

Evaluation of perennial forage legumes on Eyre Peninsula

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RESEARCH

Searching for answers



Key messages

Fifteen months after establishment the study has shown:

- **Lucerne to be well adapted to good Eyre Peninsula cropping soils.**
- **Cullen and Tedera to be more persistent and productive than lucerne on shallow calcareous and highly acidic soils respectively.**
- **Sulla to be highly productive on good lower EP cropping soils in the growing season following establishment.**

Why do the trial?

The use of perennial legumes on Eyre Peninsula is largely restricted to lucerne which is not well adapted to shallow constrained soils common across much of the region. However the benefits of a perennial legume phase within an intensive cropping system for soil rehabilitation and economic weed management is well documented.

As part of a national program to identify alternative perennial legumes to lucerne suitable for incorporation within cropping systems, there are at least 3 options potentially adapted to areas within the Eyre Peninsula environment.

Research in South Australia has shown Sulla (*Hedysarum coronarium*) to be a highly productive, short lived perennial/biennial legume. The individual plants live for 2-3 years, but it will

regenerate readily from seed. It is used for grazing or hay production and contains condensed tannins that make it bloat-safe, increase protein digestion and make Sulla less attractive to insects. These tannins also provide a reputed anthelmintic effect which may reduce worm and nematode burdens. Sheep grazing Sulla have been recorded to have less dags, which is considered to be a result of the tannin content.

Western Australian research is suggesting that *Bituminaria bituminosa* var *albomarginata*, or Tedera, as it is more commonly known in its native Canary Islands, has the potential to offer a solution to lucerne's shortcomings in Australian farming systems. Lucerne may survive summer drought by its deep roots accessing a water supply and decreasing evaporation by shedding its leaves. The result of this on many EP soils is that fodder quality is lost with the dropping of the leaves and often the plant dies in the more constrained, shallow soils. Tedera is shallow-rooted and reputedly it is very drought tolerant and does not drop its leaves.

The third option *Cullen australasicum*, a native perennial legume, has been as persistent and productive as lucerne in South Australian studies to date. These results suggest that Cullen species will have adaptations to both survival and productivity traits that make them suitable for use or further development as perennial pastures in a low rainfall, Mediterranean climate.

These 3 genera briefly described above were considered worthy of continuing evaluation to compare to lucerne at a range of Eyre Peninsula sites. To review 2010 results see EPFS Summary 2010, pg 141.

How was it done?

Six lines of forage perennials; Lucerne, Sulla, Cullen and three Tedera lines were established at four Eyre Peninsula sites in 2010 to represent four rainfall and soil type regions; Minnipa (325 mm), Rudall (350 mm), Edillilie (400 mm) and Greenpatch (450 mm). Soil types varied from red sandy loam (Minnipa, pH 7.7 -7.8 CaCl₂) calcareous sand (Rudall pH, 7.7-8.1 CaCl₂) slightly acidic, shallow duplex (Edillilie, pH 6.4-7.5 CaCl₂) to acidic sand over clay (Greenpatch pH 4-5.1 CaCl₂) in the 0-0.6 m soil profile.

In 2010 the trials were hand sown in 3 x 2 m plots; Minnipa 2 June, Edillilie 22 July, Rudall 30 July, then resown on 18 September and Greenpatch 11 October. The Minnipa site was desiccated with an unplanned broad spectrum summer herbicide spray in March 2011. A replacement site was established at Minnipa on 2 May 2011, 5 x 2 m plots with 2 replicates handsown into seeder rows at 0.5 m row spacings. Five of the lines from the 2010 entries were sown, Sulla was not included.

What happened?

Rainfall in 2011 was similar at Minnipa (400 mm) to 2010. The perennials established successfully and were sampled for biomass on 18 September (lucerne only) and 18 October (Table 1). At Rudall rainfall was 380 mm, there were 4 biomass measurements taken, 19 January, 15 March, 7 May and 17 September. Higher than average annual rainfall of 475 mm at Edillilie allowed 6 samplings, 19 January, 4 March (Cullen only, Lucerne grazed by rabbits) 9 April, 26 May, 1 August and 15 October. Three samplings on 7 May, 1 August and 14 October were completed at Greenpatch with average rainfall (<500 mm).

