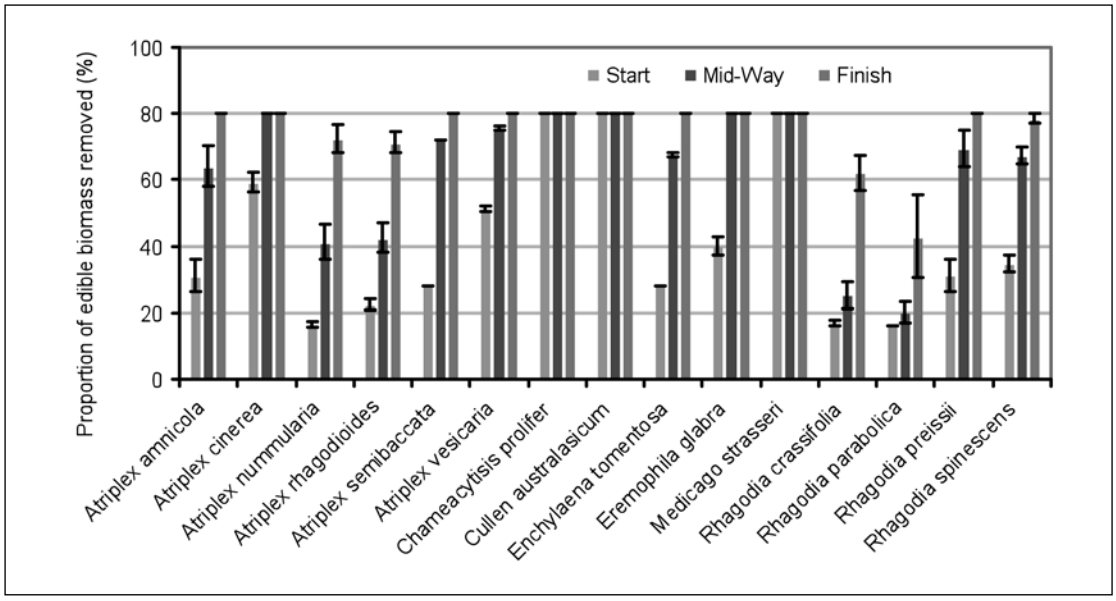

Figure 1. The proportion of edible biomass removed by mixed-aged ewes grazing perennial shrubs at the start, mid-way and finish of a ~14-day grazing period at Walpeup Research Station in winter 2011

Note: Bars represent one standard deviation of the mean. Convolvulus remotus not measured.

What was alive in November 2011 after two years of grazing events?

The survival and health of plants was measured by observation on 26 November 2011 (Figure 2). *Atriplex* and *Rhagodia* species fared the best in this experiment; and, with the exception of *A. semibaccata*, ~80% of plants were either healthy or suffered only minor leaf damage. Four species were almost completely dead, namely *A. semibaccata, C. remotus, C. australasicum* and *M. strasseri.* Additionally, more than 30% of A.vessicaria and C. prolifer plants showed major structural damage or worse.

A. semibaccata and *E. tomentosa* produced a number of recruits from shed seed (>10/plant) and may have promise as complementary species. *A. semibaccata* has a prostrate habit and could be used in an understorey capacity. Further work on their use in combinations would be required before either could be recommended for inclusion in a Mallee farming system.