Table 1 Plant establishment in 2010 (Minnipa 2011) and plant survival in November 2011

	Minnipa	Rudall (plant/m ²)		Edillilie (plants/m ²)		Greenpatch (plants/m ²)	
	2011	2010	2011	2010	2011	2010	2011
Tedera 27	17	5	5	9	9	9	8
Tedera 37	13	4	2	5	7	8	7
Tedera 42	11	4	6	6	7	7	9
Lucerene	17	3	2	8	6	6	5
Cullen	40	7	6	5	6	18	4
Sulla	-	4	2	21	5	17	7

Table 2 November to April 2010/11 and May to October (growing season) 2011 biomass production (t DM/ha) at the 4 evaluation sites

	Minnipa	Rudall		Edillilie		Greenpatch	
	May-Oct	Nov-April	May-Oct	Nov-April	May-Oct	Nov-April	May-Oct
Tedera 27	0.9	1.2	2.0	4.6	6.9	1.3	3.4
Tedera 37	0.3	0.5	0.2	3.5	4.0	0.3	0.8
Tedera 42	1.0	1.1	2.3	4.9	6.3	0.7	2.1
Lucerene	1.8	1.6	1.3	6.1	5.1	0.1	0.9
Cullen	0.9	3.1	3.8	4.3	7.0	1.0	0.5
Sulla		1.0	0.8	5.0	12.5	0.5	0.9

Table 3 November 2011 volumetric soil water contents (mm)

	Minnipa	Rudall	Edillilie	Greenpatch
	0-0.8 m	0-0.4 m	0-0.6 m	0-0.6 m
Tedera 27	95	23	131	32
Tedera 37	106	41	143	36
Tedera 42	101	25	143	35
Lucerene	78	28	126	30
Cullen	93	25	149	59
Sulla		28	141	33

Biomass samplings were undertaken at the time of one or more lines flowering. Plant counts were carried out at each time of biomass sampling. Soil water content measurements were collected in November 2011 to compare water use of species evaluated.

The biennial Sulla plant densities declined over the second growing season at all 3 sites. Cullen numbers declined at the more acidic higher rainfall Greenpatch site. Lucerne plant numbers trended lower at all 3 sites. The Tedera line 27 densities were maintained at the 3 sites, line 37 numbers varied and line 42 had higher numbers at all 3 sites over the 12 to 18 month period.

The entries that produced more biomass in 2010 and 2011 than the site mean were Lucerne at Minnipa, Cullen at Rudall, Lucerne and Sulla at Edillilie and Tedera lines 27 and 42 at Greenpatch. Tedera line 37 produced less than the site mean at all 4 sites.

Lucerne at Minnipa and Lucerne and Tedera line 27 at Edillilie. It was higher with Tedera line 37 at Rudall and Cullen at Greenpatch.

What does it mean?

The major change in plant populations has been the decline in Sulla, which is to be expected with a biennial following the second growing season. Secondly the poor adaptation of Cullen to the highly acidic soil at Greenpatch has resulted in a significant plant loss. The Tedera line 42 had higher numbers present in November 2011 than were counted in 2010. This may have been due to hard seed at the initial 2010 sowing as plants that have continually been defoliated at flowering providing little or no opportunity for seed set. The reducing trend in densities of Lucerne present 12-18 months after establishment would meet expectations with normal levels of attrition of a low input Lucerne stand.

In support of the previous 2010 report, Lucerne was highly productive on the better soil types

represented by the Minnipa and Edillilie sites. Sulla produced large amounts of biomass during the spring period in suitable soils as measured at the Edillilie site in 2011. However the adaptation of Cullen and Tedera to the range of soil types and environmental variables encountered on Eyre Peninsula is less well documented. Cullen has been comparatively productive and persistent on the shallow sandy calcareous soil at Rudall, which has been a very low input site with no pest or weed control applied. The Tedera lines have persisted satisfactorily, and while its production and growth has been low, compared to Lucerne, on the good soils at Minnipa and Edillilie it has been more productive on the constrained soils at Rudall and Greenpatch, once again in the absence of insect control.

The soil water content figures collected in November 2011 reflected the plant numbers and/or the comparative biomass production of the tested lines over the 2011 growing season.

Both the Tedera and Cullen are only partially developed lines and as such will continue to be progressed through an intensive selection process in terms of establishment, management, persistence and animal production issues. However, these trials are giving an indication as to the potential role of "improved" lines of these pasture species in the EP environment and farming systems.

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