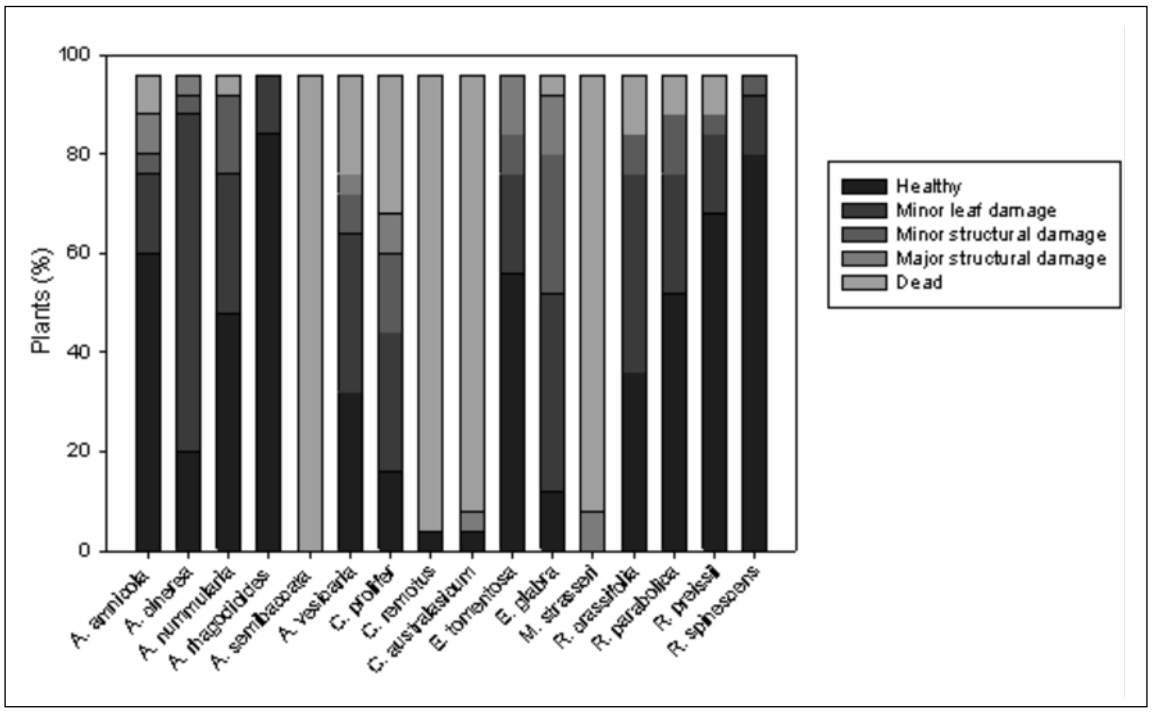

Figure 2. The health status of shrub species on 26 November 2011 planted at Walpeup Research Station

The volume of a cone (Table 2), formed from measurements of height and diameter of each plant, generated a useful number for describing the size of plants in April and November. Overall, shrubs grew in volume an average of 145% over the seven months from 21 April. This was largely attributable to the increase in height of *Atriplex* species over the period (which included grazing in July/August).

Interestingly, the increase in height created a problem for grazing management. Specifically, *A. nummularia* became too tall for sheep to graze effectively: any shrubs standing taller than ~1.4m had untouched tops out of reach to the sheep.

Table 2. The conical volume[1] of shrub species on 21 April and 26 November 2011 planted at Walpeup Research Station.

Species	21 April 2011[2]	26 Nov 2011[2]
Atriplex nummularia	1.63[a]	2.38[a]
Atriplex cinerea	0.93[b]	1.00[c]
Atriplex rhagodioides	0.89[b]	1.30[b]
Atriplex amnicola	0.63[c]	0.67[d]
Rhagodia parabolica	0.60[c]	0.72[d]
Rhagodia crassifolia	0.53[d]	0.51[e]
Rhagodia preissii	0.50[d]	0.34[efgh]
Atriplex vesicaria	0.47[de]	0.47[ef]
Rhagodia spinescens	0.42[e]	0.45[ef]
Enchylaena tomentosa	0.32[f]	0.25[gh]
Eremophila glabra	0.30[f]	0.23[h]
Atriplex semibaccata[3]	0.20[g]	0.00[i]
Chameacytisis prolifer[3]	0.17[g]	0.00[i]
Cullen australasicum[3]	0.14[g]	0.00[i]
Medicago strasseri[3]	0.05[h]	0.00[i]
Convolvulus remotus[3]	0.05[h]	0.39[efg]
Mean	**0.54**	**0.63**
Sig. diff.	**<0.001**	**<0.001**

[1]The volume of a cone was calculated using the mean of radii across and along rows. [2]Same letters within each date indicate no difference in means (LSD (5%)). No statistical comparison was made between dates. [3]These species were either prostrate or stick-like, giving a low but accurate estimate of volume.

Findings from our experiments and other related work have led to the establishment of a demonstration block in Manangatang. The best performing species are planted there and in a more typical Mallee 'saltbush environment'. More information on this experiment will be available through the Mallee CMA in 2012.

Conclusions

Old Man Salt Bush (*A. nummularia*, OMSB) is not the only perennial shrub that will establish, tolerate grazing and recover. That said, OMSB is still a dominant performer. *Atriplex* (including OMSB) and *Rhagodia* species showed the best mixture of persistence and grazing preference, but grazing preference often leads to recovery and persistence difficulties. There is scope for experimental work to optimize grazing management and stock performance on these species. Future data obtained from the Manangatang site will further guide decisions in systems with more typical Mallee soil profiles.

Reference

Harris, R., Emms, J., Nalder. K., Beloy. J., Davies, C. and Brady, M. (2010). 'Forage shrubs for alternative grazing systems,' *BCG 2010 Season Research Results: Part A.* p 188-193.

Harris, R. (2010). 'A profitable and sustainable feed source'. *The Mallee Farmer*, 1: 20-21

Acknowledgments

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